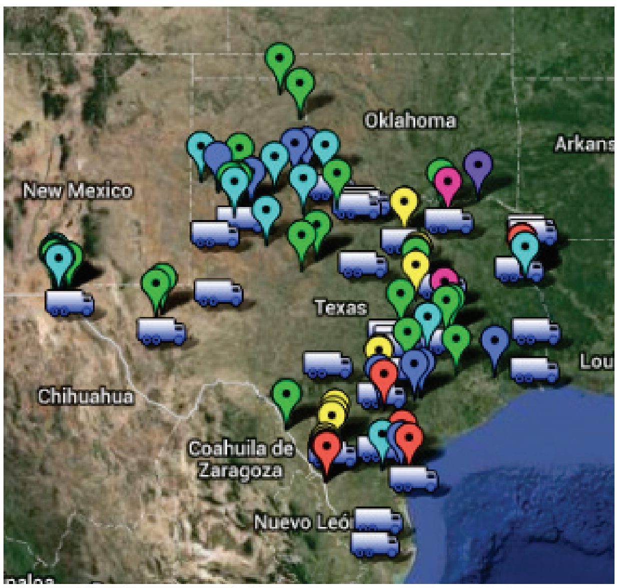
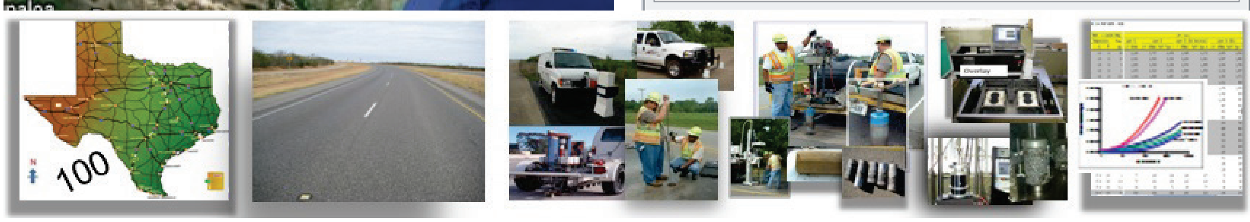
Project 0-6658

PRODUCT 0-6658-P5

Data Collection and Population of the Database (The DSS and RDSSP)





Product 0-6658-P5

by

Lubinda F. Walubita, Raenita Hassan, Sang I. Lee, Abu NM Faruk, Maria Flores, Tom Scullion, Imad Abdallah, and Soheil Nazarian

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DATA COLLECTION AND POPULATION OF THE DATABASE (THE DSS AND RDSSP)

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DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT.

This report does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. The United States Government and the State of Texas do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report. The researcher in charge of this project was Lubinda F. Walubita, Ph.D.

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SECTION 1 INTRODUCTION

This study was initiated to collect materials and pavement performance data on a minimum of 100 highway test sections around the state of Texas, incorporating both flexible pavements and overlays. Besides being used to calibrate and validate mechanistic-empirical (M-E) design models, the data collected will also serve as an ongoing reference data source and/or diagnostic tool for TxDOT engineers and other transportation professionals.

Toward this goal, this product provides an itemized documentation of the data collection and population that is being conducted, namely:

- Number of test sections to date.
- The MS Access® Data Storage System (DSS).
- The Raw Data Storage System (RDSSP) for raw data storage.
- The types of data being collected.
- The data requirements and input parameters for M-E models and design software.
- The specifications and methods used for both lab and field testing.
- The field data collection forms.
- Demonstration examples of how to access and navigate through the databases.

Detailed documentation of the data collection and population process can be found in:

Walubita, L.F., G. Das, E.M. Espinoza, J.H. Oh, T. Scullion, J.L. Garibay, S. Nazarian, I. Abdallah, and S. Lee (2012). Texas Flexible Pavements and Overlays: Year 1 Report – Test Sections, Data Collection, Analyses, and Data Storage System. Technical Research Report #0-6658-1. TTI, College Station, TX, USA.

Website Link: http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/0-6658-1.pdf.

SECTION 2 NUMBER OF TEST SECTIONS

As of summer 2014, 107 test sections had been identified on various highways across Texas. As listed in Table 2-1, these test sections comprise conventional thin (< 3-inch thick hot mix asphalt [HMA]), regular/intermediate, and thick (> 6-inch thick HMA) pavement structures encompassing surface treated pavements, overlays, new construction, and perpetual pavements.

Table 2-1. Number of Test Sections as of August 2014.

#	PVMNT Type	Number
1	Perpetual	10
2	Overlay with CTB	6
3	Overlay with flex base	12
4	Overlay with LTB	7
5	Overlay over PCC	3
6	Overlay over treated base	12
7	Overlay with TOM	5
8	Overlay with WMA	1
9	Seal coat over flex base	4
10	Seal coat over treated base	4
11	HMA new construction or Rehab with CTB	12
12	HMA new construction with flex base	12
13	HMA new construction with lime/fly-ash base	2
14	HMA new construction with treated base	12
15	HMA new construction with WMA	5
	Total	107

A location map of some of these test sections is shown in Figure 2-1; it covers all Texas climatic zones illustrated in Figure 2-2. Detailed tabulation of these test sections can be found in Appendix I. As of October 2014, about 25 percent of these test sections are still under various stages of construction such as surfacing layer placement, etc. Approximately 30 percent of the test sections have at least three years' worth of field performance data. Note that both test section solicitation and field performance monitoring (twice per year) are ongoing processes throughout the course of the study.

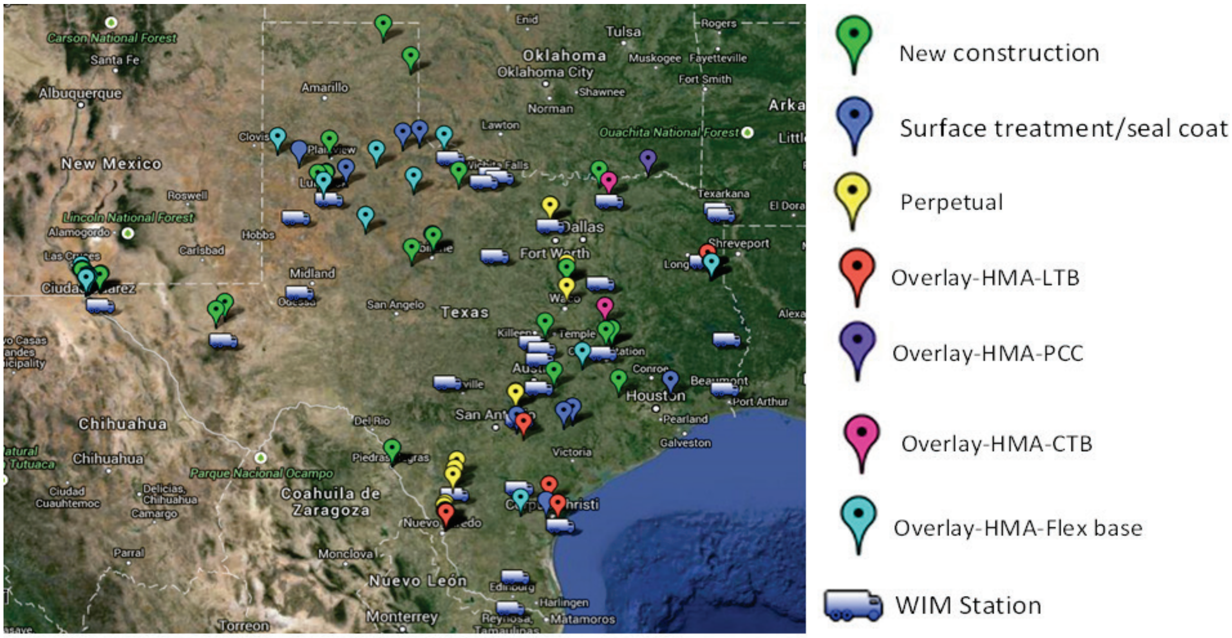


Figure 2-1. Example Location of Selected Test Sections.

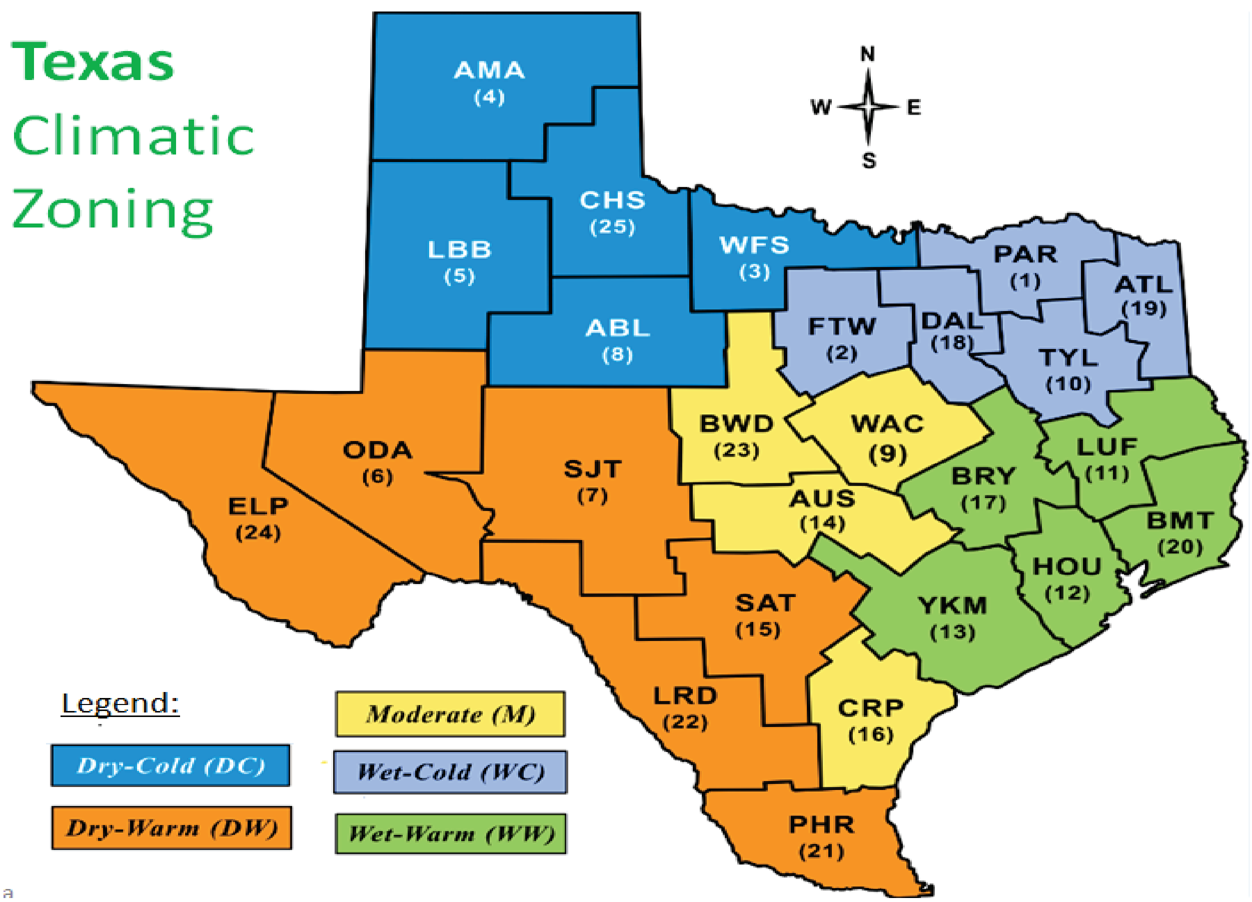


Figure 2-2. Texas Climatic-Environmental Zones.

SECTION 3 THE DATABASE AND REPOSITORY SYSTEM

The data storage system for this study consists of two repositories, one for the processed data and one for the unprocessed raw data, namely:

- The Microsoft (MS) Access DSS for the processed data.
- The RDSSP for the unprocessed raw data.

For the processed data, MS Access was selected as the database (the DSS) platform due to its commercial availability, familiarity, user-friendliness, and easy access to TxDOT engineers and the general stakeholders. Figure 3-1 shows the DSS main menu screenshot.

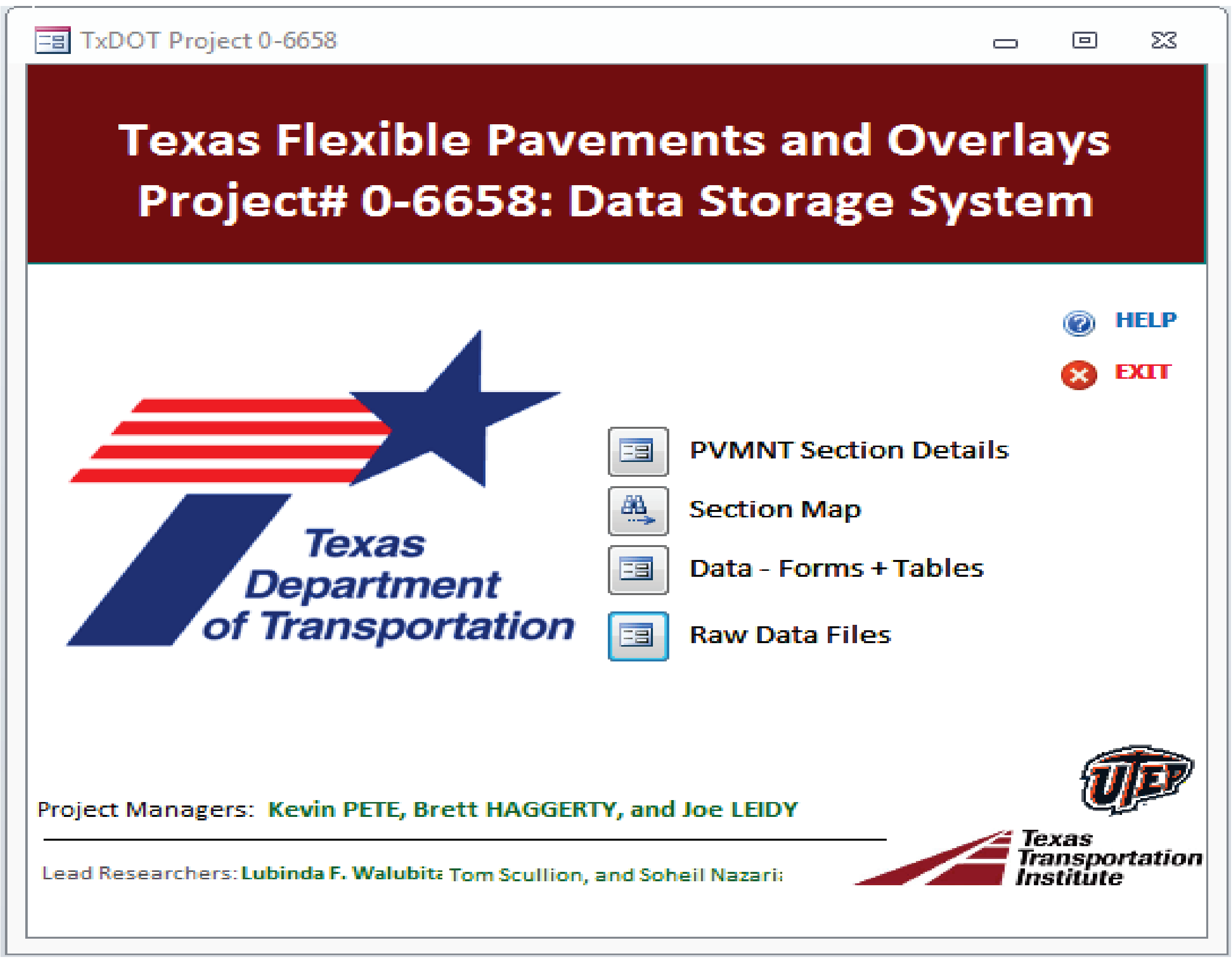


Figure 3-1. The DSS – Main Menu Screenshot.

As a backup and to provide opportunities for data verification and future analyses as the users may deem necessary, the raw data files for all the data measured and collected in this study are concurrently kept in the RDSSP. Figure 3-2 shows an example of the RDSSP structure for some selected test sections. For easy accessibility, the RDSSP is linked to the DSS via a “Raw Data Files” function on the DSS main screen shown in Figure 3-1.

Type	Name	Modified
	TxDOT_TTI-00001_US 59 ATLANTA	12/12/2012 10:27 AM
	TxDOT_TTI-00002_SH 114 FORT WORTH	1/3/2013 9:37 AM
	TxDOT_TTI-00003_SH 114 FORT WORTH	1/3/2013 9:37 AM
	TxDOT_TTI-00004_IH 35 (NB) WACO	5/16/2014 11:49 AM
	TxDOT_TTI-00005_LOOP 480 (SB) LAREDO	6/7/2014 2:20 PM
	TxDOT_TTI-00006_SH 121 PARIS	12/17/2012 3:17 PM
	TxDOT_TTI-00007_US 271 PARIS	12/17/2012 3:20 PM
	TxDOT_TTI-00008_US 82_PARIS	1/3/2013 1:14 PM
	TxDOT_TTI-00009_IH 35 WACO	12/6/2012 11:46 AM
	TxDOT_TTI-00010_IH 35 LAREDO	1/3/2013 1:19 PM
	TxDOT_TTI-00011_IH 35 LAREDO	1/3/2013 1:20 PM
	TxDOT_TTI-00012_IH 35 LAREDO	1/3/2013 1:21 PM
	TxDOT_TTI-00013_US 59 ATLANTA	1/23/2013 12:04 PM
	TxDOT_TTI-00014_US 59 ATLANTA	1/23/2013 12:04 PM
	TxDOT_TTI-00015_SH 21 BRYAN	1/23/2013 11:31 AM
	TxDOT_TTI-00016_FM 2100 HOUSTON	9/15/2013 10:33 AM
	TxDOT_TTI-00017_FM 1887 HOUSTON	9/15/2013 10:34 AM
	TxDOT_TTI-00018_IH 35 LAREDO	1/23/2013 12:02 PM
	TxDOT_TTI-00019_IH 35 SAN ANTONIO	1/23/2013 12:02 PM
	TxDOT_TTI-00020_IH 35 SAN ANTONIO	1/23/2013 12:03 PM
	TxDOT_TTI-00021_IH 35 WACO	1/23/2013 12:03 PM
	TxDOT_TTI-00022_IH 35 (NB) WACO	5/16/2014 11:49 AM
	TxDOT_TTI-00023_US 77A YOAKUM	9/26/2013 10:40 AM
	TxDOT_TTI-00024_SH 95 YOAKUM	9/26/2013 10:41 AM
	TxDOT_TTI-00025_US 181 CORPUS CHRISTI	12/4/2012 12:50 PM
	TxDOT_TTI-00026_SH 358 CORPUS CHRISTI	12/4/2012 1:42 PM
	TxDOT_TTI-00027_FM 763 (SB) CORPUS CHRISTI	5/16/2014 11:53 AM
	TxDOT_TTI-00028_US 67 (SB) FORT WORTH	5/16/2014 12:54 PM
	TxDOT_TTI-00029_SH 7 BRYAN	10/18/2013 12:13 PM
	TxDOT_TTI-00030_US 83 PHARR	1/4/2014 9:10 AM

Figure 3-2. The RDSSP – Selected Test Sections from #01 to #30.

As an integral part of this product documentation and for demonstration purposes, a CD/USB flash disk is also included and comprises the following contents:

a) The DSS in MS Access format (processed data).

b) The RDSSP (raw data with example folders and files for some selected test sections).

SECTION 4 DATA COLLECTION AND POPULATION

In general, a database should be multi-functional. While focusing on the data requirements for the Texas M-E models and related software, significant efforts were also made to collect, as much as possible, related pavement section data that could serve as an ongoing reference data source and/or general diagnostic tool for TxDOT engineers and other transportation professionals.

A database is considered useful only if it is populated with sufficient data, both in terms of quantity and accuracy. Accordingly, these researchers are collecting a variety of both laboratory and field data, including but not limited to the following:

- Design data and drawings including pavement cross sections.
- Construction data, quality control/quality assurance (QC/QA) charts, and coring.
- Material properties of each pavement layer (through both lab and field testing).
- Field testing and pavement performance data (including ground penetrating radar [GPR], falling weight deflectometer [FWD], dynamic cone penetrometer [DCP], profiles, rutting, cracking, aggregate loss, bleeding, coring, etc.).
- Traffic data including volume, classification, vehicle speeds, and load spectra (axle weights, truck distributions, adjustment factors, etc.).
- Climatic data including temperature and precipitation in Texas' five climatic zones.

Tables 4-1 through 4-10 itemize the data that are currently being collected, processed/analyzed and stored in the DSS. These data are being cataloged by means of entry forms located under the drop down menu item "Project 0-6658: Forms", or in tables under "Material Properties", accessed by the selection menu on the left side of the main menu screen; see Figure 4-1. As of October 2014, the databases are comprised of data with the following volumes:

a) 538 MB for the DSS (processed data in MS Access platform)

b) 15 GB for the RDSSP (raw data/files)

Data collection methods and measurement procedures, including test specifications, test sequence, replicates, etc., are discussed in Section 6. Demonstration examples for data access and navigation of the databases are given in Section 7 and Appendix IV through to VI.

Note however that Table 4-10 comprises of a list of supplementary lab test data that the researchers collected from their own extra effort for research informational purposes only and other engineering analyses. These data collection are optional, they are not required as M-E input parameters nor are they mandated under Study 0-6658.

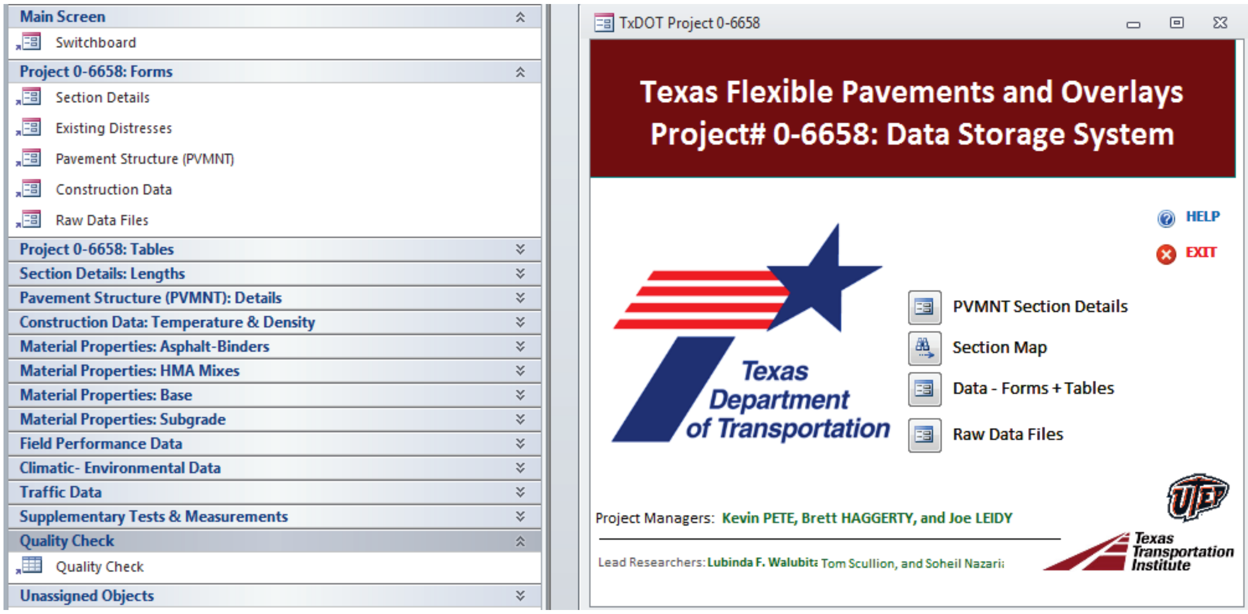


Figure 4-1. The DSS – Main Menu Screenshot with the Forms and Tables.

Table 4-1. Example of Design Data.

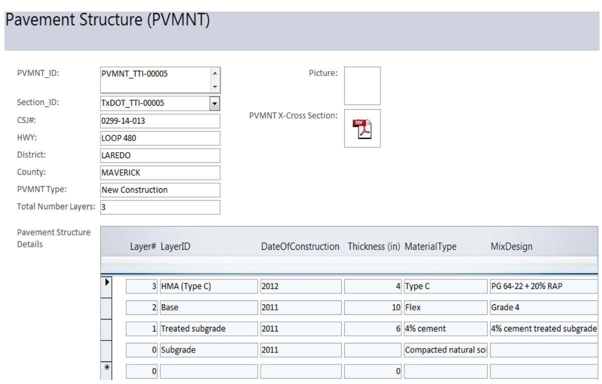
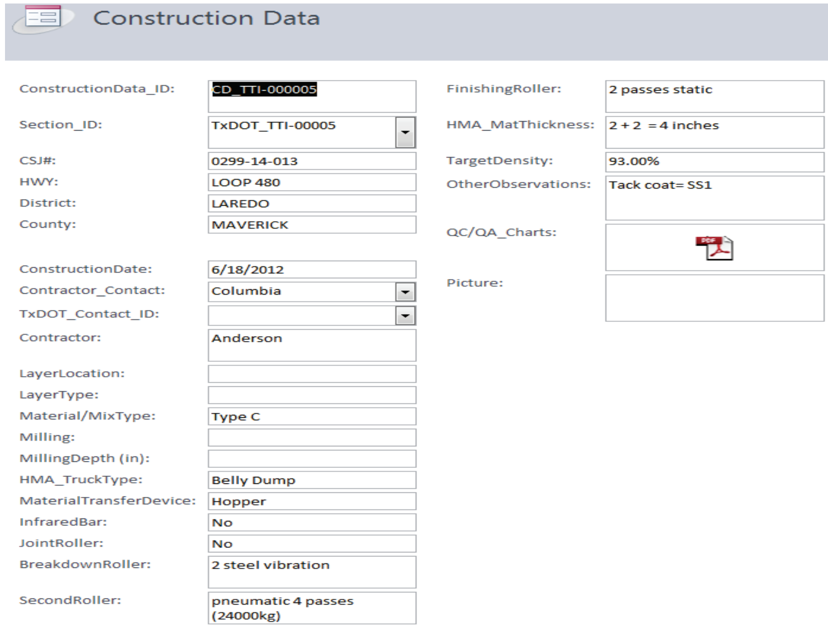
#	Data Item	DSS and RDSSP Views
1	Design reports	DSS View  RDSSP View 
2	Drawings	
3	Mix-design sheets, etc.	

Table 4-2. Example of Construction Data.

<table>
<tr><th>#</th><th>Data Item</th><th>DSS and RDSSP Views</th></tr>
<tr><td>1</td><td>Pre-construction site meeting minutes</td><td rowspan="9">DSS View



RDSSP View

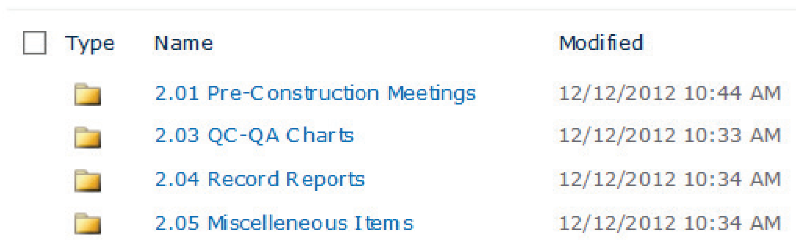
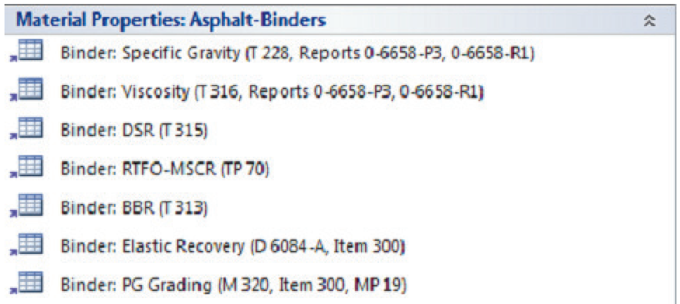

</td></tr>
<tr><td>2</td><td>Compaction patterns (number of passes, weight of compactors, etc.)</td></tr>
<tr><td>3</td><td>Material type</td></tr>
<tr><td>4</td><td>Layer/mat thicknesses</td></tr>
<tr><td>5</td><td>Density and temperatures</td></tr>
<tr><td>6</td><td>MTD</td></tr>
<tr><td>7</td><td>QC/QA data/charts</td></tr>
<tr><td>8</td><td>Coring</td></tr>
<tr><td>9</td><td>Name of contractor and contacts, etc.</td></tr>
</table>

Table 4-3. Material Properties (Example of Asphalt-Binder Data).

<table>
<tr><th>#</th><th>Data Item</th><th>DSS and RDSSP Views</th></tr>
<tr><td>1</td><td>Specific Gravity</td><td rowspan="7">DSS View


RDSSP View

</td></tr>
<tr><td>2</td><td>Viscosity</td></tr>
<tr><td>3</td><td>DSR</td></tr>
<tr><td>4</td><td>RTFO-MSCR</td></tr>
<tr><td>5</td><td>BBR</td></tr>
<tr><td>6</td><td>Elastic Recovery</td></tr>
<tr><td>7</td><td>PG Grading</td></tr>
</table>

Table 4-4. Material Properties (Example of HMA Mix Data).

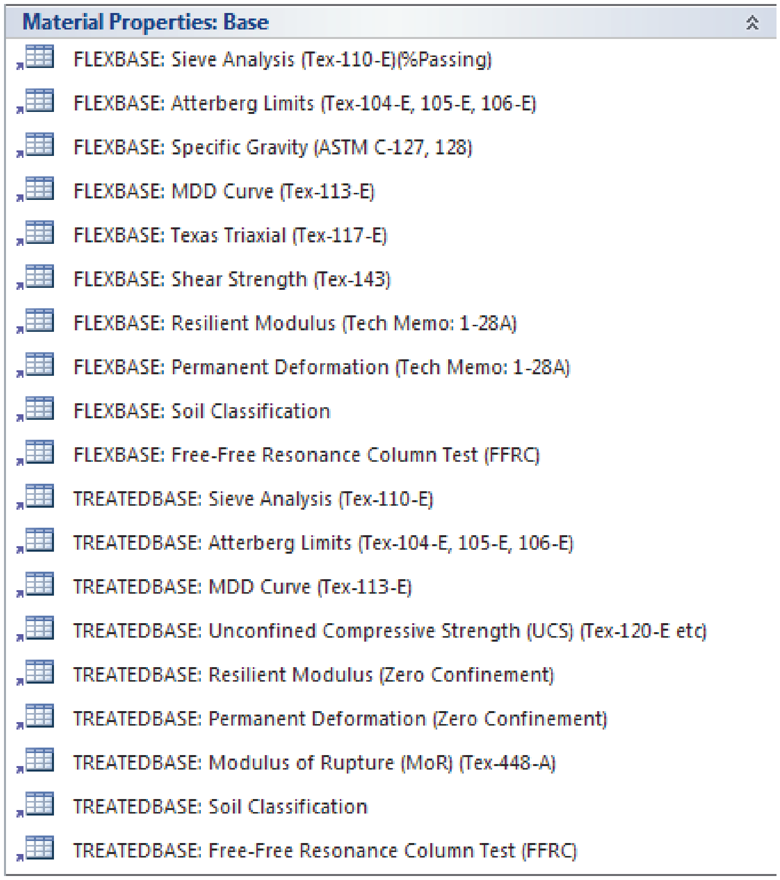
<table>
<tr><th>#</th><th>Data Item</th><th>DSS and RDSSP Views</th></tr>
<tr><td>1</td><td>Volumetrics</td><td rowspan="10">DSS View

Material Properties: HMA Mixes
HMA: Volumetrics (Mix design sheets, QC/QA charts)
HMA: AC Extractions (Tex-210-F)
HMA: Gradation Extractions (Tex-200-F) (%Passing)
HMA: Repeated Loading (RLPD) (Reports 0-6658-P3, 0-5798)
HMA: Hamburg (Tex-242-F) (Rut Depth in mm)
HMA: Dynamic Modulus (DM) (AASHTO TP 62-03) (Modulus in ksi)
HMA: Overlay (OT) (Tex-248-F I ≤1000 cycles)
HMA: Indirect Tension (IDT) (Tex-226-F I 85-200psi)
HMA: OT Fracture Properties (Reports 0-6658-P3, 0-5798-2)
HMA: Thermal Coefficient (Report 0-6658-P3, Tex-428-A)

RDSSP View

3.2.01 AC + Gradation Extractions
3.2.02 Molding Parameters
3.2.03 Hamburg
3.2.04 Repeated Load
3.2.05 Dynamic Modulus
3.2.06 OT_Tex-248-F
3.2.07 IDT_Tex-226-F
3.2.09 Thermal Coefficient
3.2.10 Flow Number</td></tr>
<tr><td>2</td><td>AC Extractions</td></tr>
<tr><td>3</td><td>Gradation Extractions</td></tr>
<tr><td>4</td><td>Repeated Loading (RLPD)</td></tr>
<tr><td>5</td><td>Hamburg (HWTT)</td></tr>
<tr><td>6</td><td>Dynamic Modulus (DM)</td></tr>
<tr><td>7</td><td>Overlay (OT)</td></tr>
<tr><td>8</td><td>Indirect Tension (IDT)</td></tr>
<tr><td>9</td><td>OT Fracture Properties</td></tr>
<tr><td>10</td><td>Thermal Coefficient</td></tr>
</table>

Table 4-5. Material Properties (Example of Base Data).

<table>
<tr><th>#</th><th>Data Item</th><th>DSS and RDSSP Views</th></tr>
<tr><td>1</td><td>FLEXBASE: Sieve Analysis</td><td rowspan="19">DSS View


RDSSP View

</td></tr>
<tr><td>2</td><td>FLEXBASE: Atterberg Limits</td></tr>
<tr><td>3</td><td>FLEXBASE: Specific Gravity</td></tr>
<tr><td>4</td><td>FLEXBASE: MDD Curve</td></tr>
<tr><td>5</td><td>FLEXBASE: Texas Triaxial</td></tr>
<tr><td>6</td><td>FLEXBASE: Shear Strength</td></tr>
<tr><td>7</td><td>FLEXBASE: Resilient Modulus</td></tr>
<tr><td>8</td><td>FLEXBASE: Permanent Deformation</td></tr>
<tr><td>9</td><td>FLEXBASE: Soil Classification</td></tr>
<tr><td>10</td><td>FLEXBASE: Free-Free Resonance Column Test</td></tr>
<tr><td>11</td><td>TREATEDBASE: Sieve Analysis</td></tr>
<tr><td>12</td><td>TREATEDBASE: Atterberg Limits</td></tr>
<tr><td>13</td><td>TREATEDBASE: MDD Curve</td></tr>
<tr><td>14</td><td>TREATEDBASE: Unconfined Compressive Strength</td></tr>
<tr><td>15</td><td>TREATEDBASE: Resilient Modulus</td></tr>
<tr><td>16</td><td>TREATEDBASE: Permanent Deformation</td></tr>
<tr><td>17</td><td>TREATEDBASE: Modulus of Rupture</td></tr>
<tr><td>18</td><td>TREATEDBASE: Soil Classification</td></tr>
<tr><td>19</td><td>TREATEDBASE: Free-Free Resonance Column Test</td></tr>
</table>

Table 4-6. Material Properties (Example of Subgrade Data).

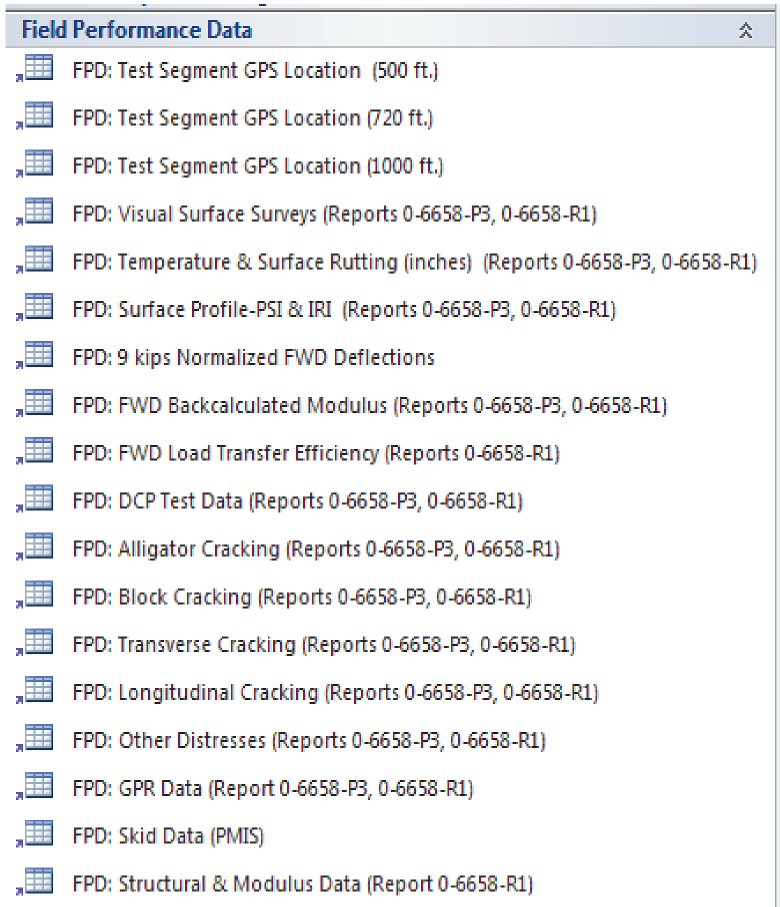
<table>
<tr><th>#</th><th>Data Item</th><th>DSS and RDSSP View</th></tr>
<tr><td>1</td><td>RAWSUBGRD: Sieve Analysis</td><td rowspan="19">DSS View

Material Properties: Subgrade
RAWSUBGRD: Sieve Analysis (Tex-110-E)(%Passing)
RAWSUBGRD: Atterberg Limits (Tex-104-E, 105-E, 106-E)
RAWSUBGRD: Specific Gravity (Tex-108-E)
RAWSUBGRD: MDD Curve (Tex-114-E)
RAWSUBGRD: Texas Triaxial (Tex-117-E)
RAWSUBGRD: Shear Strength (Tex-143)
RAWSUBGRD: Resilient Modulus (Tech Memo: 1-28A)
RAWSUBGRD: Permanent Deformation (Tech Memo: 1-28A)
RAWSUBGRD: Soil Classification
RAWSUBGRD: Free-Free Resonance Column Test (FFRC)
TREATEDSUBGRD: Gradation (Tex-110-E)
TREATEDSUBGRD: Atterberg Limits (Tex-104-E, 105-E, 106-E)
TREATEDSUBGRD: Sulfate Content (Tex-145-E)
TREATEDSUBGRD: MDD Curve (Tex-114-E)
TREATEDSUBGRD: Unconfined Compressive Strength (Tex-121-E)
TREATEDSUBGRD: Resilient Modulus (Zero Confinement)
TREATEDSUBGRD: Permanent Deformation (Zero Confinement)
TREATEDSUBGRD: Soil Classification
TREATEDSUBGRD: Free-Free Resonance Column Test (FFRC)

RDSSP View

RAWSUBGRD_Atterberg Limits_Loop 480 Laredo
RAWSUBGRD_MD Curve_LP480 Laredo
RAWSUBGRD_Shear Strength 1_Loop480 Laredo
RAWSUBGRD_Shear Strength 2_Loop480 Laredo
RAWSUBGRD_Sieve Anaysis_Loop 480 Laredo
RAWSUBGRD_Specific gravity_LP480 Subgrade
RAWSUBGRD_Texas Triaxial 1_Loop480 Laredo
RAWSUBGRD_Texas Triaxial 2_Loop480 Laredo</td></tr>
<tr><td>2</td><td>RAWSUBGRD: Atterberg Limits</td></tr>
<tr><td>3</td><td>RAWSUBGRD: Specific Gravity</td></tr>
<tr><td>4</td><td>RAWSUBGRD: MDD Curve</td></tr>
<tr><td>5</td><td>RAWSUBGRD: Texas Triaxial</td></tr>
<tr><td>6</td><td>RAWSUBGRD: Shear Strength</td></tr>
<tr><td>7</td><td>RAWSUBGRD: Resilient Modulus</td></tr>
<tr><td>8</td><td>RAWSUBGRD: Permanent Deformation</td></tr>
<tr><td>9</td><td>RAWSUBGRD: Soil Classification</td></tr>
<tr><td>10</td><td>RAWSUBGRD: Free-Free Resonance Column Test</td></tr>
<tr><td>11</td><td>TREATEDSUBGRD: Gradation</td></tr>
<tr><td>12</td><td>TREATEDSUBGRD: Atterberg Limits</td></tr>
<tr><td>13</td><td>TREATEDSUBGRD: Sulfate Content</td></tr>
<tr><td>14</td><td>TREATEDSUBGRD: MDD Curve</td></tr>
<tr><td>15</td><td>TREATEDSUBGRD: Unconfined Compressive Strength</td></tr>
<tr><td>16</td><td>TREATEDSUBGRD: Resilient Modulus</td></tr>
<tr><td>17</td><td>TREATEDSUBGRD: Permanent Deformation</td></tr>
<tr><td>18</td><td>TREATEDSUBGRD: Soil Classification</td></tr>
<tr><td>19</td><td>TREATEDSUBGRD: Free-Free Resonance Column Test</td></tr>
</table>

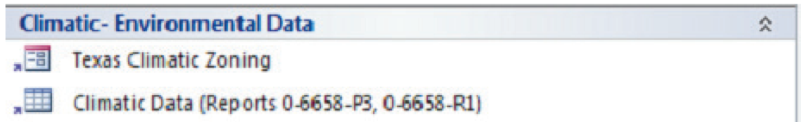
Table 4-7. Example of Field Performance Data.

<table>
<tr><th>#</th><th>Data Item</th><th>DSS and RDSSP Views</th></tr>
<tr><td>1</td><td>Test Segment GPS Location (500 ft)</td><td rowspan="18">DSS View


RDSSP View

</td></tr>
<tr><td>2</td><td>Test Segment GPS Location (720 ft)</td></tr>
<tr><td>3</td><td>Test Segment GPS Location (1000 ft)</td></tr>
<tr><td>4</td><td>Visual Surface Surveys</td></tr>
<tr><td>5</td><td>Temperature and Surface Rutting</td></tr>
<tr><td>6</td><td>Surface Profiles - PSI and IRI</td></tr>
<tr><td>7</td><td>9 kips Normalized FWD Deflections</td></tr>
<tr><td>8</td><td>FWD Back-calculated Modulus</td></tr>
<tr><td>9</td><td>FWD Load Transfer Efficiency</td></tr>
<tr><td>10</td><td>DCP Test Data</td></tr>
<tr><td>11</td><td>Alligator Cracking</td></tr>
<tr><td>12</td><td>Block Cracking</td></tr>
<tr><td>13</td><td>Transverse Cracking</td></tr>
<tr><td>14</td><td>Longitudinal Cracking</td></tr>
<tr><td>15</td><td>Other Distresses</td></tr>
<tr><td>16</td><td>GPR Data</td></tr>
<tr><td>17</td><td>Skid Data</td></tr>
<tr><td>18</td><td>Structural and Modulus Data</td></tr>
</table>

Table 4-8. Example of Climatic-Environmental Data.

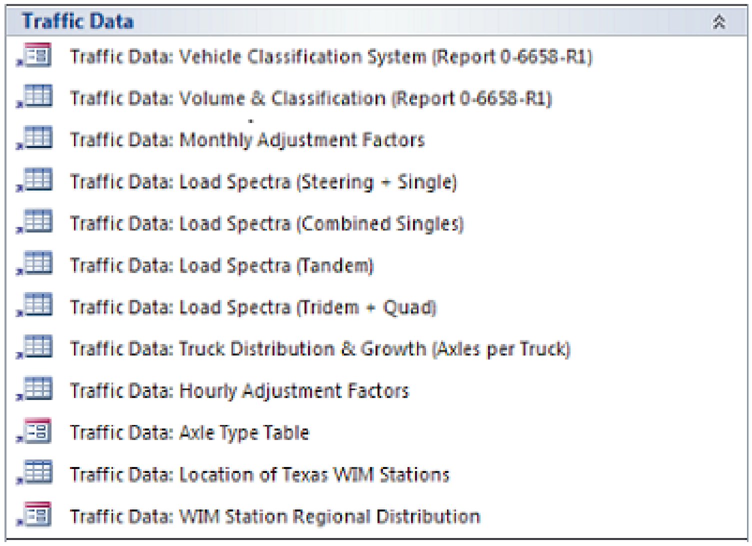
<table>
<tr><th>#</th><th>Data Item</th><th>DSS and RDSSP Views</th></tr>
<tr><td>1</td><td>Texas Climatic Zoning</td><td rowspan="2">DSS View


RDSSP View

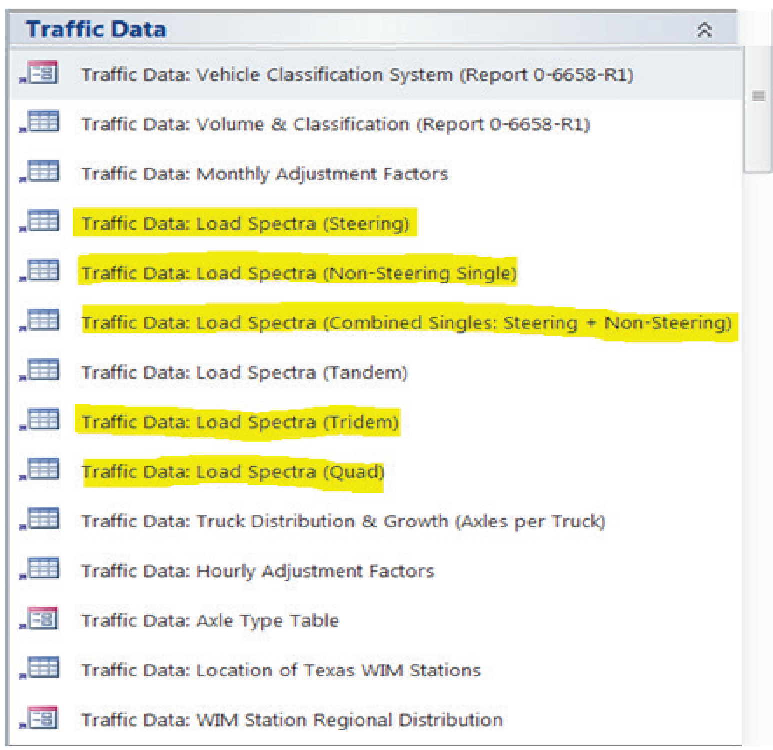
</td></tr>
<tr><td>2</td><td>Climatic Data (temperature, precipitation, GPS, elevation, etc.)</td></tr>
</table>

Table 4-9. Traffic Data (Example of Volume and Load Spectra Data).

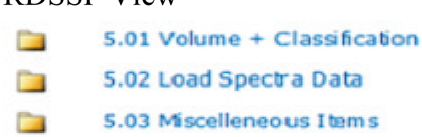
<table>
<tr><th>#</th><th>Data Item</th><th>DSS and RDSSP Views</th></tr>
<tr><td>1</td><td>Vehicle Classification System</td><td rowspan="12">
DSS View



<u>Proposed Modified Arrangement of Traffic Data Tables</u>



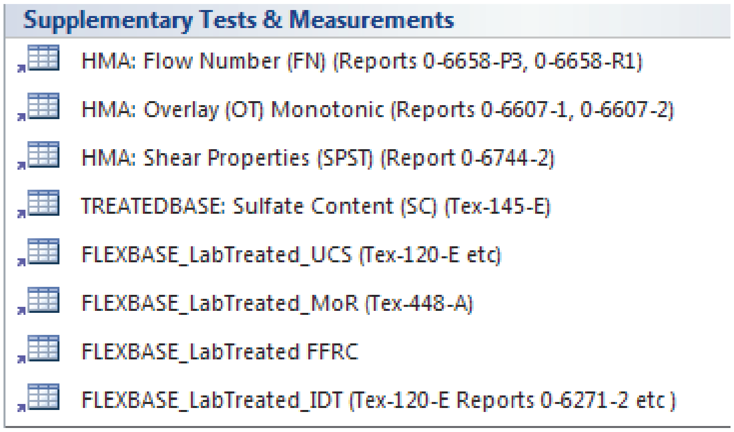
RDSSP View



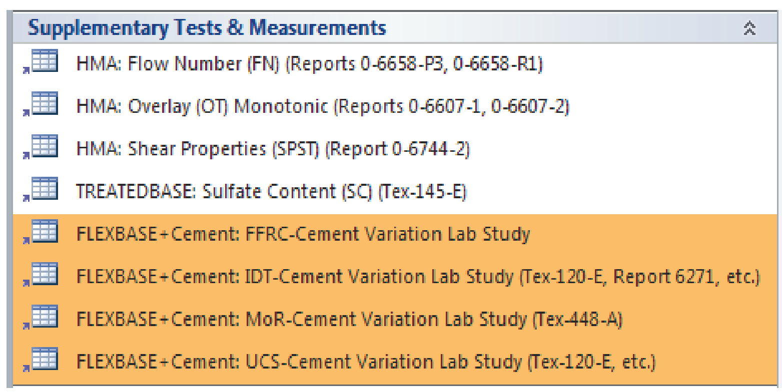
</td></tr>
<tr><td>2</td><td>Volume and Classification</td></tr>
<tr><td>3</td><td>Monthly Adjustment Factors</td></tr>
<tr><td>4</td><td>Load Spectra (Steering + Single)</td></tr>
<tr><td>5</td><td>Load Spectra (Combined Singles)</td></tr>
<tr><td>6</td><td>Load Spectra (Tandem)</td></tr>
<tr><td>7</td><td>Load Spectra (Tridem + Quad)</td></tr>
<tr><td>8</td><td>Truck Distribution and Growth (Axles per Truck)</td></tr>
<tr><td>9</td><td>Hourly Adjustment Factors</td></tr>
<tr><td>10</td><td>Axle Type Table</td></tr>
<tr><td>11</td><td>Location of Texas WIM Stations</td></tr>
<tr><td>12</td><td>WIM Station Regional Distribution</td></tr>
</table>

Table 4-10. Example of Supplementary Tests and Measurements.

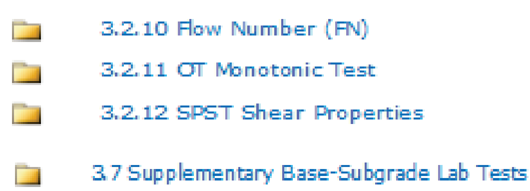
<table>
<tr><th>#</th><th>Data Item</th><th>DSS and RDSSP Views</th></tr>
<tr><td>1</td><td>HMA: Flow Number (FN)</td><td rowspan="8">DSS View



<u>Proposed Modified Table Titles in the DSS</u>



RDSSP View


</td></tr>
<tr><td>2</td><td>HMA: Overlay (OT) Monotonic</td></tr>
<tr><td>3</td><td>HMA: Shear Properties (SPST)</td></tr>
<tr><td>4</td><td>TREATEDBASE: Sulfate Content (SC)</td></tr>
<tr><td>5</td><td>FLEXBASE_LabTreated_ UCS</td></tr>
<tr><td>6</td><td>FLEXBASE_LabTreated_ MoR</td></tr>
<tr><td>7</td><td>FLEXBASE_LabTreated FFRC</td></tr>
<tr><td>8</td><td>FLEXBASE_LabTreated_ IDT</td></tr>
</table>

SECTION 5 M-E DATA REQUIREMENTS

As stated in the introductory section of this submission, one of the primary goals of this study is to collect sufficient data to aid in the calibration and validation of the M-E models and the related software, namely:

- The Flexible Pavement Design System (FPS) design procedure.
- The Texas Overlay design system (TxACOL).
- The Texas M-E (Tx-ME).
- The Mechanistic-Empirical Pavement Design Guide (M-E PDG).

Significant efforts were made in this study to ensure that the data requirements of these M-E models and related software were adequately addressed in the data collection plans and in both the DSS and RDSSP. Appendix II contains the itemized list of the various M-E data requirements and input parameters, along with their source locations in the DSS. Figures 5-1 to 5-4 show screenshots of the corresponding M-E software.

Figure 5-1. Main Menu Screenshot of the FPS Software.

Figure 5-2. Main Menu Screenshot of the TxACOL Software.

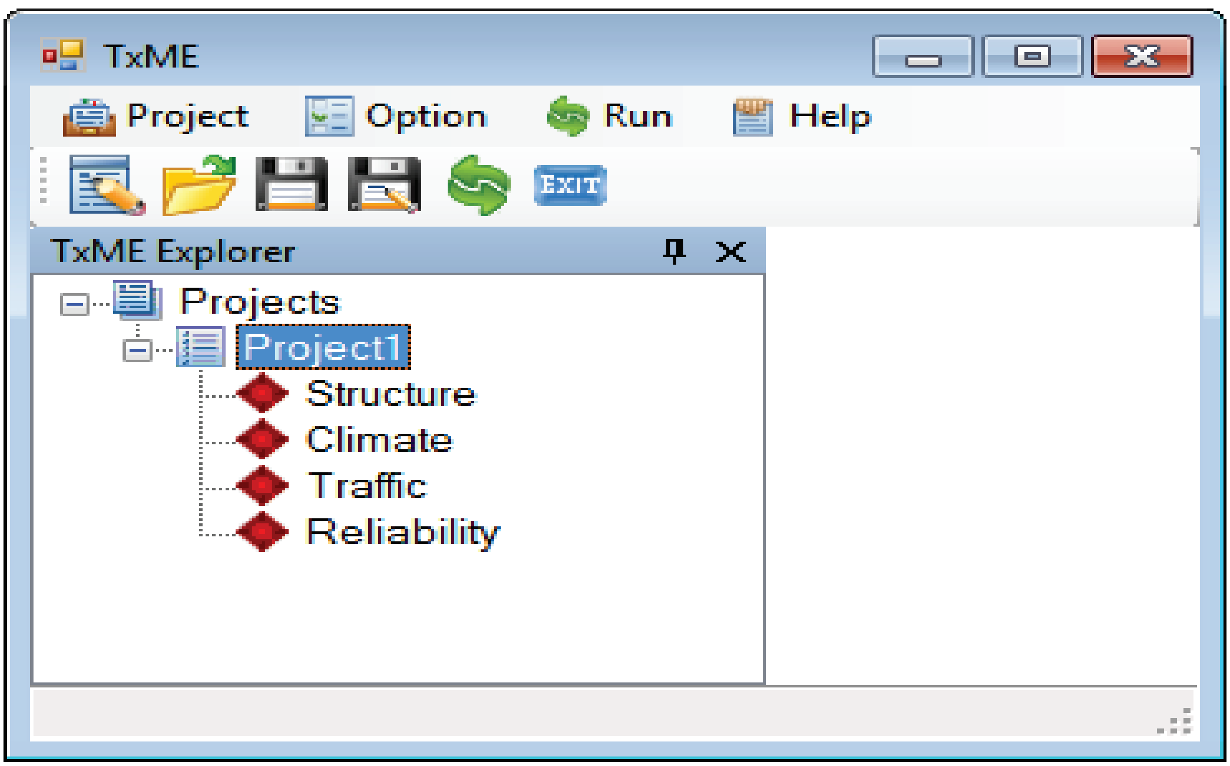


Figure 5-3. Main Menu Screenshot of the TxM-E Software.

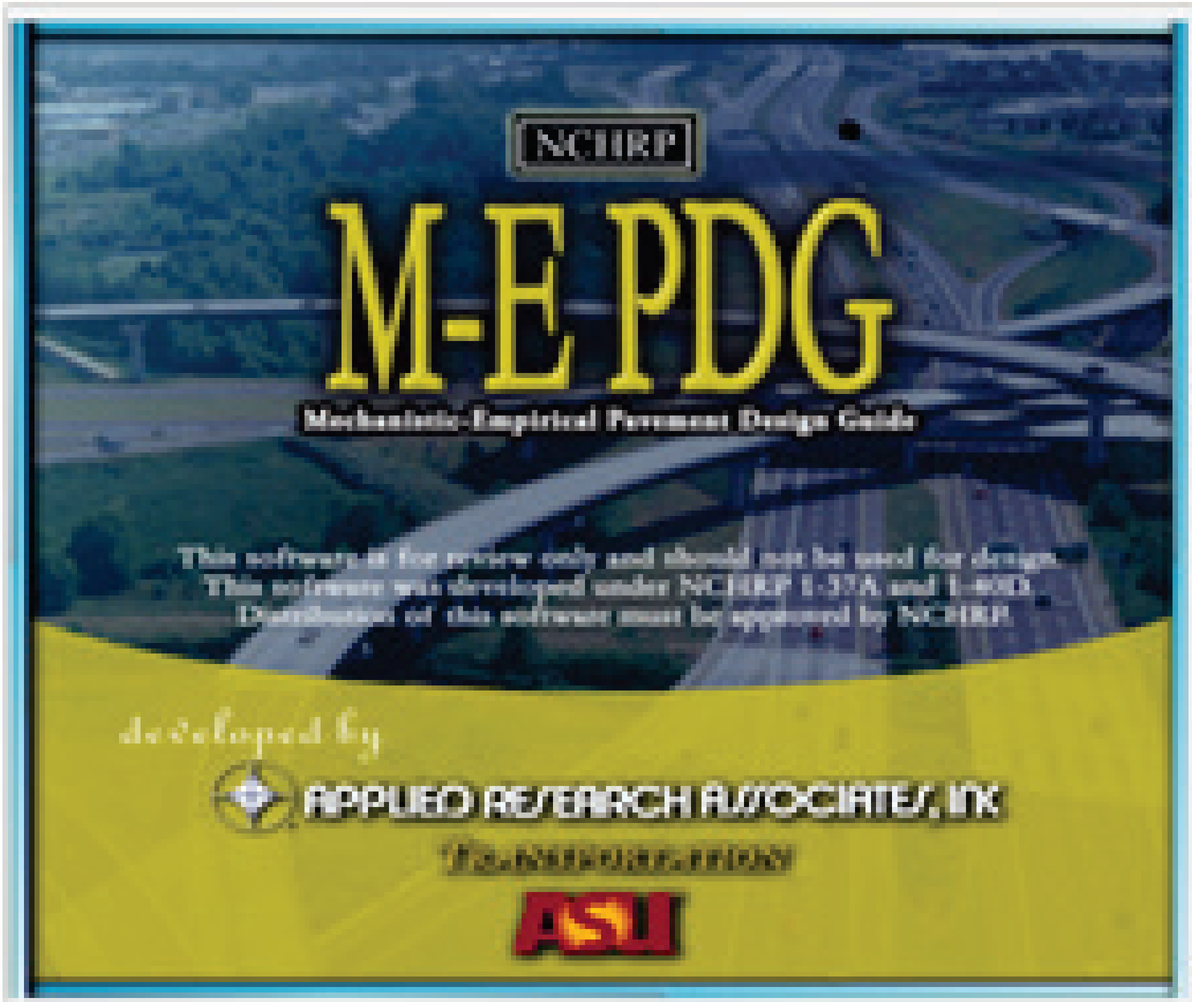


Figure 5-4. Opening Screenshot of the M-E PDG Software (Version 1.1).

SECTION 6 TEST SPECIFICATIONS AND GUIDELINES

To ensure quality and data consistency, the researchers adhere to a set of stipulated test specifications and guidelines when collecting, processing, and analyzing the data. These specifications, guidelines, and data collection forms are listed in Appendix III and include the following:

- Asphalt-binder testing and material characterization.
- HMA testing and data analysis and material characterization.
- Base and soil material testing and material characterization.
- Field testing and data collection.
- Pre-construction distress survey sheets.
- Construction data collection sheets.
- Field data collection sheets.

Detailed documentation of these test specifications, guidelines, data collection forms, and data analysis methods can be found in:

Walubita, L.F., G. Das, E.M. Espinoza, J.H. Oh, T. Scullion, J.L. Garibay, S. Nazarian, I. Abdallah, and S. Lee (2012). Texas Flexible Pavements and Overlays: Year 1 Report – Test Sections, Data Collection, Analyses, and Data Storage System. Technical Research Report #0-6658-1. TTI, College Station, TX, USA.

Website Link: http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/0-6658-1.pdf.

SECTION 7 DATABASE ACCESS AND NAVIGATION DEMO

All laboratory and field data can be accessed and navigated via the database system developed in Project 0-6658 as the following:

1) Unprocessed raw data from the RDSSP.
2) Processed data from the MS Access DSS.

Both data types can be downloaded, exported, and emailed directly from each of these database systems. These aspects are discussed and demonstrated in the subsequent subsections and Appendices IV thru VI, with full details to be documented in Product 0-6658-P2 (User's Manual). Prototype databases for demonstration purposes have been included in the accompanying external drive (CD/USB flash disk).

THE RDSSP – ACCESSING AND DOWNLOADING DATA

All the unprocessed raw data measured and collected in this study are available in the RDSSP and can be accessed and downloaded for data verification and future analysis. The RDSSP is linked to the DSS via a **Raw Data Files** function on the DSS main screen shown in Figure 7-1. In response to the user clicking on **Raw Data Files** in the DSS main menu, the **Raw Data Prompt** dialog box will appear, asking for the destination of the raw data collected.

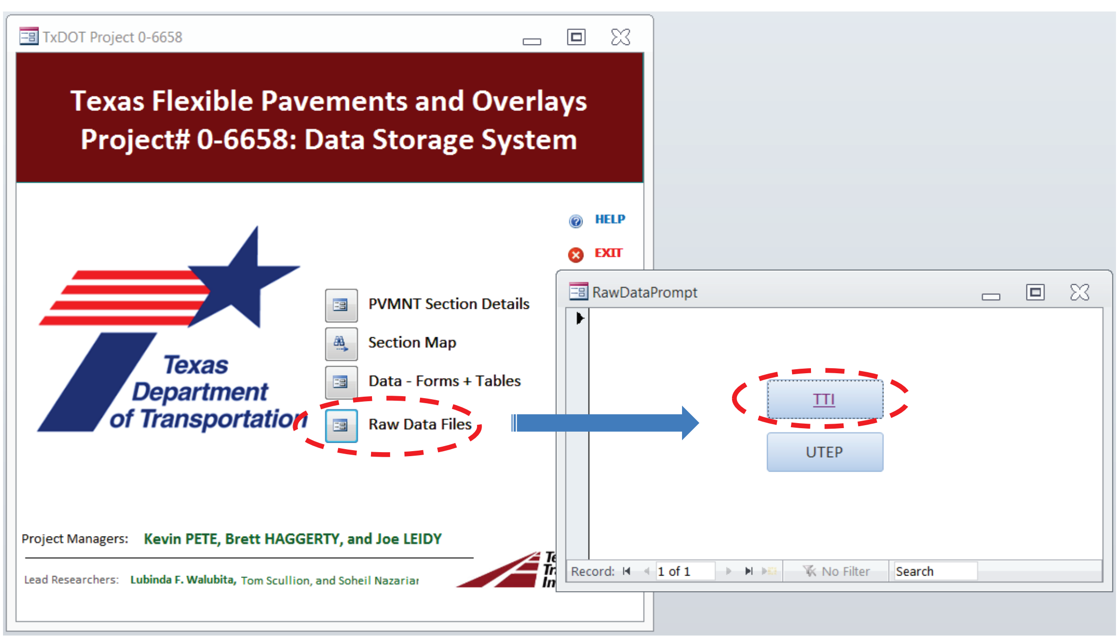


Figure 7-1. DSS Main Menu and Raw Data Prompt in DSS.

When the user specifies a destination, the linked website will open in a web browser as shown in Figure 7-2. Upon clicking a test section and selecting a data folder to be accessed, the user can access, download, and email the data file as exemplified in Figure 7-3.

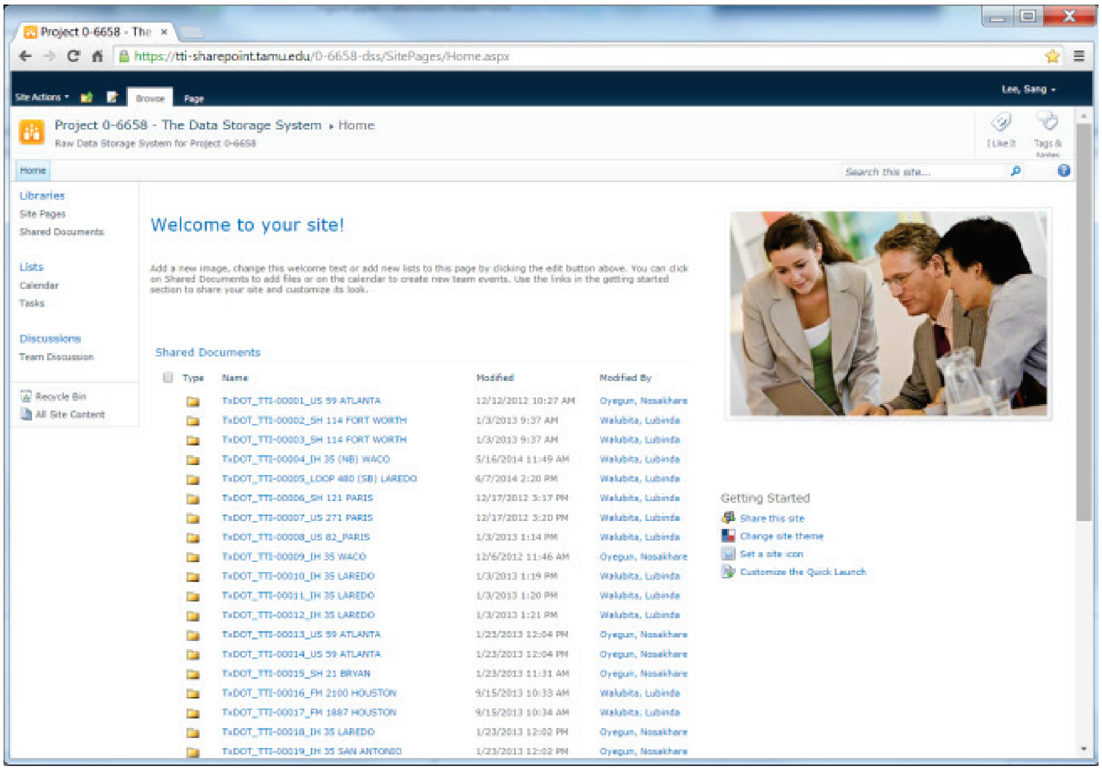


Figure 7-2. The RDSSP Website.

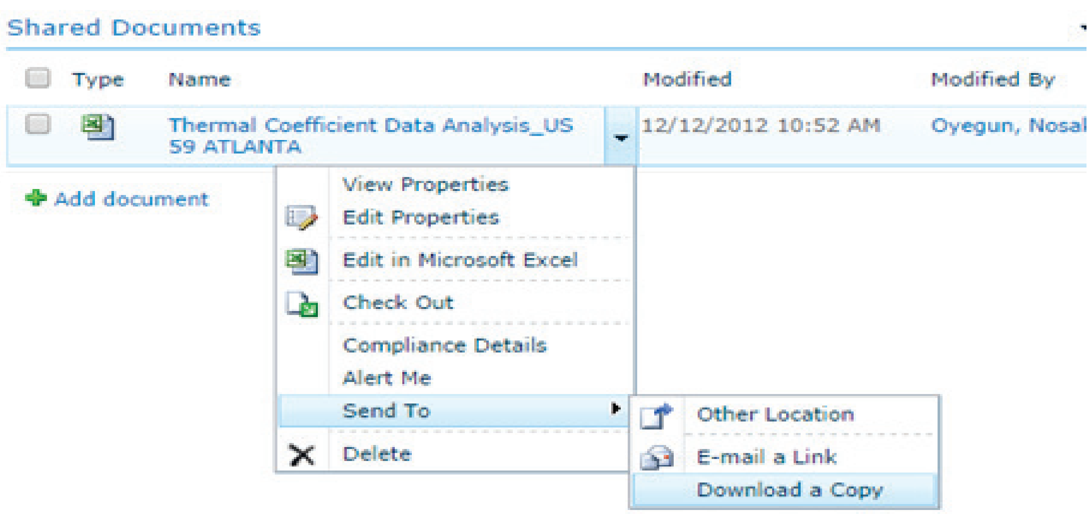


Figure 7-3. Downloading and Emailing Data in RDSSP.

In the current setup, a user ID and password that can be obtained from TTI are required to access the RDSSP. Thus, for demonstration purposes and size considerations, an extract of the RDSSP with some three selected test sections (1.68 GB) has been included in the CD/USB flash disk accompanying this documentation.

THE DSS – ACCESSING, ANALYZING, AND DISPLAYING DATA

The DSS allows users to conveniently assess, analyze, and display the stored data (refer to the accompanying CD/USB flash disk for access to the DSS). The four view options at the bottom right corner of MS Access, namely the Datasheet view, the Pivot Table view, the Pivot Chart view, and the Design view are useful for these purposes (Figure 7-4).

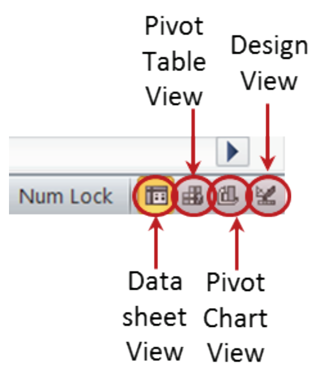


Figure 7-4. View Options in the MS Access for Analyzing and Displaying Data.

Showing Average, Maximum, Minimum, and Standard Deviation of Data in a Table

Mathematical operations such as average, maximum, minimum, standard deviation (Stdev), etc., can be performed on the stored DSS data in the **Pivot Table View**. The detailed step-by-step procedure is presented in Table IV-1 in Appendix IV. In the Pivot Table view, the user can select the data set to be analyzed from a **Pivot Table Field List** and drag it to the desired position in the Pivot Table (Figure 7-5). The desired analyses can be performed by right clicking on the data table and selecting **AutoCalc** followed by the appropriate analysis option (e.g., average, maximum, minimum, standard deviation).

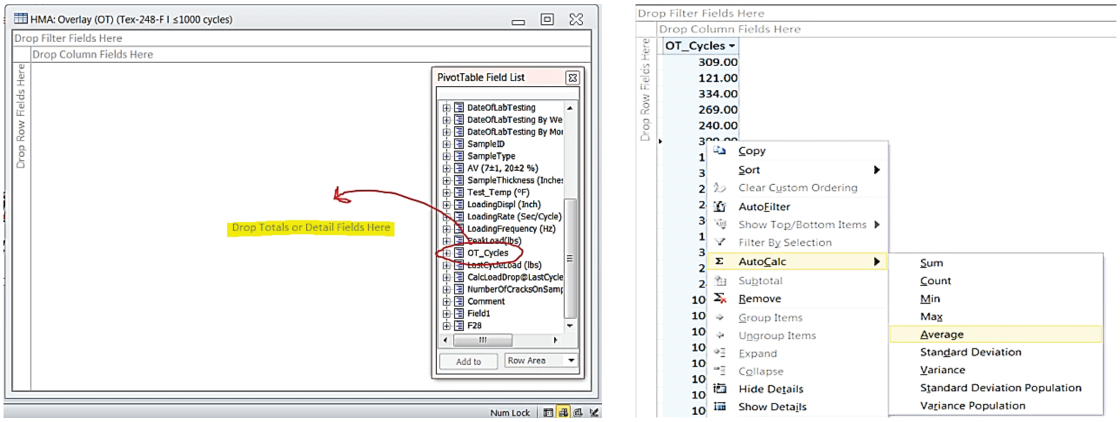
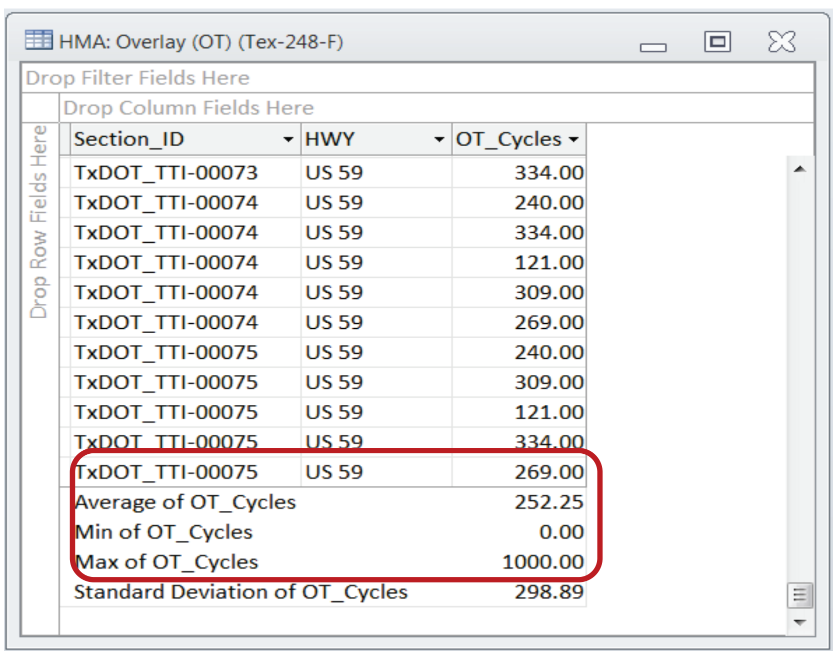


Figure 7-5. Calculating Average, Maximum, Minimum, and Stdev in Pivot Table View.

The desired analysis result/results for all the data in the column will be presented at the end of the data column as exemplified in Figure 7-6.



Section_ID	HWY	OT_Cycles
TxDOT_TTI-00073	US 59	334.00
TxDOT_TTI-00074	US 59	240.00
TxDOT_TTI-00074	US 59	334.00
TxDOT_TTI-00074	US 59	121.00
TxDOT_TTI-00074	US 59	309.00
TxDOT_TTI-00074	US 59	269.00
TxDOT_TTI-00075	US 59	240.00
TxDOT_TTI-00075	US 59	309.00
TxDOT_TTI-00075	US 59	121.00
TxDOT_TTI-00075	US 59	334.00
TxDOT_TTI-00075	US 59	269.00
Average of OT_Cycles		252.25
Min of OT_Cycles		0.00
Max of OT_Cycles		1000.00
Standard Deviation of OT_Cycles		298.89

Figure 7-6. Calculating Average, Maximum, Minimum, and Stdev in Pivot Table.

Generating Graphs from Data in a Table

Graphs can be generated from the stored DSS data in the **Pivot Chart View**. The data to be presented in the chart can be dragged and dropped to their appropriate axes from a **Chart Field List** as shown in Figure 7-7.

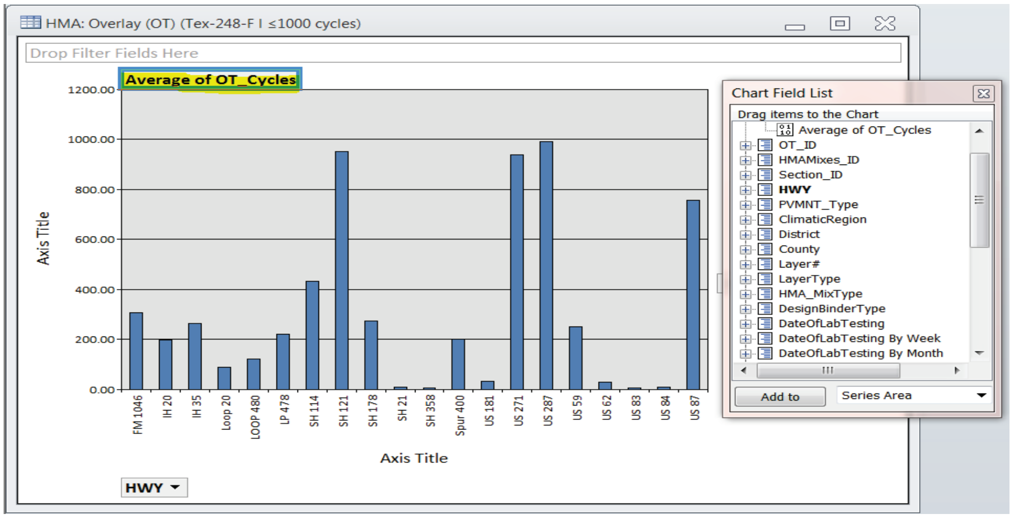


Figure 7-7. Generating Data Charts in Pivot Chart View in MS Access.

Multiple data sets can be presented in this procedure by simply adding the desired data to the appropriate axes. The detailed step-by-step procedure is presented in Table IV-2 in Appendix IV.

THE DSS – EXPORTING AND EMAILING DATA

All tables in the MS Access DSS can be exported or emailed as a specific file type such as an Excel or PDF file directly from MS Access. This can be done by clicking on the **Export** group in the **External Data** tab, and then clicking on **Excel**, **PDF or XPS** or **E-mail** on the export category as shown in Figure 7-8.

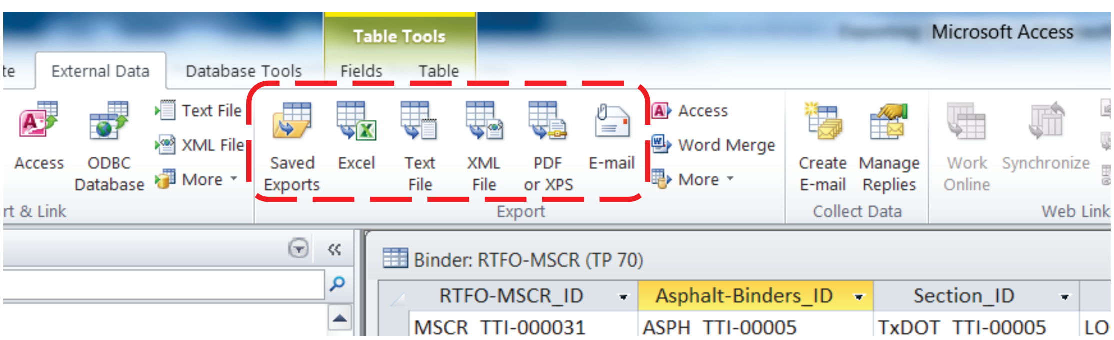


Figure 7-8. Exporting and Emailing Tables.

Exporting a Table to Excel File

In response to clicking on the **Excel** option, a menu will appear asking for a destination file name and format as shown in Figure 7-9. By specifying a folder location for the table and clicking **OK**, the Excel file can be found in the destination folder. In order to preserve the formatting of the table, check the option of "**Export data with formatting and layout.**"

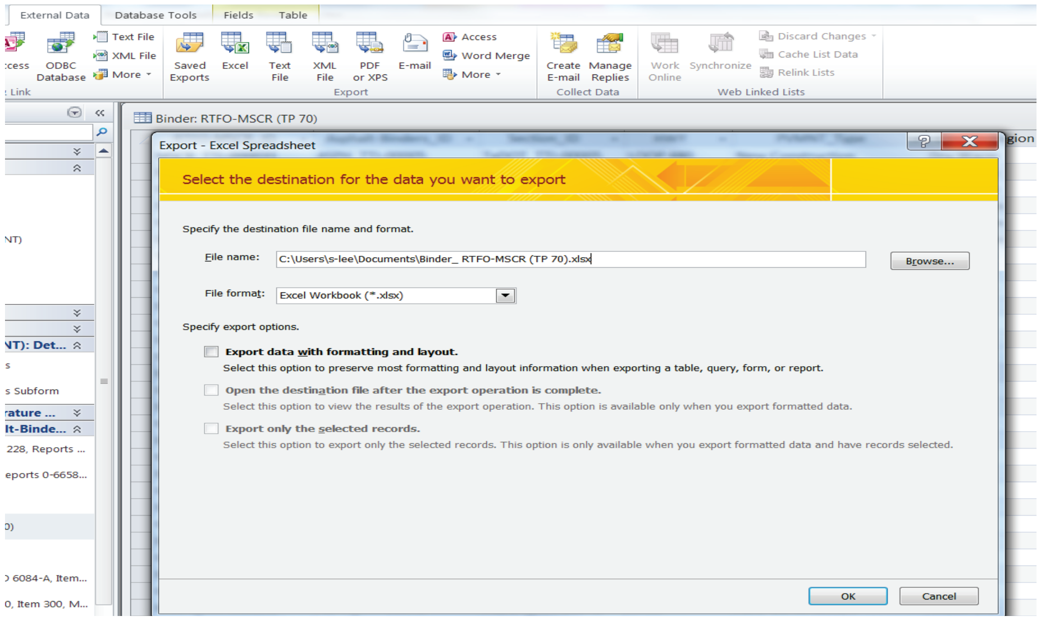


Figure 7-9. Excel Exporting Option Menu.

Exporting a Table to PDF

The DSS tables can be published as PDF to be used for documentation. In response to clicking on the **PDF or XPS** option in the **Export** group, a menu will appear selecting a destination and typing a name for the table as shown in Figure 7-10. By clicking **Publish**, the PDF file can be found in the destination folder.

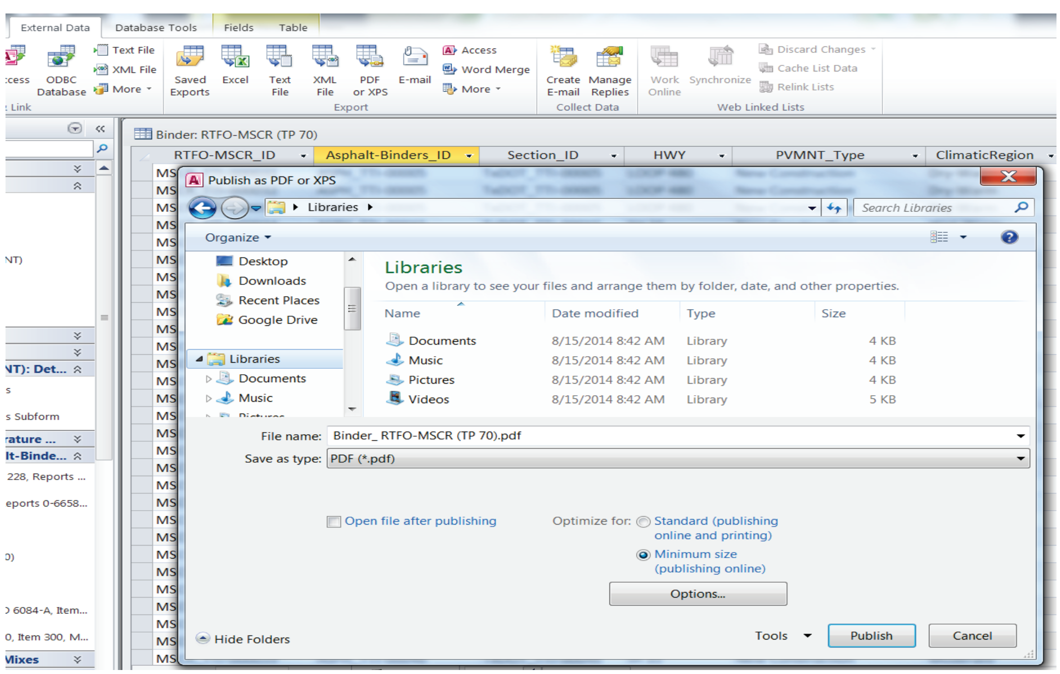


Figure 7-10. PDF Exporting Option Menu.

Emailing a Data Table

Clicking the **Email** option in the **Export** group opens a pop-up menu asking to specify the file format. Once the file format has been selected, Microsoft Outlook will open a new message window with the file as an attachment, as shown in Figure 7-11. It is noted that the email option to export tables will not work if the user is disconnected from Microsoft Outlook. Appendix V contains step-by-step examples for exporting and emailing the DSS data tables.

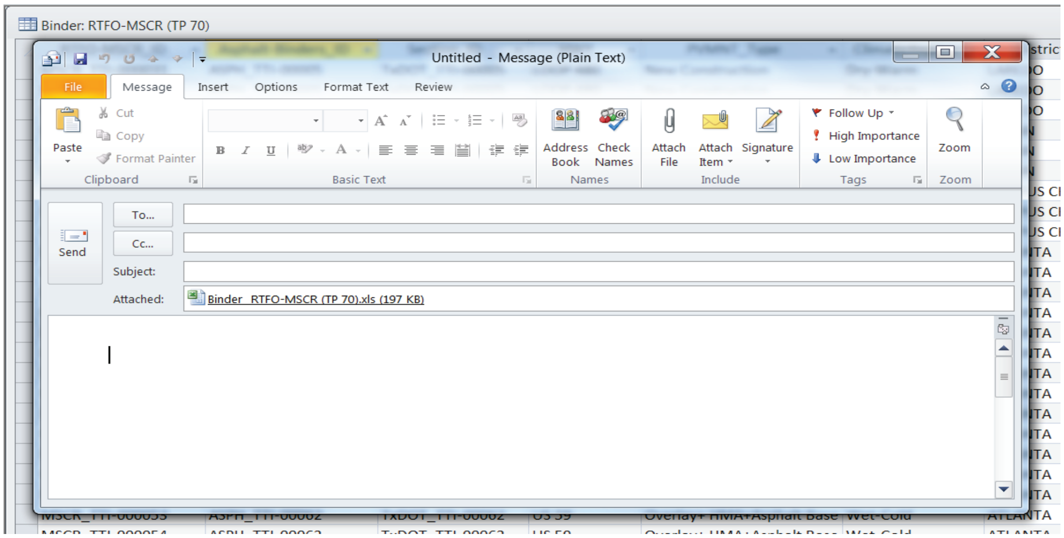


Figure 7-11. Microsoft Outlook Email Draft with Attachment.

THE DSS – ACCESSING MULTIPLE DATA

Multiple data columns from different tables can be accessed and presented together in MS Access by creating a **Query Table** (see Figure 7-12). The user can select the desired data fields from their respective tables in the **Query Design** and select the order in which the data fields are to be presented and displayed. The data in the Tables can also be filtered by declaring the **Criteria** for each field. The detailed step-by-step procedure is presented in Appendix VI.

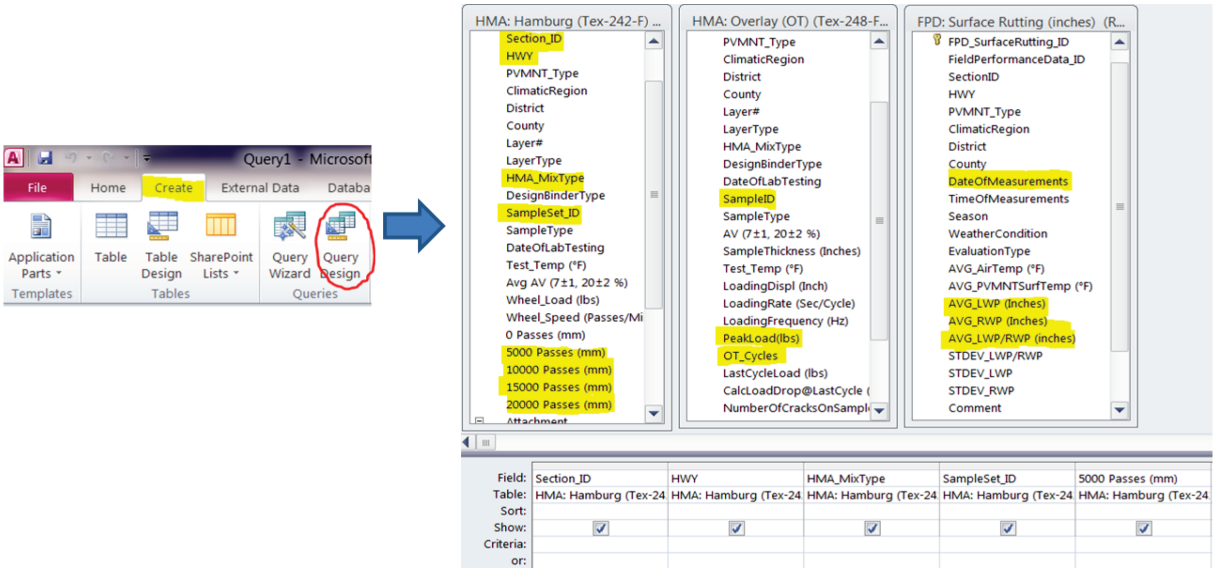


Figure 7-12. Accessing Multiple Data in MS Access.

APPENDIX I. TABULATION OF TEST SECTIONS

Table I-1. Example Test Section Summary by District.

	District			Climatic Region	Hwy	Section ID#		PVMNT Type	Layer Material Type						
#	Abbre.	Full Name	#						0	1	2	3	4	5	6
	ABL	Abilene	8	Dry-Cold	US 84	UTEP	7	Overlay-HMA-FlexBase	Subgrade	Existing Base	Existing HMA	HMA	PFC		
1	ABL	Abilene	8	Dry-Cold	FM 2833	UTEP	11	New Construction	Subgrade	3% Lime Treated Subgrade so	RBL	1" SFHMA (RRL)	3/4" SFHMA	SMA	Overlay
	ABL	Abilene	8	Dry-Cold	FM 600	UTEP	21	Overlay	Subgrade	Treated Subgrade	RBL	1" SFHMA (RRL)	3/4" SFHMA	SMA	PFC
	ATL	Atlanta	19	Wet-Cold	US 59	TTI	1	Overlay-HMA-LTB	Subgrade	LFA Base	LFA Base	HMA (Existing)	HMA (Existing)	HMA (Existing)	HMA (Exis
	ATL	Atlanta	19	Wet-Cold	US 59	TTI	13	Overlay-HMA-LTB	Subgrade	LFA Base	LFA Base	HMA (Existing)	HMA (Existing)	HMA (Existing)	HMA (Exis
	ATL	Atlanta	19	Wet-Cold	US 59	TTI	14	Overlay-HMA-LTB	Subgrade	LFA Base	LFA Base	HMA (Existing)	HMA (Existing)	HMA (Existing)	HMA (Exis
	ATL	Atlanta	19	Wet-Cold	US 59	TTI	61	Overlay+ HMA+Asphalt B	Subgrade	Treated Subgrade	Asphalt Stabiliz	HMA (Existing)	Type D		
2	ATL	Atlanta	19	Wet-Cold	US 59	TTI	62	Overlay+ HMA+Asphalt B	Subgrade	Treated Subgrade	Asphalt Stabiliz	HMA (Existing)	Type D		
	ATL	Atlanta	19	Wet-Cold	US 59	TTI	72	Overlay+ HMA+Asphalt B	Subgrade	tReated Subgrade	Asphalt Stabiliz	HMA (Existing)	Type D		
	ATL	Atlanta	19	Wet-Cold	US 59	TTI	73	Overlay-HMA-LTB	Subgrade	LFA Base	LFA Base	HMA (Existing)	HMA (Existing)	HMA (Existing)	HMA (Exis
	ATL	Atlanta	19	Wet-Cold	US 59	TTI	74	Overlay-HMA-LTB	Subgrade	LFA Base	LFA Base	HMA (Existing)	HMA (Existing)	HMA (Existing)	HMA (Exis
	ATL	Atlanta	19	Wet-Cold	US 59	TTI	75	Overlay-HMA-LTB	Subgrade	LFA Base	LFA Base	HMA (Existing)	HMA (Existing)	HMA (Existing)	HMA (Exis
3	AMA	Amarillo	4	Dry-Cold	US 83	UTEP	16	New Construction	Fly ash Subgrade	Subbase	Base	HMA			
4	AUS	Austin	14	Moderate	SH 304	TTI	71	New Construction	Subgrade	Flex Base	(To start 2014)	Rehab (To start 2014)			
	BMT	Beaumont	20	Wet-Warm	FM 770	TTI	34	Overlay	In Progress						
5	BMT	Beaumont	20	Wet-Warm	FM 565	TTI	36	Reconstruction	In Progress						
	BMT	Beaumont	20	Wet-Warm	Loop 207	TTI	76	Reconstruction	In Progress						
	BRY	Bryan	17	Wet-Warm	SH 21	TTI	15	New Construction	Subgrade	Treated Subbgrade	Flex Base	Type C (Coarse)	Type C (Surface)		
	BRY	Bryan	17	Wet-Warm	SH 7	TTI	29	Overlay-HMA-CTB	Subgrade	Flex Base	CTB	HMA (Existing)	Type C		
	BRY	Bryan	17	Wet-Warm	FM 974	TTI	35	Seal Coat (FDR-Rehab)	Subgrade	Existing Base					
6	BRY	Bryan	17	Wet-Warm	SH 21	TTI	42	Overlay-HMA-FlexBase	Subgrade	Flex Base	HMA (Existing)	Type C			
	BRY	Bryan	17	Wet-Warm	SH 21	TTI	49	Overlay	Subgrade	Base	HMA (Existing)	Type C			
	CHS	Childress	25	Dry-Cold	FM 1046	UTEP	6	New Construction	Subgrade	Treated Base	Type D				
	CHS	Childress	25	Dry-Cold	US 287	UTEP	10	Overlay-HMA-FlexBase	Subgrade	Existing Base	HMA (Existing)	SMA			
	CHS	Childress	25	Dry-Cold	US 62	UTEP	23	Overlay	Subgrade	SMA	HMA (Existing)				
7	CHS	Childress	25	Dry-Cold	US 82	UTEP	24	Overlay	Subgrade	Existing Base	HMA				
	CHS	Childress	25	Dry-Cold	US 287	UTEP	31	Seal Coat	Subgrade	Existing Base	HMA (Existing)	HMA			
	CHS	Childress	25	Dry-Cold	US 62	UTEP	32	Seal Coat	Subgrade	Existing Base	HMA				
	CRP	Corpus Chris	16	Moderate	US 181	TTI	25	Overlay-HMA-LTB	Subgrade	Subgrade	Base	HMA	Type C		
8	CRP	Corpus Chris	16	Moderate	SH 358	TTI	26	Overlay-HMA-LTB	Subgrade	Subgrade	Base	HMA	Type C		
	CRP	Corpus Chris	16	Moderate	FM 763	TTI	27	Seal Coat (FDR-Rehab)	Subgrade	Treated Reclaimed Material	Flex Base	Grade 5 Seal Coat	Grade 3 Seal Coat	Grade 4 Seal Coat	
	ELP	El Paso	24	Dry-Warm	SH 178	UTEP	1	New Construction	Subgrade	Treated Base	Type C WMA				
	ELP	El Paso	24	Dry-Warm	US 62	UTEP	2	New Construction	Subgrade	Treated Base	WMA				
	ELP	El Paso	24	Dry-Warm	US 62	UTEP	3	New Construction	Subgrade	Treated Base	WMA				
	ELP	El Paso	24	Dry-Warm	LP 478 (Dyer)	UTEP	15	Overlay-HMA-FlexBase	Subgrade	Existing Base	Existing WMA	New WMA			
	ELP	El Paso	24	Dry-Warm	Loop 375 TM	UTEP	13	New Construction	Subgrade	Treated Base	WMA				
	ELP	El Paso	24	Dry-Warm	Loop 375 TM	UTEP	14	New Construction	Subgrade	Treated Base	WMA				
9	ELP	El Paso	24	Dry-Warm	IH10 frontage	UTEP	25	Overlay	Subgrade	Existing Base	Existing WMA	WMA			
	ELP	El Paso	24	Dry-Warm	IH10 frontage	UTEP	29	Overlay	Subgrade	Existing Base	WMA				
	ELP	El Paso	24	Dry-Warm	IH10 frontage	UTEP	30	Overlay	Subgrade	Existing Base	WMA				
	ELP	El Paso	24	Dry-Warm	US 85	UTEP	26	Overlay	Subgrade	Existing Base	Existing WMA	WMA			
	ELP	El Paso	24	Dry-Warm	US 85	UTEP	27	Overlay	Subgrade	Existing Base	Existing WMA	WMA			
	ELP	El Paso	24	Dry-Warm	SP 16	UTEP	28	New Construction	Subgrade	Existing Base	Treated Base	WMA			

Table I-1. Example Test Section Summary by District (Continued).

	FTW	Fort Worth	2	Wet-Cold	SH 114	TTI	2	Perpetual	Subgrade	Treated Sub	RBL	1" SFHMA (RRL)	3/4" SFHMA	SMA			
10	FTW	Fort Worth	2	Wet-Cold	SH 114	TTI	3	Perpetual	Subgrade	Treated Sub	RBL (Type C)	Type B (RRL)	Type C	SMA			
	FTW	Fort Worth	2	Wet-Cold	FM 2135	TTI	30	Overlay	Subgrade	In Progress							
	FTW	Fort Worth	2	Wet-Cold	SH 267	TTI	77	Reconstruction	Subgrade	In Progress							
	LBB	Lubbock	5	Dry-Cold	US 62	UTEP	4	New Construction	Subgrade	Treated Bas	HMA	SMA					
	LBB	Lubbock	5	Dry-Cold	US 70	UTEP	5	New Construction	Subgrade	Existing Bas	WMA	HMA					
	LBB	Lubbock	5	Dry-Cold	FM 2255	UTEP	9	New Construction	Subgrade	Treated Bas	Base HMA	HMA					
11	LBB	Lubbock	5	Dry-Cold	US 87	UTEP	19	Overlay-HMA-FlexBase	Subgrade	SMA	HMA (Existing)	Flexbase					
	LBB	Lubbock	5	Dry-Cold	US 70	UTEP	20	Overlay	Subgrade	Treated Bas	Base HMA	HMA					
	LBB	Lubbock	5	Dry-Cold	US 62	UTEP	18	Overlay-HMA-FlexBase	Subgrade	Existing Bas	HMA (Existing)	HMA	SMA				
	LBB	Lubbock	5	Dry-Cold	FM 37	UTEP	22	Reconstruction/FDR	Subgrade	Treated Base							
	LRD	Laredo	22	Dry-Warm	LOOP 480	TTI	5	New Construction	Subgrade	Treated Sub	Flex Base	Type C					
	LRD	Laredo	22	Dry-Warm	IH 35	TTI	10	Perpetual	Subgrade	CTB	RBL	1" SFHMA	3/4" SFHMA	SMA	Type D		
	LRD	Laredo	22	Dry-Warm	IH 35	TTI	11	Perpetual	Subgrade	Treated Sub	RBL	1" SFHMA	3/4" SFHMA	SMA	Overlay		
	LRD	Laredo	22	Dry-Warm	IH 35	TTI	12	Perpetual	Subgrade	Treated Sub	RBL	1" SFHMA	3/4" SFHMA	SMA	Overlay		
	LRD	Laredo	22	Dry-Warm	IH 35	TTI	18	Perpetual	Subgrade	Treated Sub	RBL	1" SFHMA	3/4" SFHMA	SMA			
12	LRD	Laredo	22	Dry-Warm	SS 260	TTI	40	Overlay-HMA-LTB	Subgrade	Flex Base	HMA (Existing)	HMA (Existing)	HMA (Existing)	Type D			
	LRD	Laredo	22	Dry-Warm	US 83	TTI	41	Overlay-HMA-CTB	Subgrade	CTB	HMA (Existing)	Type C					
	LRD	Laredo	22	Dry-Warm	US 59	TTI	54	Overlay-HMA-FlexBase	Subgrade	Flex Base Ty	HMA (Existing)	Type C					
	LRD	Laredo	22	Dry-Warm	SPUR 400	TTI	55	Overlay-HMA-FlexBase	Subgrade	Flex Base Ty	HMA (Existing)	Type C					
	LRD	Laredo	22	Dry-Warm	Loop 20	TTI	56	Overlay-HMA-FlexBase	Subgrade	Flex Base Ty	HMA (Existing)	Type C	Type C				
	LRD	Laredo	22	Dry-Warm	FM 469	TTI	57	Reconstruction	Subgrade	In Progress							
	LRD	Laredo	22	Dry-Warm	IH 35	TTI	67	Perpetual	Subgrade	Treated Sub	RBL	1" SFHMA	3/4" SFHMA	SMA			
13	LFK	Lufkin	11	West-Warm	LOOP 500	TTI	52	New Construction		In Progress							
	PAR	Paris	1	Wet-Cold	SH 121	TTI	6	Overlay-HMA-CTB	Subgrade	CTB	HMA (Existing)	CAM	PFC				
14	PAR	Paris	1	Wet-Cold	US 271	TTI	7	Overlay-HMA-PCC	Subgrade	PCC	HMA (Existing)	PetroMat	HMA (Existing)	Type F	PFC		
	PAR	Paris	1	Wet-Cold	US 82	TTI	8	New Construction	Subgrade	Treated Sub	Treated Base	Base	Type B	Type D			
	PAR	Paris	1	Wet-Cold	US 82	TTI	45	Overlay-HMA-CTB	Subgrade	Existing Sub	Existing Base	Existing HMA	New HMA Overlay				
15	PHR			Dry-Warm	SH 107	TTI	17	Overlay-HMA-LTB		In Progress							
	ODA	Odessa	6	Dry-Warm	IH 20	UTEP	8	HMA Replacement	Subgrade	Existing Bas	HMA PG 70-22	HMA PG 64-22					
16	ODA	Odessa	6	Dry-Warm	IH 20	UTEP	17	HMA Replacement	Subgrade	Flex Base	HMA						
17	SJT			Dry-Warm	US 87	TTI	16	Overlay-HMA-LTB		In Progress							
	SAT	San Antonio	15	Dry-Warm	IH 35	TTI	19	Perpetual	Subgrade	Treated Sub	RBL	1" SFHMA	1/2" SFHMA	SMA	PFC		
	SAT	San Antonio	15	Dry-Warm	IH 35	TTI	20	Perpetual	Subgrade	Treated Sub	RBL	1" SFHMA	1/2" SFHMA	SMA	PFC		
	SAT	San Antonio	15	Dry-Warm	SH 123	TTI	39	Reconstruction	In Progress								
18	SAT	San Antonio	15	Dry-Warm	US 87	TTI	44	Seal Coat	Subgrade	Base	HMA (Existing)						
	SAT	San Antonio	15	Dry-Warm	SH 123	TTI	48	Overlay	Subgrade	Base	HMA (Existing)						
	TYL	Tyler	10	Wet-Cold	SH 64	TTI	50	In Progress									
19	TYL	Tyler	10	Wet-Cold	US 79	TTI	51	In Progress									
	TYL	Tyler	10	Wet-Cold	FM 2658	TTI	58	In Progress									
	WAC	Waco	9	Moderate	IH 35	TTI	4	New Construction	Subgrade	Treated Sub	Flex Base	Type B	SMA				
	WAC	Waco	9	Moderate	IH 35	TTI	9	New Construction	Subgrade	Flex Base	Type B	Type C					
20	WAC	Waco	9	Moderate	IH 35	TTI	21	Perpetual	Subgrade	Treated Sub	RBL	1" SFHMA	3/4" SFHMA	SMA	PFC		
	WAC	Waco	9	Moderate	IH 35	TTI	22	Perpetual	Subgrade	Treated Sub	RBL	1" SFHMA	3/4" SFHMA	SMA	PFC		
	WAC	Waco	9	Moderate	IH 35	TTI	46	New Construction	Subgrade	Treated Sub	Flex Base	Type B	SMA				
	WAC	Waco	9	Moderate	IH 35	TTI	47	New Construction	In Progress								
21	WFS	Wichita Falls	3	Dry-Cold	US 277	TTI	31	Seal Coat	In Progress	Seal Coat							
	WFS	Wichita Falls	3	Dry-Cold	US 277	TTI	32	New Construction	Subgrade	Treated Sub	Type A	HMA	Type D				
	WFS	Wichita Falls	3	Dry-Cold	FM 455	TTI	57	FDR/Overlay	In Progress								
	WFS	Wichita Falls	3	Dry-Cold	US 277	TTI	68	New Construction	In Progress								
	YKM	Yoakum	13	Wet-Warm	US 77A	TTI	23	Overlay-HMA-PCC	Subgrade	Base	Concrete Paven	HMA (Existing)	Type C				
22	YKM	Yoakum	13	Wet-Warm	SH 95	TTI	24	Overlay-HMA-PCC	Subgrade	Base	Concrete Paven	HMA (Existing)	Type D				

Table I-2. Example Summary by Material Type for Selected Test Sections and Selected Districts.

Material Type	Abilene	Amarillo	Atlanta	Austin	Beaumont	Bryan	Childress	Corpus Christi	Dallas	El Paso	Fort Worth	Laredo	Lubbock	Lufkin	Odessa	Paris	Pharr	San Angelo	San Antonio	Taylor	Waco	Wichita Falls	Materials Totals
Existing HMA	1	1	3		1	2	3	2	3			5	3	1	3	3	1	2	4	1		1	40
Type D			3		2	1						1				2							9
Type B											1					1					4		6
RBL											2	5							2		2		11
Type F																1							1
Type C					2	2		2			1	6								2	2		17
SMA	1	1			1		1				2	5	5		1				2		4		23
SFHMA											1	5							2		2		10
WMA										4		1	1										6
CAM																1							1
PFC	1				2											2			2		2		9
PCC					1											1							2
CMHB-F										2													2
TOM										5													5
TruePave			1																				1
PetroMat			1																				1
Seal Coat	2							1				1	1						1			1	7
Treated Base	2	1					1			5			5	1									15
CTB					1				3		1	2				3			2				12
LTB						1																	1
Existing Base								2											2				4
LFA Base			3																				3
Flex Base		1			2	2		1				5				1	1	2		2	4	1	22
Subgrade	1		3		1	3		3		5	2	11	4			2			4	1	6	1	47
Treated Subgrade		1			2	1		1			2	5				2			2	1	4	1	22
District Totals	8	5	14		15	12	5	12	6	21	12	52	19	2	4	19	2	4	23	7	30	5	277

APPENDIX II. LIST OF DESIGN SOFTWARE INPUT PARAMETERS

Table II-1. List of Basic Input Parameters for the FPS Software.

#	Item	#	Description	Data Source/Location in the DSS
1	General Information	a.	Problem #	User Input
		b.	Highway, district, county	DSS: PVMNT Section Details
		c.	Control, section, and job #	DSS: PVMNT Section Details (CSJ #)
		d.	Date	Automatically generated (editable)
2	Basic Design Criteria	a.	Length of analysis period (yrs)	User Input
		b.	Min. time to first overlay (yrs)	User Input
		c.	Min. time between overlays (yrs)	User Input
		d.	Design confidence level	User input based on help file guidelines
		e.	Initial and final serviceability index	DSS: Field Performance Data\FPD: Surface Profiles-PSI and IRI
		f.	Serviceability index after overlay	DSS: Field Performance Data\FPD: Surface Profiles-PSI and IRI
		g.	District temperature constant	Automatically generated
		h.	Interest rate (%)	User Input
3	Program Controls	a.	Max. funds/sq. yd, init. const.	User Input
		b.	Max. thickness, init. const.	User Input
		c.	Max. thickness, all overlays	User Input
4	Traffic Data	a.	ADT begin (veh/day)	DSS: Traffic Data\Volume and Classification, (and Excel Macro)
		b.	ADT end 20 yr (veh/day)	
		c.	18 kip ESALs 20 yr – 1 direction (millions)	
		d.	Avg. app. speed to OV zone	User Input based on help file guidelines
		e.	Avg. speed OV and non-OV direction	User Input based on help file guidelines
		f.	Percent ADT/HR construction	User Input based on help file guidelines
		g.	Percent trucks in ADT	DSS: Traffic Data\Volume and Classification
5	Const. and Maint. Data	a.	Min. overlay thickness (in)	User Input
		b.	Overlay const. time, hr/day	User Input
		c.	ACP comp. density, tons/CY	User Input
		d.	ACP production rate, tons/hr	User Input
		e.	Width of each lane, ft	DSS: PVMNT Section Details
		f.	First year cost, RTN maint.	User Input
		g.	Annual, inc. incr. in maint. cost	User Input
6	Detour Design for Overlays	a.	Detour model during overlays	User Input
		b.	Total number of lanes	DSS: PVMNT Section Details
		c.	Num. open lanes, overlay direction	User Input
		d.	Num. open lanes, non-OV direction	User Input
		e	Dist. traffic slowed, OV direction	User Input
		f.	Dist. traffic slowed, non-OV direction	User Input
		g.	Detour distance, overlay zone	User Input
7	Structure and Material Properties	a.	Layer and material name	DSS: PVMNT Structure Details
		b.	Cost per CY	User Input
		c.	Modulus E (ksi)	DSS: Field Performance Data\FWD Back-Calculated Modulus
		d.	Min and Max Depth	DSS: PVMNT Structure Details
		e.	Salvage PCT and Poisson's ratio	User Input or default value.

Table II-2. List of Basic M-E Input Parameters Required for the TxACOL Software (General, Traffic, and Climatic Information).

Item	Description	Location in the DSS		Comment
		Group	Table	
General Information	Type of AC overlay design	Tables	Section Details	
		PVMNT: Details	PVMNT Structure Details	
	Analysis/design life (yrs)	N/A		User input
	Pavement overlay construction month and year	Tables	Construction Data	
	Traffic open month and year	PVMNT: Details	PVMNT Structure Details	
Project Identification	District, county, CSJ	Tables	Section Details	
	Functional class	Traffic Data	Traffic Data: Classification	
	Date	User input		
	Reference mark format (lat/long) Reference mark (start-end)	Tables	Section Details	
Analysis Parameters and Performance Criteria	Reflective cracking rate (%)	N/A		User input
	AC rutting (in)	N/A		User input
Traffic	ADT begin (veh/day) ADT end 20 yr (veh/day) 18 kip ESALs 20 yr – 1 direction (millions) Operation speed (mph)	Traffic Data	Volume and Classification	
Climate	EICM weather station data	Attachment	Raw data files (EICM files stored in DSS and Raw Data Files)	Can also be user input
	Latitude and longitude (degrees.minutes) Elevation (ft)	Climatic-Environmental Data	Climatic Data	

Table II-3. List of Basic M-E Input Parameters Required for the TxACOL Software (Structural and Material Information).

Layer	Material	Description	Location in the DSS		Comment
			Group	Table	
Overlay	HMA	Layer thickness (inches)	PVMNT: Details	PVMNT Structure Details	
		Material type	PVMNT: Details	PVMNT Structure Details	
		Thermal coefficient of expansion	Material Properties HMA Mixes	HMA: Thermal Coefficient	
		Poisson's ratio	N/A		Default value
		Superpave PG binder grading	PVMNT: Details	PVMNT Structure Details	
		Dynamic modulus by temperature and frequency	Material Properties HMA Mixes	HMA: Dynamic Modulus (DM)	Export from raw data file (*.dm)
		Fracture property data: temperature, A and n	Material Properties HMA Mixes	HMA: OT Fracture Properties	
		Rutting property data: temperature, α and μ	Material Properties HMA Mixes	HMA: Repeated Loading (RLPD)	
Existing Surface	HMA	Layer thickness (inches)	PVMNT: Details	PVMNT Structure Details	
		Material type	PVMNT: Details	PVMNT Structure Details	
		Thermal coefficient of expansion	N/A		Default value
		Poisson's ratio	N/A		Default value
		Main cracking pattern			
		1) Alligator/longitudinal/block cracking			
		a) Severity level (low/medium/high)	Form	Existing Distress	
		b) FWD temperature (°F) and modulus (ksi)	Field Performance Data	FWD Back-calculated Modulus	
		2) Transverse cracking			
		a) Crack spacing (ft), severity level, LTE	Form	Existing Distress	
		b) FWD temperature (°F) and modulus (ksi)	Field Performance Data	FWD Back-calculated Modulus	
	JPCP/ CRCP	Layer thickness (inches)	PVMNT: Details	PVMNT Structure Details	
		Material type	PVMNT: Details	PVMNT Structure Details	
		Thermal coefficient of expansion	N/A		Default value
		Poisson's ratio	N/A		Default value
		Joint/crack spacing (ft)	Existing Distresses and Field Performance Data	Transverse Cracking	
		PCC modulus (ksi)	Field Performance Data	FWD Back-calculated Modulus	
		LTE (%) and LTE standard deviation	Field Performance Data	FWD Load Transfer Efficiency	

Table II-3. List of Basic M-E Input Parameters Required for the TxACOL Software (Structural and Material Information) (Continued).

Layer	Materials	Description	Location in the DSS		Comment
			Group	Table	
Existing Subsurface	Granular Base	Layer thickness (inches)	PVMNT: Details	PVMNT Structure Details	
		Material type	PVMNT: Details	PVMNT Structure Details	
		Poisson's ratio	N/A		Default value
		Modulus (ksi)	Field Performance Data	FWD Back-calculated Modulus	
	Stabilized Base/ Subbase	Layer thickness (inches)	PVMNT: Details	PVMNT Structure Details	
		Material type	PVMNT: Details	PVMNT Structure Details	
		Poisson's ratio	N/A		Default value
		Thermal coefficient of expansion	N/A		Default value
		Modulus (ksi)	Field Performance Data	FWD Back-calculated Modulus	
	Subgrade	Layer thickness (inches)	PVMNT: Details	PVMNT Structure Details	
		Material type	PVMNT: Details	PVMNT Structure Details	
		Poisson's ratio	N/A		Default value
		Modulus (ksi)	Field Performance Data	FWD Back-calculated Modulus	

Table II-4. List of Basic M-E Input Parameters Required for the TxM-E Software.

Item	Description	Location in the DSS: Group	Location in the DSS: Table	Comment1	Example Values from The DSS: Min	Avg	Max	# Points	Comment2
1) Structure	Pavement type	Tables	Section Details						
	Design/Analysis Life	User defined							
	Project Location (District/County)	Tables	Tables						
	Optional Project								
	Construction and Traffic Open Time	PVMNT: Details	PVMNT Structure Details						
	Reference Mark Begin/End	Tables	Section Details						
	CSJ	Tables	Section Details						
	Functional Class	Traffic Data	Traffic Data: Volume and Class.						
	Date	User defined							
	AC Layer Material Information								
	Material Type	PVMNT: Details	PVMNT Structure Details						
	Layer Thickness	PVMNT: Details	PVMNT Structure Details						
	Binder Type	PVMNT: Details	PVMNT Structure Details						
	Gradation	PVMNT: Details	PVMNT Structure Details						
	RAP %	PVMNT: Details	PVMNT Structure Details						
	RAS %	PVMNT: Details	PVMNT Structure Details						
	Dynamic Modulus (ksi)	Material Properties HMA Mixes	HMA: Dynamic Modulus (DM)		335	973	2604	139	70 F, 10 Hz
	Fracture Property (A and n)	Material Properties HMA Mixes	HMA: OT Fracture Properties		A = 1.67E-08 n = 4.16	A = 5.72E-07 n = 5.11	A = 9.07E-06 n = 5.46	18	
	Rutting Properties (α and μ) 40 °C	Material Properties HMA Mixes	HMA: Repeated Loading (RLPD)		$\alpha = 0.5300$ $\mu = 0.1200$	$\alpha = 0.7179$ $\mu = 0.4778$	$\alpha = 0.8828$ $\mu = 0.9980$	51	
	(α and μ) 50 °C				$\alpha = 0.0000$ $\mu = 0.1210$	$\alpha = 0.6707$ $\mu = 0.1210$	$\alpha = 0.9184$ $\mu = 0.9980$	51	
	Poisson Ratio	N/A		Default value					
	Thermal Coefficient of Expansion (alpha)	Material Properties HMA Mixes	HMA: Thermal Coefficient		5.94E-06	1.85E-05	4.90E-05	54	
	Base and Subbase Material Information								
	Material Type	PVMNT: Details							
	Layer Thickness	PVMNT: Details							
	Modulus	Field Performance							
	Rutting Properties (α and μ)	Material Properties Base	Flexible or asphalt treated						
	Modulus of Rupture	Material Properties Base	FA, LFA, lime, or cement stabilized						
	Fatigue Cracking Parameter B1 and B2								
	Poisson Ratio	N/A		Default value			Default value		

Table II-4. List of Basic M-E Input Parameters Required for the TxM-E Software (Continued).

Item		Description		Location in the DSS		Comment1
				Group	Table	
Structure		Subgrade Material Information				
			Modulus	Field Performance Data	FWD Back-calculated Modulus	
			Rutting Properties (α and μ)	Material Properties Base	Permanent Deformation	
			Poisson Ratio	N/A		Default value
2) Climate		EICM weather station data		Attachment	Raw data files (EICM files stored in DSS and Raw Data Files)	
		Latitude, Longitude, Elevation		Climatic-Environmental Data	Climatic Data	
3)Traffic	Lev. 2	Tire Pressure				User defined or default value
		ADT Beginning ADT-End 20 YR 18kip ESALs 20 YR (1 DIR, millions) Operation Speed		Traffic Data	Volume and Classification	
	Lev. 1	General Traffic Information				
			Traffic Two-way AADTT	Traffic Data	Volume and Classification	
			No. of Lanes in Design Direction	Traffic Data	Volume and Classification	
			% of Trucks in Design Direction	Traffic Data	Volume and Classification	
			% of Trucks in Design Lane	Traffic Data	Volume and Classification	
			Operation Speed	Traffic Data	Volume and Classification	
		Axle Configuration				
			Axle Tire (Single and Dual Tire Pressure)			User defined or default value
			Axle Spacing (Tandem, Tridem, and Quad)			User defined or default value
		Monthly Adjustment		Traffic Data	Monthly Adjustment Factors	
		Axle Load Distribution		Traffic Data	Load Spectra	
		Vehicle Class Distribution and Growth		Traffic Data	Volume and Classification	
		Axle Per Truck		Traffic Data	Vehicle Classification System	
4) Reliability		Performance Criteria		User defined		
		Variability of Input Parameters		User defined		

Table II-5. List of Basic M-E Input Parameters Required for the M-E PDG Software.

#	Item	#	Description	Location in the DSS
1	General Information	a.	Project name	
		b.	Design life (yrs.)	User input
		c.	Base/Subgrade construction month/year	Construction data
		d.	Pavement construction month/year	Construction data
		e.	Traffic open month/year	Construction data
		f.	Section	Section details
		g.	Date	Section details
		h.	Job	Section details
		i.	Type of design	Section details
2	Site/Project Identification	a.	Location	Section details
		b.	Project ID	Section details
		c.	Section ID	Section details
		d.	Date	Section details
		e.	Station/milepost format	Section details
		f.	Station/milepost begin	Section details
		g.	Station/milepost end	Section details
		h.	Traffic direction	Section details
3	Analysis Parameters	a.	Project name	Section details
		b.	Initial IRI (inches/mi)	Field performance data: Surface profiles – PSI and IRI
		c.	Terminal IRI (inches/mi)	User defined or default values
		d.	AC surface down cracking long. Cracking (ft/mi)	User defined or default values
		e.	AC bottom up cracking. Alligator cracking (%)	User defined or default values
		f.	AC thermal fracture (ft/mi)	User defined or default values
		g.	Chemically stabilized layer fatigue fracture (%)	User defined or default values
		h.	Permanent deformation – total pavement (inches)	User defined or default values
		i.	Permanent deformation – AC only (inches)	User defined or default values

Table II-5. List of Basic M-E Input Parameters Required for the M-E PDG Software (Continued).

#	Item	#	Description	Location in the DSS
4	Traffic	a.	Design life (yrs.)	User defined
		b.	Opening date	Construction data
		c.	Initial two-way AADTT	Traffic data – volume and classification
		d.	Number of lanes in design direction	Traffic data – volume and classification
		e.	Percent of trucks in design direction (%)	Traffic data – volume and classification
		f.	Percent of trucks in design lane (%)	Traffic data – volume and classification
		g.	Operational speed (mph)	Traffic data – volume and classification
4.1	Traffic Volume Adjustment Factors	a.	4.1.1. Monthly adjustment	Traffic data – monthly adjustment factors
		b.	4.1.2. Vehicle class distribution	Traffic data – volume and classification
		c.	4.1.3. Hourly distribution	Traffic data – hourly adjustment factors
		d.	4.1.4. Traffic growth factors	Traffic data – volume and classification
4.2	Axle Load Distribution Factors	a.	Single axle	Traffic data – load spectra
		b.	Tandem axle	
		c.	Tridem axle	
		d.	Quad axle	
4.3	General Traffic Inputs	a.	Mean wheel location (inches from the lane marking)	User defined or default
		b.	Traffic wander standard deviation (inches)	User defined or default
		c.	Design lane width (ft) (Note: Not slab width)	PVMNT section details, user defined or default
4.3.1	Number Axles/Truck		Single, tandem, tridem, and quad (Class 4 to 13)	Data currently being processed for inclusion in the DSS
4.3.2	Axle Configuration	a.	Average Axle width (edge to edge) outside dimensions, ft	User defined or default
		b.	Dual tire spacing (inches)	
		c.	Tire Pressure (psi)	
		d.	Tandem Axle spacing (inches)	
		e.	Tridem Axle spacing (inches)	
		f.	Quad Axle spacing (inches)	
4.3.3	Wheelbase	a.	Average Axle spacing (ft)	
		b.	Percent of trucks (%)	Traffic data – volume and classification

Table II-5. List of Basic M-E Input Parameters Required for the M-E PDG Software (Continued).

#	Item	#	Description	Location in the DSS
5	Climate	a.	Latitude (degrees.minutes)	Climatic data
		b.	Longitude (degrees.minutes)	Climatic data
		c.	Elevation (ft)	Climatic data
		d.	Depth of water table (ft) (Spring, Summer, Fall, Winter)	Climatic data
6	Structure	a.	Surface shortwave absorptivity	User defined or default value
		b.	Layer	PVMNT structure details
		c.	Type	PVMNT structure details
		d.	Material	PVMNT structure details
		e.	Thickness	PVMNT structure details
		f.	Interface	PVMNT structure details
		g.	For overlay design:	PVMNT structure details
		h.	Level 1: existing rutting and milled thickness	Construction data
		i.	Level 2: existing rutting, crack (%) in existing AC, and milled thickness	Existing distresses and/or field performance data
		j.	Level 3: milled thickness, total rutting, and pavement rating (Excellent, Good, Fair, Poor, and Very Poor)	Construction data
		k.	Fatigue analysis endurance limit (national calibration based on no endurance limit	User defined or default value

Table II-5. List of Basic M-E Input Parameters Required for the M-E PDG Software (Continued).

#	Item	#	Description	Location in the DSS
7	HMA (Use Level 3 if most data are unavailable)	a.	Dynamic modulus —Level 1	Material properties - HMA
		b.	DSR—Level 1 ~ 3	Material properties – Binders
		c.	Gradation—Level 2 and 3	Material properties – HMA
		d.	Effective binder content	Material properties – HMA
		e.	Air void	Material properties – HMA
		f.	Total unit weight	Material properties – HMA
		g.	Poisson's ratio	User defined or default value
		h.	Thermal conductivity	
		i.	Shear capacity asphalt	
		j.	Tensile strength and creep compliance	
8	Base and Subgrade (Use Level 3 if most data are unavailable)	a.	Resilient modulus	Material properties – Base and Subgrade
		b.	Soil classification	Material properties – Base and Subgrade
		c.	Gradation	Material properties – Base and Subgrade
		d.	Atterberg limits	Material properties – Base and Subgrade
		e.	Maximum dry unit weight	Material properties – Base and Subgrade
		f.	Specific gravity (calculated or tested)	Material properties – Base and Subgrade
		g.	Optimum gravimetric moisture content	Material properties – Base and Subgrade
		h.	Saturated hydraulic conductivity (calculated)	User defined or default values
		i.	Degree of saturation at optimum (calculated)	
		j.	Coefficient of later pressure	
		k.	Soil suction coefficients (tested or calculated)	User defined or default values
		l.	DCP data	

APPENDIX III. TEST SPECIFICATIONS AND DATA COLLECTION FORMS

Table III-1. Asphalt-Binder Tests (Extracted Asphalt-Binders Only).

#	Test	Spec	Test Parameters	Output Data	Sample Replicates			Comment
					TTI	UTEP	*TxDOT Recommendation*	
1	AC extraction	Tex-210-F[a]	As per spec	N/A – just binder	≥ 65 lbs		≥ 65 lbs	Extract enough to run all the necessary tests (i.e., about 100 lbs)
2	Specific gravity (SG)	T 228	As per spec	Specific gravity	3		*1[a]*	Report 0-6658-1
3	Viscosity	T 316	135 °C	Viscosity	3		*1[a]*	Report 0-6658-1
4	DSR[c]	T 315	As per spec	True grade, G*, & G*/Sin(δ)	3		*1[a]*	Report 0-6658-1
5	DSR – RTFO	T 240	As per spec	True grade, G*, & G*/Sin(δ)	3		*0[b]*	Report 0-6658-1
6	DSR _ PAV	R 28	As per spec	G*, G*/Sin(δ), & true grade	3		*0[b]*	Report 0-6658-1
7	MSCR	TP 70	As per spec; min 3 test temperatures per binder	R100, R3200, R_{diff}, J_{nr}100, J_{nr}3200, & $J_{nr-diff}$	9		*9 (3 × 3 temps)*	Report 0-6658-1
8	BBR[f]	T 313, R 28	As per spec; min 2 temps	Stiffness, m-value	6 (3 × 2 temps)		*2[a]* (1 × 2 temps)	Report 0-6658-1
9	Elastic recovery (ductility)	(D 6084-A)	As per TxDOT spec @ 50 °F	Elastic recovery	3		*3*	Report 0-6658-1
10	Binder PG grading	M 320, Item 300, MP 19	As per spec	PG grade	-	-	-	Report 0-6658-1
Total number of replicates					33		*17*	
Approximate material requirement ≥ **65 lbs** of plant-mix (better to target 100 lbs)								

Note: *a* – results for first test sections were very repeatable with coefficient of variation less than 5%, so no need for 3 or more replicates; *b* – tests will be done on extracted binders only and treated as RTFO residue, so no need for RTFO or PAV; *c* – also run the intermediate temperature DSR and BBR on the extracted binders as it is (with no PAV) for mixes with RAP or RAS.

Table III-2. HMA Mix Tests (Plant-Mix and Cores Only).

#	Test	Spec	Test Parameters	Output Data	Sample Replicates			Comment
					TTI	UTEP	*TxDOT Recommendation*	
1	AC extraction	Tex-210-F[a]	As per spec	AC % (by weight)	3		***3***	
		Tex-236-F	As per spec	AC %	3		***0***[b]	
2	Aggregate gradation	Tex-200-F	As per spec	Particle size distribution	3		***3***	Use aggregates from Tex-210-F
3	Hamburg	Tex-242-F	As per spec, but run all samples to 20000 load passes	Test temp., rut depth and number of wheel passes (i.e., 0, 5000, 10000, 15000, & 20000)	3 (3 sets of 2)		***1***[c] *(1 set of 2)*	During testing, it is recommended to set the maximum rut depth to about 25 mm (instead of 12.5 mm)
4	Overlay	Tex-248-F	0.025 inch, 93% load drop, 77 °F	Test temperature, max load, & cycles to failure	5		***5***	
5	OT fracture properties		0.017 inch @ 77 °F for 100 cycles	Test temp., *E(OT), A,* & *n*	5		***5***	Test parameters recommended from Study 0-6622
6	Dynamic modulus (DM)	AASHTO TP 62-03	As per spec; 5 temps; 6 frequencies	Dynamic modulus (|E|), temperature, & frequency	3		***3***	Report 0-6658-1
7	Permanent deformation (RLPD)	Reports 0-6658-P3 & 0-6658-1	(a)104 °F, 20 psi, & 10000 cycles, & (b) 122 °F, 10 psi, & 10000 cycles,	Test temperatures, α, μ , & microstrains	6 (3 × 2 temps)		***6*** (3 × 2 temps)	Report 0-6658-1
8	Indirect tension (IDT)	Tex-226-F	As per spec	Test temp., IDT strength, & displacement @ peak load	3	-	***3***	Report 0-6658-1
9	Thermal coefficient	Reports 0-6658-P3 & 0-6658-1	14–104 °F	Thermal coefficient (α)	3		***3***	Report 0-6658-1
10	Flow number (F_N)	Reports 0-6658-P3 & 0-6658-1	50 °C, 30 psi	Test temp., F_N, Time to F_N, accumulated microstrain @ F_N (εP), & εP/F_N	3		**-**	Report 0-6658-1
11	OT monotonic	Report 0-6607-2	0.125 inch/min @ 77 °F	Peak load, HMA tensile strength, strain, FE, FE index, etc	5	-	**-**	Report 0-6607-2
Total number of replicates					45		***32***	
Approximate material requirement ≥ **405 lbs** of plant-mix (better to target 450 lbs)								

Note: *a* – test to be performed only if data cannot be obtained from QC/QA records; *b* – no need to do Tex-236-F if Tex-210-F is being conducted, though time consuming and costly, TxDOT prefers Tex-210 because it is more accurate; *c* – results for first test sections were very repeatable with coefficient of variation less than 5%, so no need for 3 replicate sets.

Table III-3. Base Tests (Flex).

#	Test	Spec	Test Parameters	Output Data	Sample Replicates			Comments
					TTI	UTEP	***TxDOT Recom.***	
1	Sieve analysis[a,b]	Tex-110-E	As per spec	Gradation	3	Stock	*Stock (Tex-110-E for +#40 & Tex-111-E for –#40)*	Report 0-6658-1
2	Atterberg limits[a]	Tex-104-E, Tex-105-E, Tex-106-E	As per spec	PI, LL, & PL	3	2[d]	*1+*	Report 0-6658-1
3	Specific gravity	ASTM C-127, 128	As per spec	SG value	3	2[d]	*2*[c]	Report 0-6658-1
4	Wet Ball Mill[a,d]	Tex-116-E	As per spec	Wet Ball Mill value	3	2[d]	*0*	Report 0-6658-1
5	MD Curve[a]	Tex-113-E	6″ × 8″	MDD, OMC	3	2[d]	*1+*	Report 0-6658-1
6	Texas Triaxial	Tex-117-E	6″ × 8″	Classification, C, & ϕ	3	2[d]	*1*[e]	Report 0-6658-1
7	Resilient modulus	NCHRP 1-28A	6″ × 12″ OMC	k-parameters	3	2[d]	*2*[c]	Report 0-6658-1
8	Permanent deformation	NCHRP 1-28A	6″ × 12″ OMC	α & μ	3	2[d]	*2*[c]	Report 0-6658-1
9	Shear strength	Tex-143	6″ × 8″	C and ϕ	3	2[d]	*2*[c]	Report 0-6658-1
10	Soil suction	Filter paper		Suction coefficient	3	-	*0*	Report 0-6658-1
Total material to sample from the field					33		*11*	
Approximate material requirement ≥ 700 lbs (better to target 800 lbs or more)								

Note: * – Time in parentheses refers to wait (cure) time; *a* – Perform sieve analysis and compare gradation to TXDOT. If gradation matches, then use TXDOT QC data; otherwise, run test; *b* – Include sieves #100 and #200, which will be washed; *c* – A third test is performed if the duplicate results vary by a wide margin; *d* – If available, use from TXDOT QC 1+ – Researchers to run one test, if the results match the districts, they can use district results; if not, the researchers will run two samples; *e* – One sample at each confining pressure.

Table III-4. Base Tests (Treated – CTB).

#	Test	Spec	Test Parameters	Output Data	Sample Replicates			Comments
					TTI	UTEP	*TxDOT Recom.*	
1	Sieve analysis[a,b]	Tex-110-E	As per spec	Gradation	3	Stock	*Stock*	Report 0-6658-1
2	Atterberg limit[d]	Tex-104-E, Tex-105-E, Tex-106-E	As per spec	PI, LL, & PL	3	2[f]	*1+*	Report 0-6658-1
3	Sulfate content[c]	Tex-145-E	As per spec	Sulfate content	3	2[f]	*0*	Report 0-6658-1
4	Wet Ball Mill[c]	Tex-116-E	As per spec	Wet Ball Mill value	3	2[f]	*0*	Report 0-6658-1
5	MD Curve[d]	Tex-113-E	As per spec	MDD & OMC	3	2[f]	*1+*	Report 0-6658-1
6	Unconfined compressive strength[d]	Tex-120-E, Tex-121-E	As per spec	UCS	3	2[f]	*1[h]*	Report 0-6658-1
7	Resilient modulus[d,g]	NCHRP 1-28A	6″ × 12″ OMC	k-parameters	3	2[f]	*2[e]*	Zero confinement, Report 0-6658-1
8	Modulus of rupture[d,f]		Beam 6″ × 6″ × 12″ OMC	Modulus of Rupture	3	2[f]	*2[e]*	Report 0-6658-1
Total material to sample from the field					24		*7*	
Approximate material requirement ≥ 550 lbs (better to target 600 lbs or more)								

Note: * – Time in parentheses refers to wait (cure) time; *a* – Perform sieve analysis and compare gradation to TXDOT. If gradation matches then use TXDOT QC data; otherwise; run test; *b* – Include sieves #100 and #200; *c* – Test is performed before treatment; *d* – Test is performed after treatment; *e* – A third test is performed if the duplicate results vary by a wide margin; *f* – Test only for cement treated (>2%); *g* – Run FFRC instead of RM at zero confinement; *h* – Includes running three samples at the cement content.

Item #8 (Modulus of Rupture Testing) – When the cement stabilization content is 2% or less, reclassify the material as "Untreated Base" and test according to that protocol, i.e., the tests listed on page 1 of this document. For all other materials that have more than 2% stabilization content, leave it as a treated material, and if the modulus of rupture specimens cannot be fabricated, make a note in the DSS under the "comments field."

Table III-5. Base Tests (Treated – Asphalt/Low Stabilizers).

#	Test	Spec	Test Parameters	Output Data	Sample Replicates			Comments
					TTI	UTEP	***TxDOT Recom.***	
1	Sieve analysis[a,b]	Tex-110-E	As per spec	Gradation	3	Stock	*Stock*	Report 0-6658-1
2	Atterberg limit[c]	Tex-104-E, Tex-105-E, Tex-106-E	As per spec	PI, LL, & PL	3	2[f]	*1+*	Report 0-6658-1
3	Sulfate content[c]	Tex-145-E	As per spec	Sulfate content	3	2[f]	*0*	Report 0-6658-1
4	Wet Ball Mill[c]	Tex-116-E	As per spec	Wet Ball Mill value	3	2[f]	*0*	Report 0-6658-1
5	MD Curve[d]	Tex-113-E	As per spec	MDD & OMC	3	2[f]	*1+*	Report 0-6658-1
6	Unconfined compressive strength[d]	Tex-120-E, Tex-121-E	As per spec	UCS	3	2[f]	*1*[f]	Report 0-6658-1
7	Resilient modulus[d,g]	NCHRP 1-28A	6″ × 12″ OMC	k-parameters	3	2[f]	*2*[e]	Zero confinement, Report 0-6658-1
8	Permanent deformation[d,f]	NCHRP 1-28A	6″ × 12″ OMC	α & μ	3	2[f]	*2*[e]	Zero confinement, Report 0-6658-1
Total material to sample from the field					24		*9*	
Approximate material requirement ≥ 550 lbs (better to target 600 lbs or more)								

<u>Note</u>: * – Time in parentheses refers to wait (cure) time; *a* – Perform sieve analysis and compare gradation to TXDOT. If gradation matches then use TXDOT QC data, otherwise run test; *b* – Include sieves #100 and #200; *c* – Test is performed before treatment; *d* – Test is performed after treatment; *e* – A third test is performed if the duplicate results vary by a wide margin; *f* – Test only for asphalt treated & low stabilizer content (< 2%); *g* – Run FFRC instead of RM at zero confinement.

Table III-6. Subgrade Soil Tests (Raw).

#	Test	Spec	Test Parameters	Output Data	Sample Replicates			Comment
					TTI	UTEP	*TxDOT Recom.*	
1	Sieve Analysis[a,b]	Tex-110-E	As per spec	Gradation	3	Stock	*Stock (Tex-110-E, Part I for +#40 and Part II for –#40 [hydrometer])*	Report 0-6658-1
2	Atterberg limits	Tex-104-E, Tex-105-E, Tex-106-E	As per spec	PI, LL, & PL	3	2[d]	*1+*	Report 0-6658-1
3	Specific gravity	Tex-108-E	As per spec	SG value	3	2[d]	*2[c]*	Report 0-6658-1
4	Sulfate content	Tex-145-E	As per spec	Sulfate content	3	2[d]	*0*	Report 0-6658-1
5	Organic content	Tex-408-A	As per spec	Organic content	3	2[d]	*0*	Report 0-6658-1
6	MD curve	Tex-114-E	As per spec	MDD & OMC	3	2[d]	*1+*	Report 0-6658-1
7	Texas Triaxial	Tex-117-E	As per spec	Classification, C, & ϕ	3	2[d]	*1*	Report 0-6658-1
8	Resilient modulus	NCHRP 1-28A	4″ × 8″ OMC	k-parameters	3	2[d]	*2[c]*	Report 0-6658-1
9	Permanent deformation	NCHRP 1-28A	4″ × 8″ OMC	α & μ	3	2[d]	*2[c]*	Report 0-6658-1
10	Shear strength	Tex-143	As per spec	C & ϕ	3	2[d]	*2[c]*	Report 0-6658-1
11	Soil suction	Filter paper		Suction coefficient	3	-	*0*	Report 0-6658-1
Total material to sample from the field					33		*11*	
Approximate material requirement ≥ 350 lbs (better to target 400 lbs or more)								

Note: * – Time in parentheses refers to wait (cure) time; *a* – Perform sieve analysis and compare gradation to TXDOT. If gradation matches then use TXDOT QC data; otherwise, run test; *b* – Include sieves #100 and #200; *c* – A third test is performed if the duplicate results vary by a wide margin; *d* – plus one sample for every change in material.

Table III-7. Subgrade Soil Tests (Treated).

#	Test	Spec	Test Parameters	Output Data	Sample Replicates			Comment
					TTI	UTEP	*TxDOT Recom.*	
1	Sieve analysis[a,b]	Tex-110-E	As per spec	Gradation	3	Stock	*Stock (Tex-110-E, Part I for +#40 and Part II for –#40 [hydrometer])*	Report 0-6658-1
2	Atterberg limits[c,d]	Tex-104-E, Tex-105-E, Tex-106-E	As per spec	PI, LL, & PL	3	2[f]	*1+*[g]	Report 0-6658-1
3	Sulfate content[d]	Tex-145-E	As per spec	Sulfate content	3	2[f]	*2*[e]	Report 0-6658-1
4	Organic content[d]	Tex-408-A	As per spec	Organic content	3	2[f]	*0*	Report 0-6658-1
5	MD Curve[d]	Tex-114-E	As per spec	MDD & OMC	3	2[f]	*0*	Report 0-6658-1
6	Unconfined compressive strength[d]	Tex-120-E, Tex-121-E	As per spec	UCS	3	2[f]	*1+*	Report 0-6658-1
7	Resilient modulus[d,f]	NCHRP 1-28A	4″ × 8″ OMC	k-parameters	3	2[f]	*2*[d]	Report 0-6658-1
8	Permanent deformation[d]	NCHRP 1-28A	4″ × 8″ OMC	α & μ	3	2[f]	*2*[d]	Report 0-6658-1
Total material to sample from the field					24		*8*	
Approximate material requirement ≥ 150 lbs (better to target 200 lbs or more)								

Note: * – Time in parentheses refers to wait (cure) time*;* *a* – Perform sieve analysis and compare gradation to TXDOT. If gradation matches then use TXDOT QC data, otherwise run test; *b* – Include sieves #100 and #200; *c* – Test is performed before treatment; *d* – Test is performed after treatment; *e* – A third test is performed if the duplicate results vary by a wide margin; *f* – Run FFRC instead of RM at zero confinement; *g* – Plus 1 sample for every change in material.

Table III-8. Lab Tests (Neat Asphalt-Binders: Obtained Directly from the Plant or Truck [Onsite during Construction]).

#	Test	Spec	Parameters	Sample Replicates			Comments/Reference
				TTI	**UTEP**	***TxDOT Recommendation***	
1	Residual recovery (Emulsions only)	Texas Oven (6 hr @ 60 °C)	Residual recovery	3 (60 g)		*3*	Silicon sheets may be obtained from Bed, Bath & Beyond Report 0-6658-1
2	Viscosity	T 316	Viscosity	1 (40 g)		*1*	Report 0-6658-1
3	Specific gravity	T 228	SG	1 (40 g)		*1*	Report 0-6658-1
4	RTFO & PAV	T 240, R 28		1 (60 g)		*1*	Report 0-6658-1
5	DSR	T 315	G*, & G*/Sin(δ)	1 (60 g)		*1*	Report 0-6658-1
6	MSCR	TP 70	Jnr, Jnr ratio % recoverable strain	9 *(3 × 3 temps)* (60 g)		*9* *(3 × 3 temps)*	Report 0-6658-1
7	BBR	T 313	S & m-values	2 *(1 × 2 temps)* (60 g)		*2* *(1 × 2 temps)*	Report 0-6658-1
8	Elastic recovery	D 6084	% recovery	3 (100 g)		*3*	Report 0-6658-1
9	SPG grading	Report 0-1710-2	SPG binder grade	-		-	1) Report 0-1710-2 2) Report 0-6658-1
Total number of replicates				21		*21*	
Approximate material requirement = One 5-gallon (≅ 38 lbs) bucket of neat binder obtained either from the plant or directly from the truck onsite during construction.							

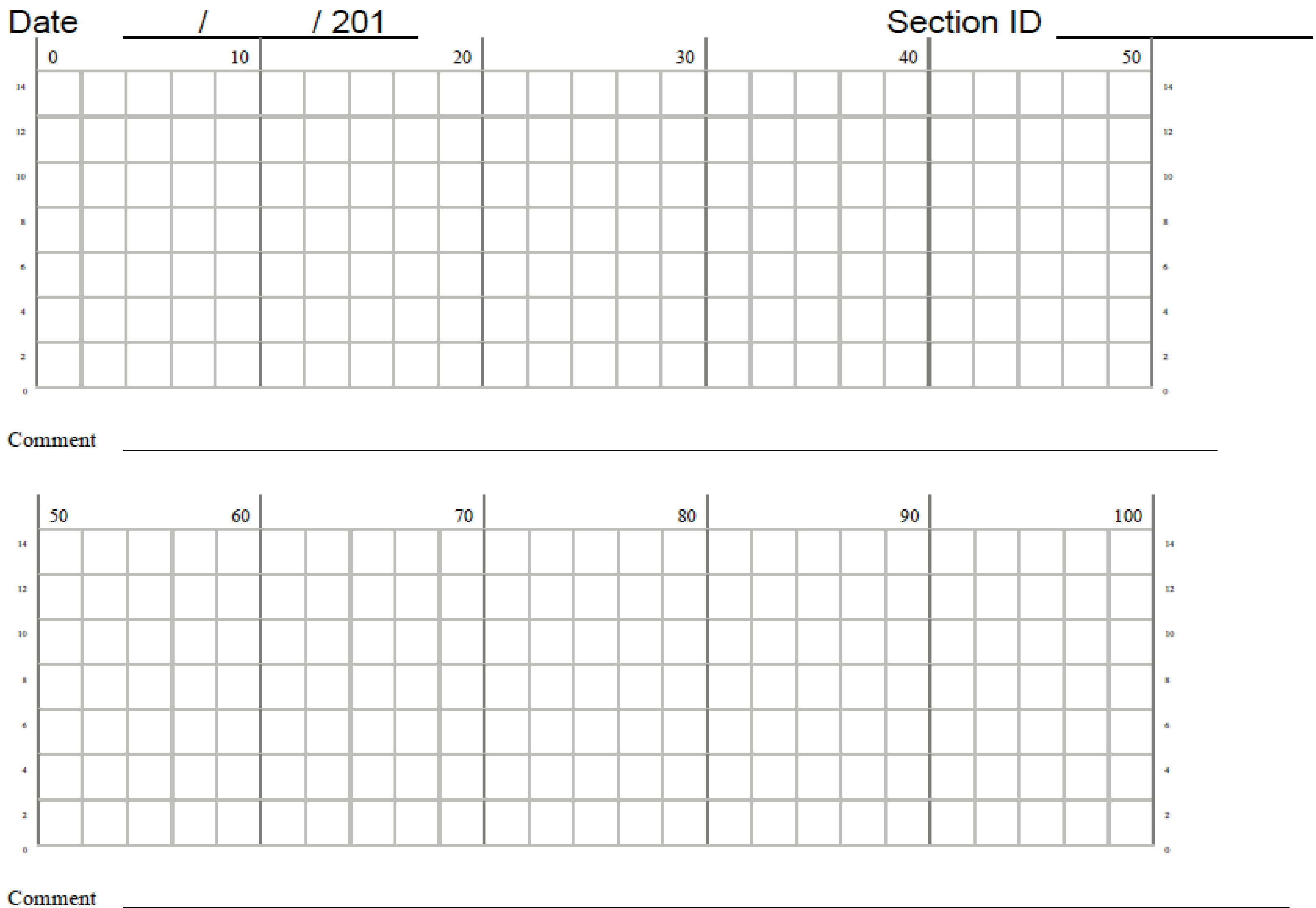


Figure III-1. Example Preconstruction Distress Survey Sheet for 100 Ft Length.

PROJECT 0-6658: CONSTRUCION DATA COLLECTION SHEET

Construction Data ID#	
Section ID#	
Highway	
Sampling Location (GPS)	
Material/Mix type	
Tack Coat	
Construction Date	
Contractor Contact	
TxDOT Contact	
Contractor	
HMA Truck Type	
Material Transfer Device	
Infrared Bar	
Joint Roller	

1|2 Project 0-6658 (Lubinda)

Figure III-2. Construction Data Collection Sheet.

PROJECT 0-6658: CONSTRUCION DATA COLLECTION SHEET

Breakdown Roller							
Second Roller							
Finishing Roller							
HMA Mat Thickness							
Target Density							
Other Observations							
HMA Mix Temp (°F)	Temp 1	Temp 2	Temp 3	Temp 4	Temp 5	Avg.	COV %
Pavement Surface Temp (°F) (After Paving, Before Compaction)	Temp 1	Temp 2	Temp 3	Temp 4	Temp 5	Avg.	COV %
Air Temp (°F)	Temp 1	Temp 2	Temp 3	Temp 4	Temp 5	Avg.	COV %
PVMNT Surface Temp Prior to Paving (°F)	Temp 1	Temp 2	Temp 3	Temp 4	Temp 5	Avg.	COV %
Core Density	Core 1	Core 2	Core 3	Core 4	Core 5	Avg.	COV %
Nuclear Density	Loc 1	Loc 2	Loc 3	Loc 4	Loc 5	Avg.	COV %
Pavement Quality Indicator	Loc 1	Loc 2	Loc 3	Loc 4	Loc 5	Avg.	COV %

*Also take pictures and videos (during construction & post construction if possible) *Request TxDOT for QC/QA sheets, HMA mix-design sheets, & QC/QA cores

2|2 Project 0-6658 (Lubinda)

Figure III-2. Construction Data Collection Sheet (Continued).

PROJECT 0-6658: PERFORMANCE DATA COLLECTION SHEET

Test Section ID# ______________________________

Hwy: __________ Direction: __________ Date: __________ Time: __________

Material/Mix Type: __________ Weather Condition: __________

Lane: __________ District: __________ County: __________

Distance		0 ft	100 ft	200 ft	300 ft	400 ft	500 ft
Mile Marker							
GPS Coordinates	N						
	W						
Elevation (ft)							
Rut Depth (in)	LWP*						
	RWP						
Cracking							
Other Distresses							
Air temperature (°F)							
PVMNT Surface temp. (°F)							
Comments							

*LWP= Left Wheel Path, RWP= Right Wheel Path

(Refer to Report 0-6658-1 for detailed list of field tests or the "Help" function on the MS Access Data Storage System)

Surveyed by: ______________________________

1|1 Project 0-6658 (Lubinda)

Figure III-3. Field Performance Data Collection Sheet.

APPENDIX IV. EXAMPLES OF ANALYZING AND DISPLAYING DSS DATA

Table IV-1. Accessing and Analyzing the DSS Data: Showing Average, Maximum, Minimum, etc. of Data in a Table.

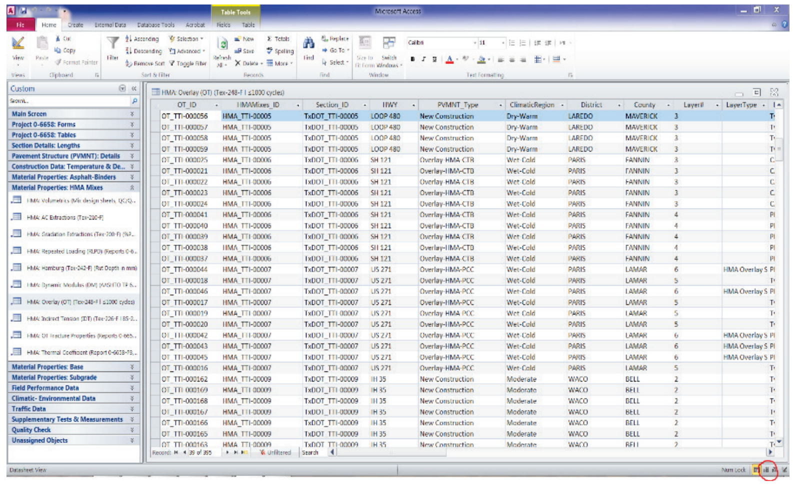
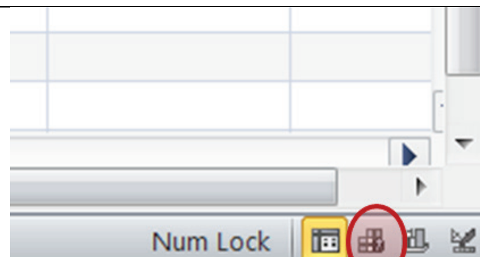
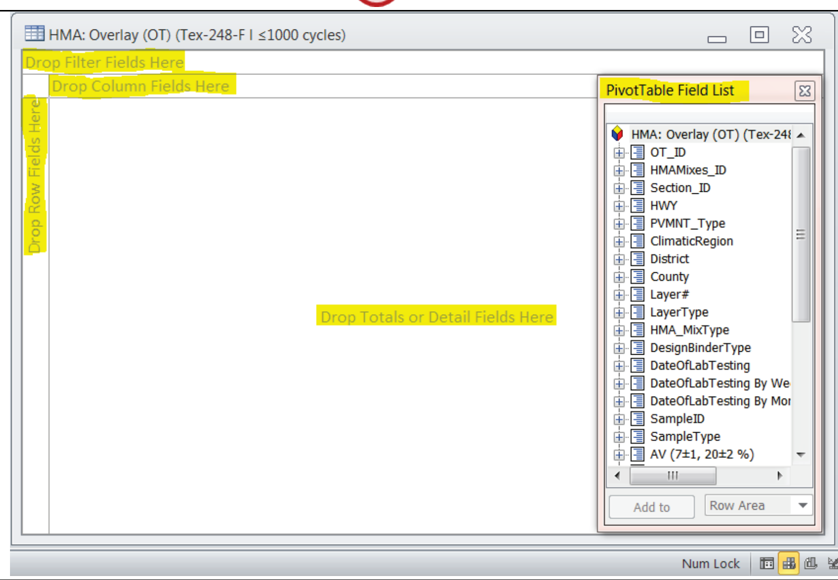
1. Open a data table that you want to analyze for maximum, minimum, average, standard deviation, etc. For this example, we are using the DSS table: **"HMA: Overlay (OT) (Tex-248-F │ ≤ 1000 cycles)"**	
2. Open the table in the **Pivot Table View** by clicking the icon in the bottom right corner.	
3. The pivot table includes a **Pivot Table Field List** that lists all the data fields in the table and four areas/zones, namely the **Filter** field, **Column** field, **Row** field, and **Totals or Detail** field. Any data field from the **Pivot Table Field List** can be dragged and dropped to one of these four zones**.**	

Table IV-1. Accessing and Analyzing the DSS Data: Showing Average, Maximum, Minimum, etc. of Data in a Table (Continued).

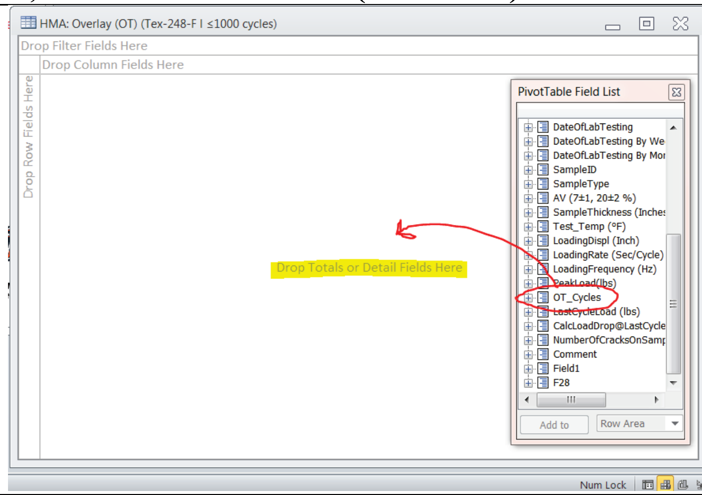
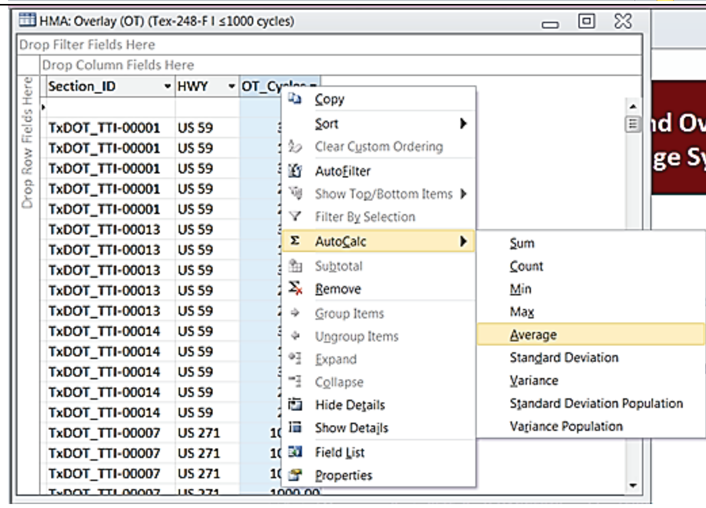
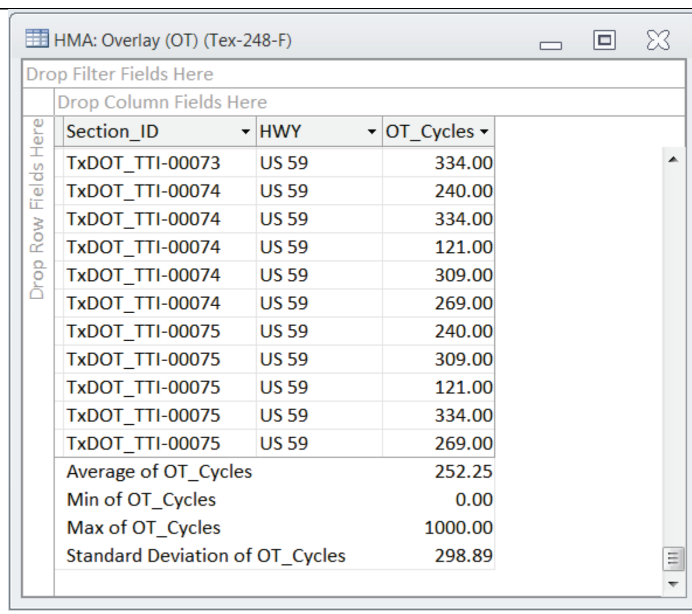
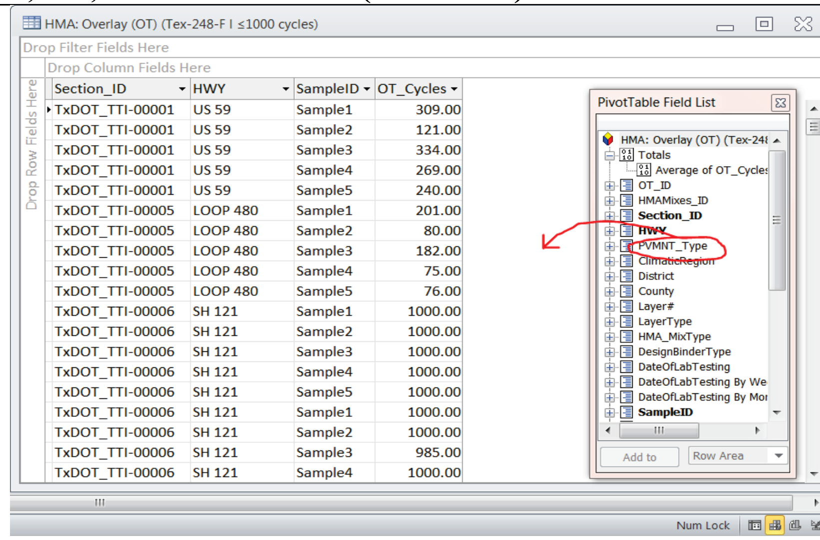
<table>
<tr>
<td>4. From the PivotTable Field List in the Pivot Table View, drag and drop the desired data field into the empty space in the middle of the pivot table marked as: Drop Totals or Detail Fields Here. For this example, we are using the Section_ID, HWY, and OT_Cycles data fields.</td>
<td>
</td>
</tr>
<tr>
<td>5. Select the data column, click the right mouse button, and select analysis types in AutoCalc, e.g., summation, maximum, minimum, average, standard deviation, etc.</td>
<td>
</td>
</tr>
<tr>
<td>6. The desired analysis result/results for all the data in the column will be presented at the end of the data column.</td>
<td>
</td>
</tr>
</table>

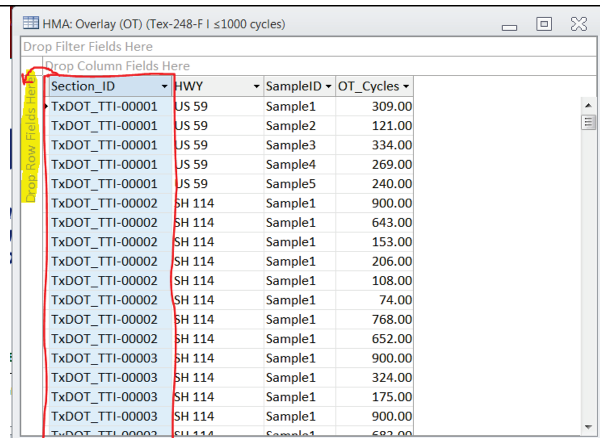
Table IV-1. Accessing and Analyzing the DSS Data: Showing Average, Maximum, Minimum, etc., of Data in a Table (Continued).

7. You can also add other fields (e.g., PVMNT_Type, SampleID, etc.) to the pivot table following the same **"drag and drop"** procedure as described in Item #3 in this table.

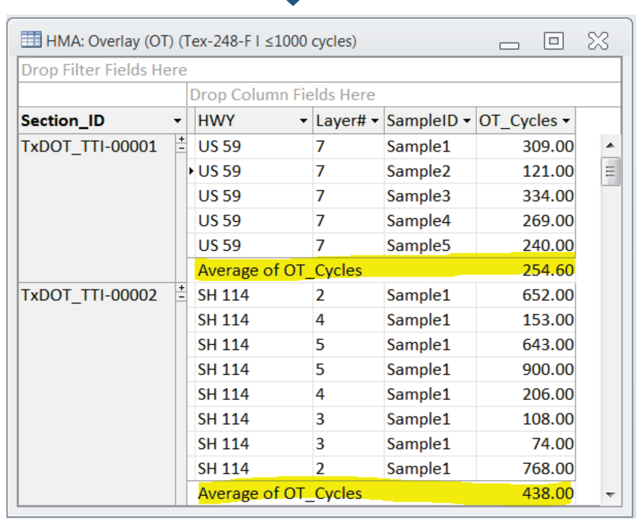


Section_ID	HWY	SampleID	OT_Cycles
TxDOT_TTI-00001	US 59	Sample1	309.00
TxDOT_TTI-00001	US 59	Sample2	121.00
TxDOT_TTI-00001	US 59	Sample3	334.00
TxDOT_TTI-00001	US 59	Sample4	269.00
TxDOT_TTI-00001	US 59	Sample5	240.00
TxDOT_TTI-00005	LOOP 480	Sample1	201.00
TxDOT_TTI-00005	LOOP 480	Sample2	80.00
TxDOT_TTI-00005	LOOP 480	Sample3	182.00
TxDOT_TTI-00005	LOOP 480	Sample4	75.00
TxDOT_TTI-00005	LOOP 480	Sample5	76.00
TxDOT_TTI-00006	SH 121	Sample1	1000.00
TxDOT_TTI-00006	SH 121	Sample2	1000.00
TxDOT_TTI-00006	SH 121	Sample3	1000.00
TxDOT_TTI-00006	SH 121	Sample4	1000.00
TxDOT_TTI-00006	SH 121	Sample5	1000.00
TxDOT_TTI-00006	SH 121	Sample1	1000.00
TxDOT_TTI-00006	SH 121	Sample2	1000.00
TxDOT_TTI-00006	SH 121	Sample3	985.00
TxDOT_TTI-00006	SH 121	Sample4	1000.00

8. The average **OT_Cycles** for each Section can be calculated by moving the **Section_ID** field to the **Row Field** (drag and drop). Similarly, the average for each HMA_MixType, PVMNT_Type, climatic region, etc., can be obtained by simply dropping the desired Field to the Row Fields area.

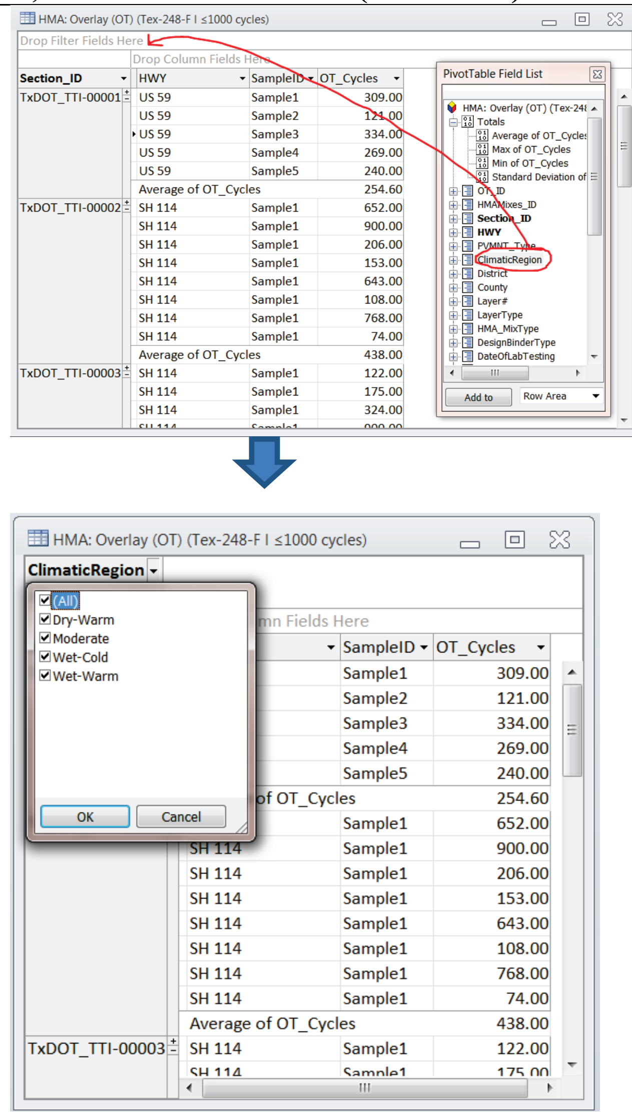


Section_ID	HWY	SampleID	OT_Cycles
TxDOT_TTI-00001	US 59	Sample1	309.00
TxDOT_TTI-00001	US 59	Sample2	121.00
TxDOT_TTI-00001	US 59	Sample3	334.00
TxDOT_TTI-00001	US 59	Sample4	269.00
TxDOT_TTI-00001	US 59	Sample5	240.00
TxDOT_TTI-00002	SH 114	Sample1	900.00
TxDOT_TTI-00002	SH 114	Sample1	643.00
TxDOT_TTI-00002	SH 114	Sample1	153.00
TxDOT_TTI-00002	SH 114	Sample1	206.00
TxDOT_TTI-00002	SH 114	Sample1	108.00
TxDOT_TTI-00002	SH 114	Sample1	74.00
TxDOT_TTI-00002	SH 114	Sample1	768.00
TxDOT_TTI-00002	SH 114	Sample1	652.00
TxDOT_TTI-00003	SH 114	Sample1	900.00
TxDOT_TTI-00003	SH 114	Sample1	324.00
TxDOT_TTI-00003	SH 114	Sample1	175.00
TxDOT_TTI-00003	SH 114	Sample1	900.00
TxDOT_TTI-00003	SH 114	Sample1	682.00



Section_ID	HWY	Layer#	SampleID	OT_Cycles
TxDOT_TTI-00001	US 59	7	Sample1	309.00
	US 59	7	Sample2	121.00
	US 59	7	Sample3	334.00
	US 59	7	Sample4	269.00
	US 59	7	Sample5	240.00
	Average of OT_Cycles			254.60
TxDOT_TTI-00002	SH 114	2	Sample1	652.00
	SH 114	4	Sample1	153.00
	SH 114	5	Sample1	643.00
	SH 114	5	Sample1	900.00
	SH 114	4	Sample1	206.00
	SH 114	3	Sample1	108.00
	SH 114	3	Sample1	74.00
	SH 114	2	Sample1	768.00
	Average of OT_Cycles			438.00

Table IV-1. Accessing and Analyzing the DSS Data: Showing Average, Maximum, Minimum, etc. of Data in a Table (Continued).

<table>
<tr>
<td>9. You can also filter the data by dropping the filter criteria from the Pivot Table Field List to the Filter Field. In this example, we'll filter the data by Climatic Region.</td>
<td>


</td>
</tr>
</table>

Table IV-2. Accessing and Analyzing the DSS Data: Generating Graphs from Data in a Table.

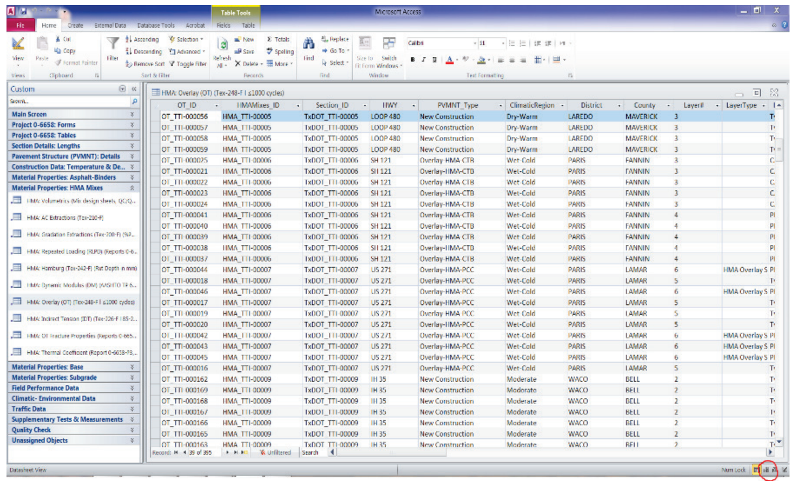
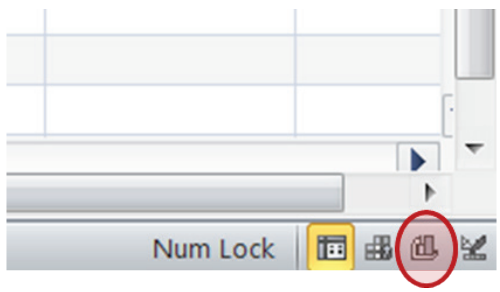
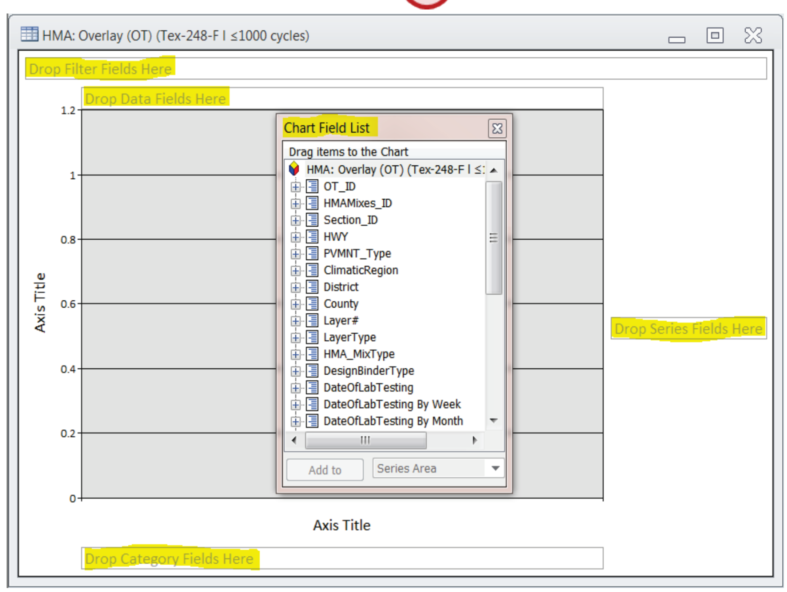
1. Open a DSS table that contains the data for drawing graphs. For this example, we are using the DSS Table: **“HMA: Overlay (OT) (Tex-248-F | ≤ 1000 cycles)”**	
2. Click the **Pivot Chart View** icon in the bottom right corner. The **Chart Field List** appears and lists all the data fields in the DSS table. The Pivot Chart includes four fields: **- Filter Field.** - **Data Field.** - **Series Field.** - **Category Field.** The **Filter Field** can be used to filter the presented data. The **Category Field** and the **Data Field** comprise the x- and y-axes of the chart, respectively. Any data field from the **Pivot Table Field List** can be dragged and dropped to one of these four zones**.**	 

Table IV-2. Accessing and Analyzing the DSS Data: Generating Graphs from Data in a Table (Continued).

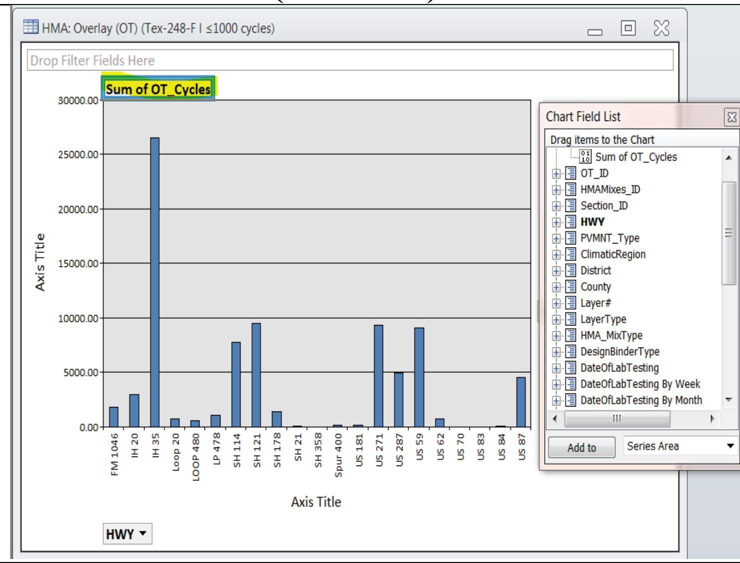
<table>
<tr>
<td>

3. From the **Chart Field List**, drag and drop an item to the **Category Field** for the x-axis of the chart. Similarly, drag and drop another item to the **Data Field** for the y-axis data.

For example, the following items were dragged and dropped for a bar chart as:

- **HWY** to **Category Field**
- **OT_Cycles** to **Data Field**

</td>
<td>

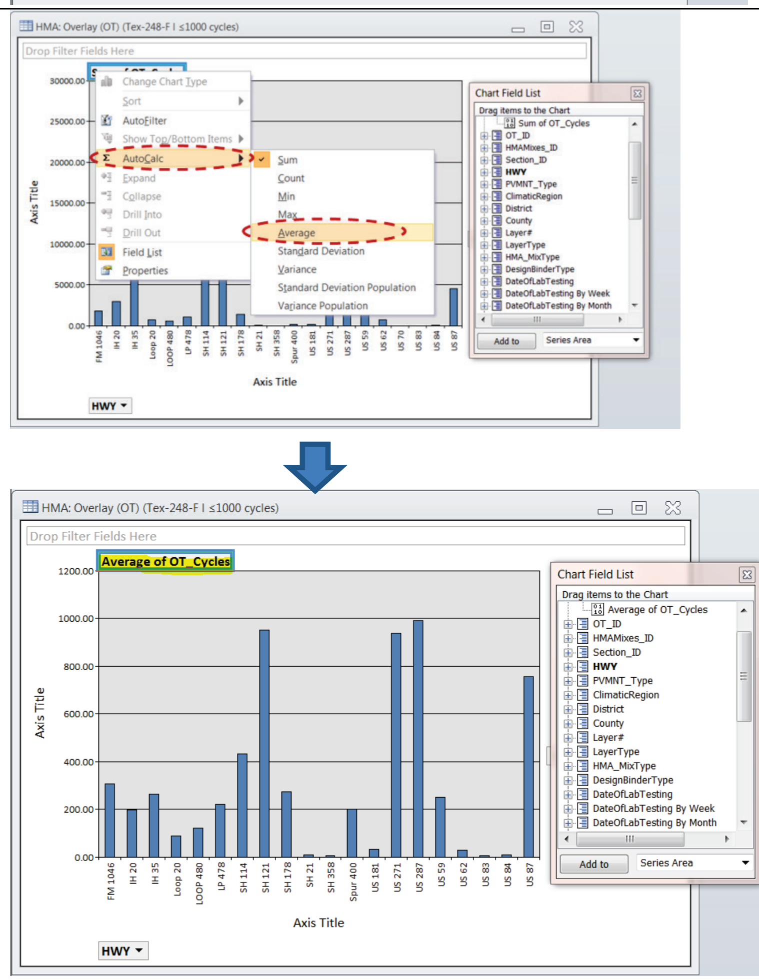


</td>
</tr>
<tr>
<td>

4. Note that the chart automatically shows the **Sum of OT Cycles** in the y-axis since there are multiple data points for each Hwy section.

To use the **Average of OT_Cycles** as the y-axis, you can right click on the **Sum of OT_Cycles,** and select **Average** in **AutoCalc.**

</td>
<td>



</td>
</tr>
</table>

Table IV-2. Accessing and Analyzing the DSS Data: Generating Graphs from Data in a Table (Continued).

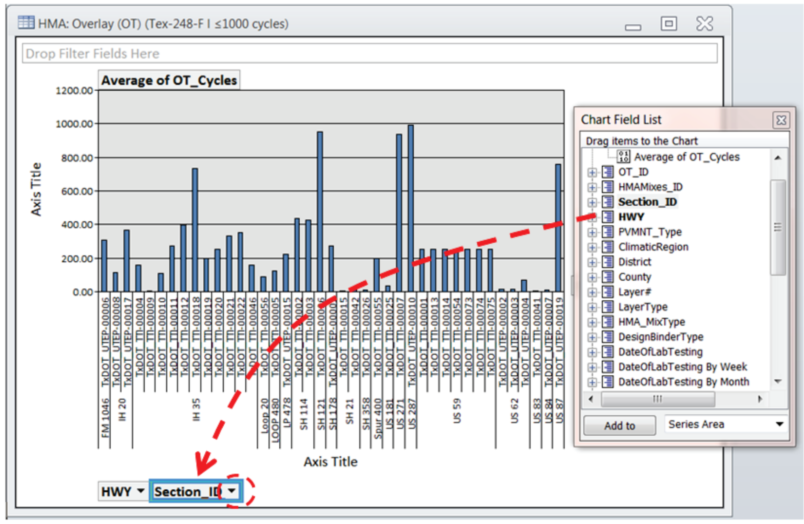
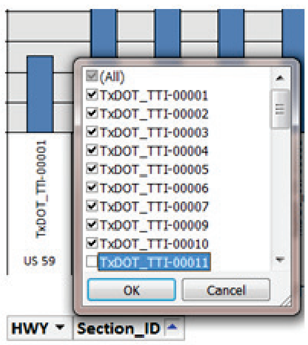
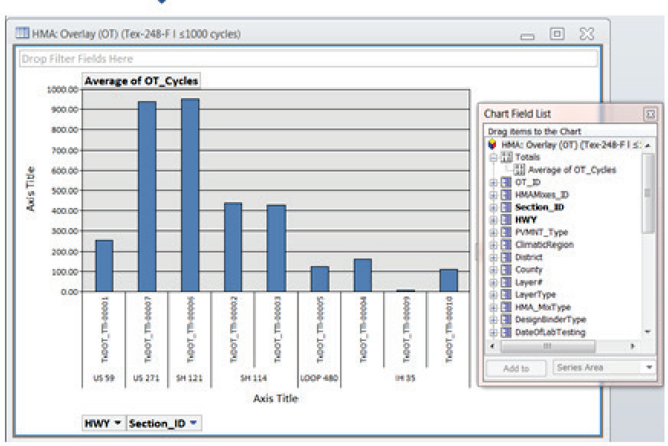
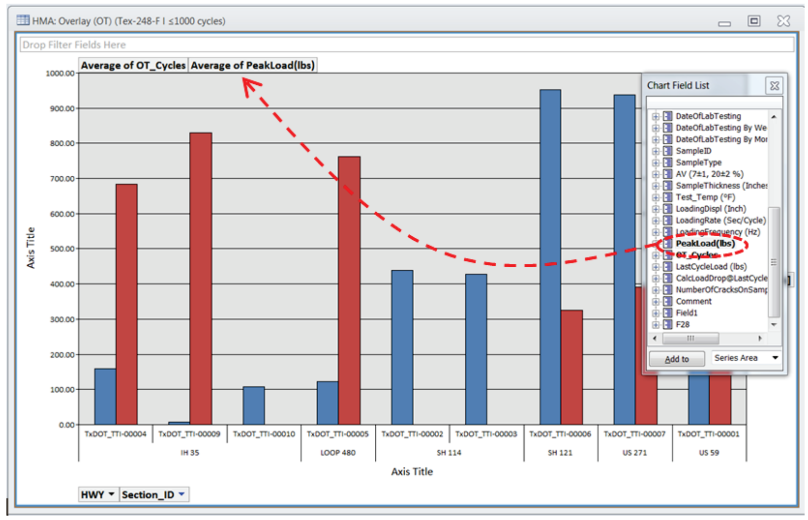
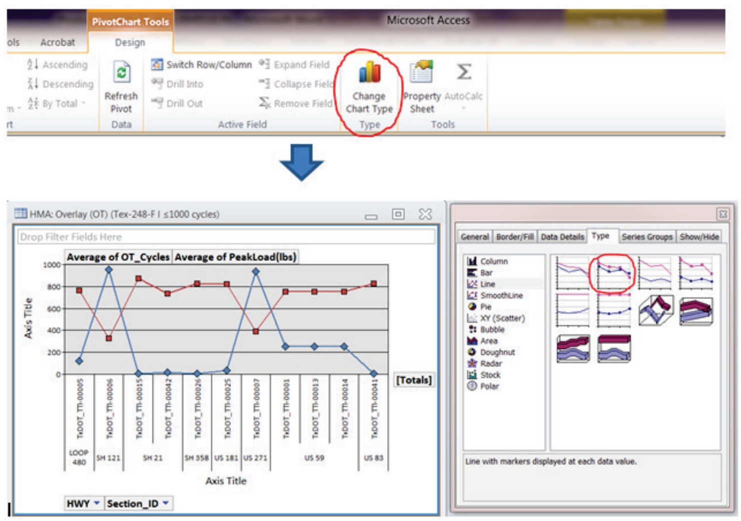
5. By adding the **Section_ID** field to the **Category Field,** you can see the information of some test sections you want to see: - Add the **Section_ID** field next to the **HWY** (in the **Category Field**). - Click the down arrow at **Section_ID**. - Select the section number(s) to be included in the chart.	  

Table IV-2. Accessing and Analyzing the DSS Data: Generating Graphs from Data in a Table (Continued).

6. You can add more Fields to the **Data Field** to present multiple data sets together in one chart by using the drag and drop function.	
7. To change the Chart type, select a desired chart type from the **Change Chart Type**. The line chart is presented here as an example.	

APPENDIX V. EXAMPLES OF EXPORTING AND EMAILING DSS DATA

Table V-1. Exporting a DSS Table to Excel Workbook.

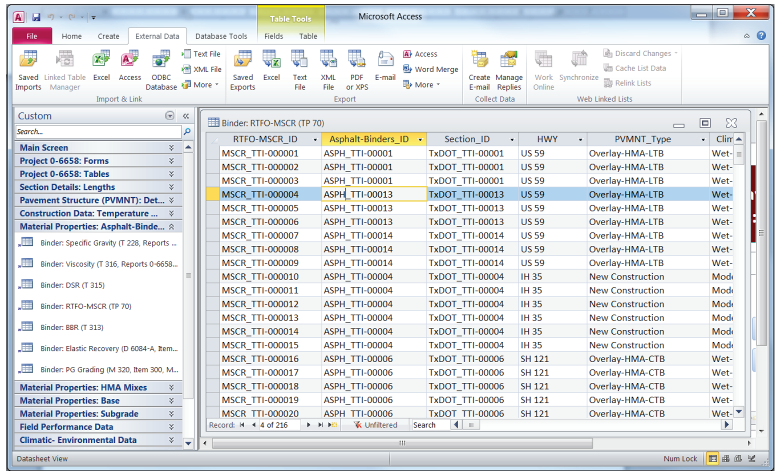
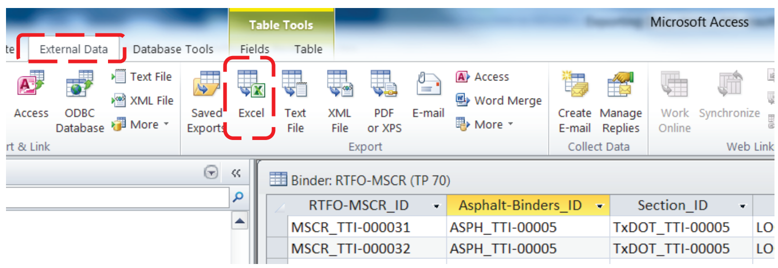
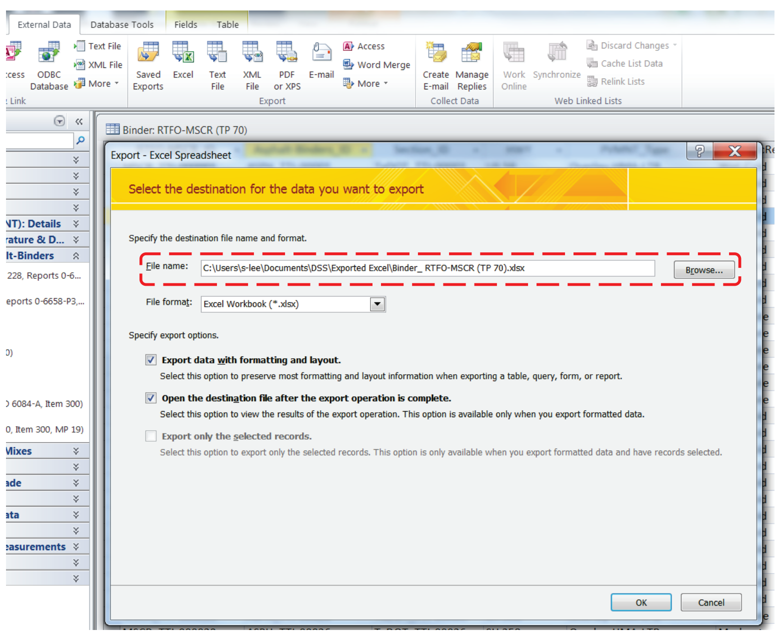
<table>
<tr><td>1. Open a data table that you want to export.</td><td>
</td></tr>
<tr><td>2. On the External Data tab, in the Export group, click Excel.</td><td>
</td></tr>
<tr><td>3. In the Export - Excel Spreadsheet dialog box, specify the destination of the Excel workbook. You can change the file name if you want to.</td><td>
</td></tr>
</table>

Table V-1. Exporting a DSS Table to Excel Workbook (Continued).

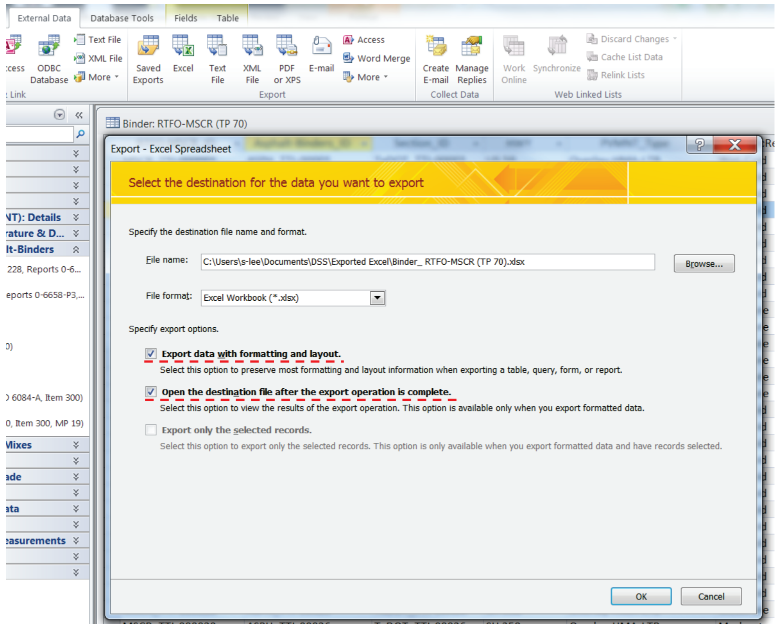
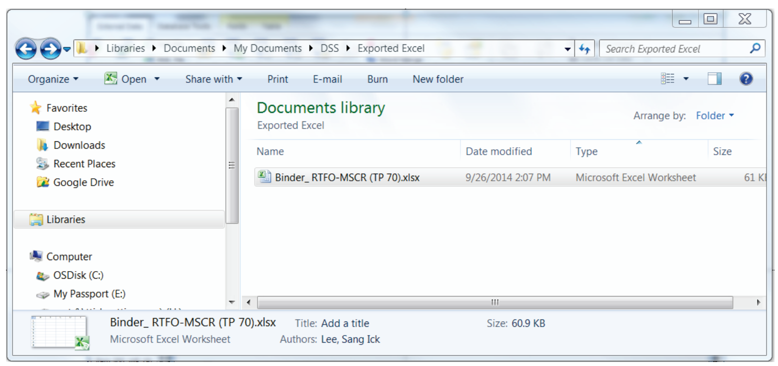
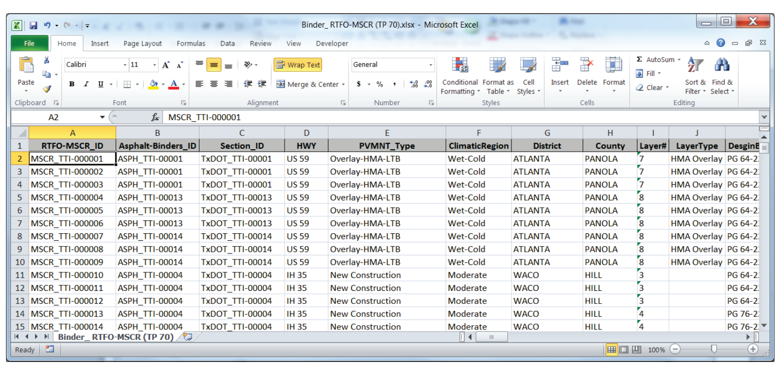
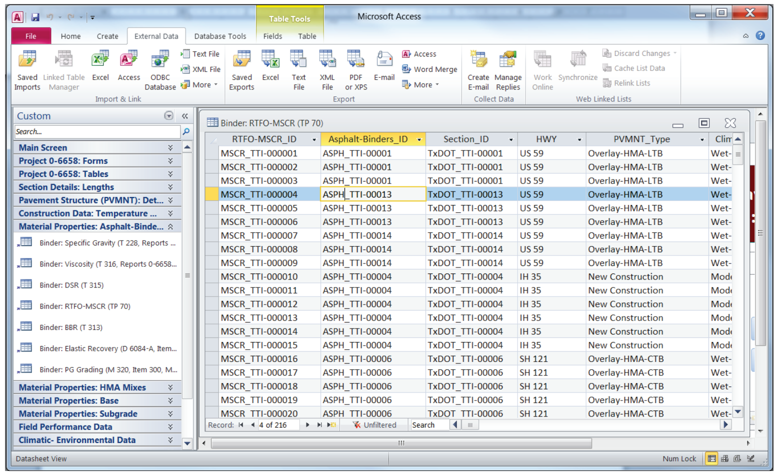
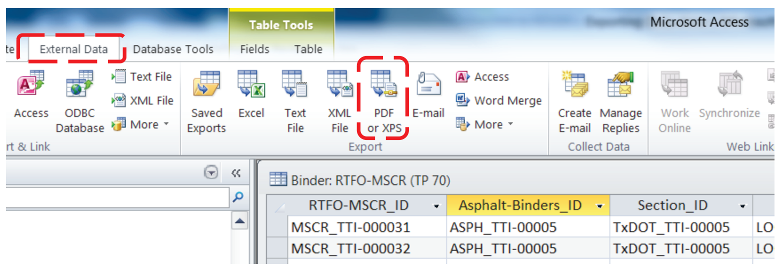
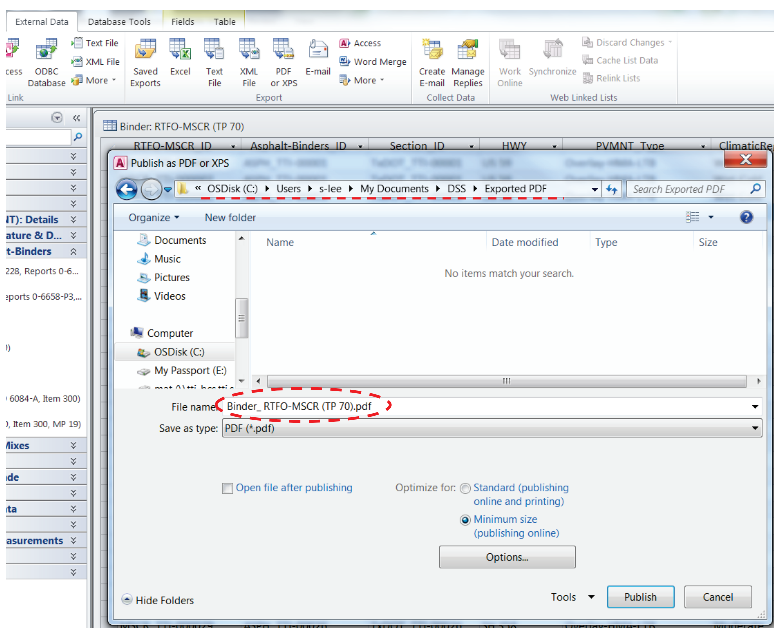
4. If you want to export the formatted data, select the **Export data with formatting and layout** check box. To view the Excel workbook after the export operation is complete, select the **Open the destination file after the export operation is complete** check box.	
5. Go to the destination folder and find the exported Excel workbook.	

Table V-2. Exporting a DSS Table to PDF.

<table>
<tr>
<td>1. Open a data table in the DSS that you want to export.</td>
<td>

</td>
</tr>
<tr>
<td>2. On the External Data tab, in the Export group, click PDF or XPS.</td>
<td>


</td>
</tr>
<tr>
<td>3. In the Publish as PDF or XPS dialog box, specify the destination of the PDF file and/or select a file name.</td>
<td>


</td>
</tr>
</table>

Table V-2. Exporting a DSS Table to PDF (Continued).

<table>
<tr><td>4. In the Publish as PDF or XPS dialog box, select one of the Optimize for options:

a. If the document requires high print quality, click Standard (publishing online and printing).

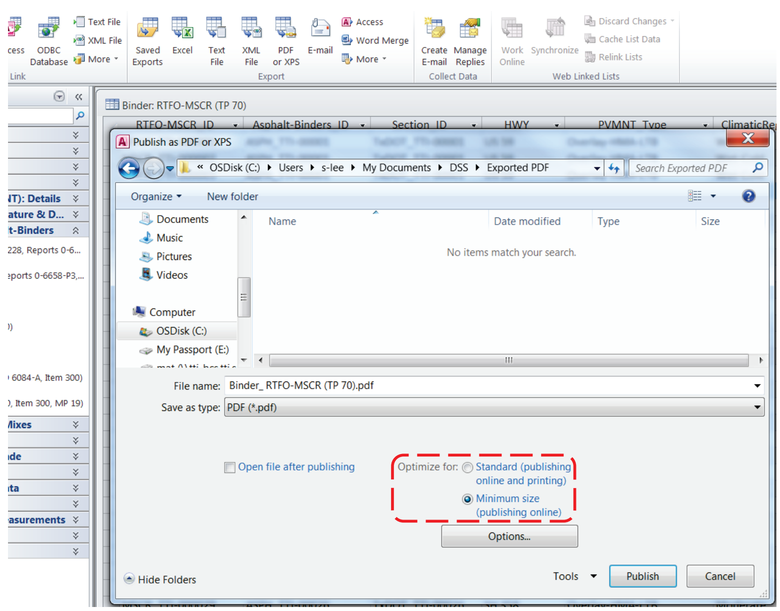
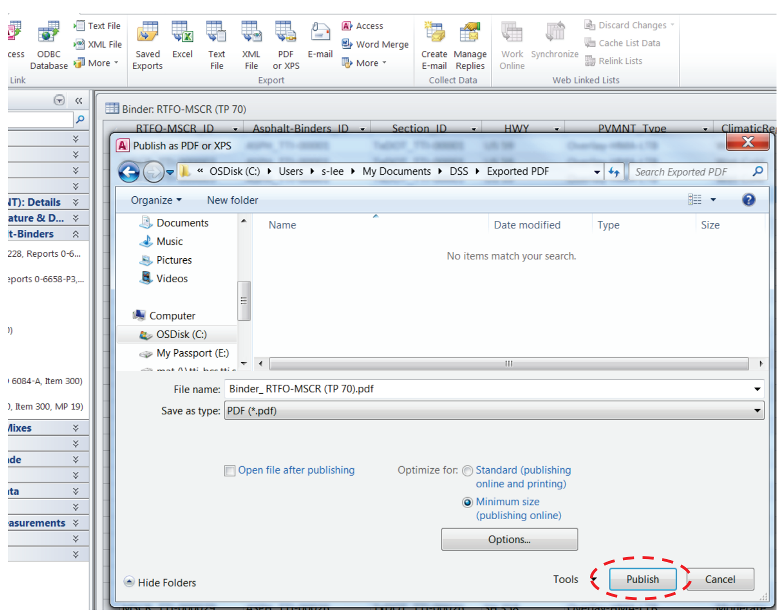
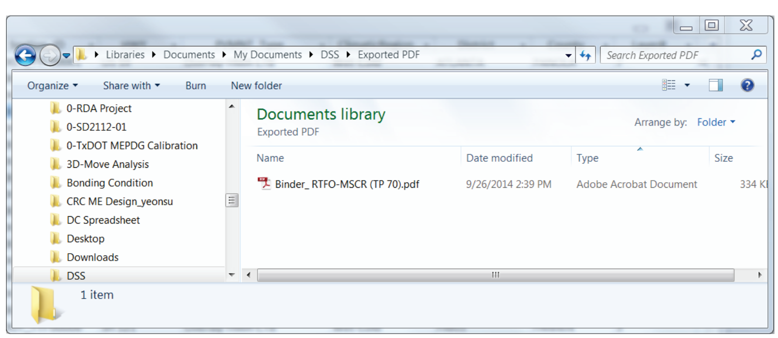
b. If file size is more important than print quality, click Minimum size (publishing online).</td><td>
</td></tr>
<tr><td>5. Click the Publish button.</td><td>
</td></tr>
<tr><td>5. Go to the destination folder and find the exported PDF file.</td><td>
</td></tr>
</table>

Table V-3. Emailing a DSS Table.*

<table>
<tr>
<td>1. Open a data table in the DSS that you want to email.

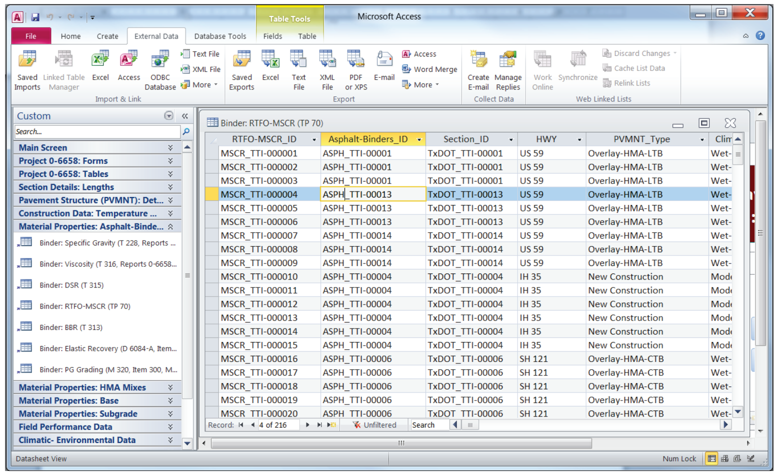
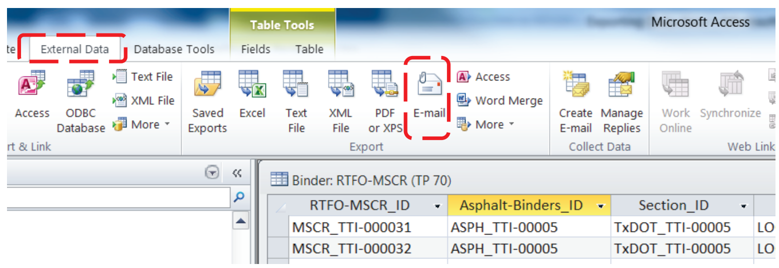
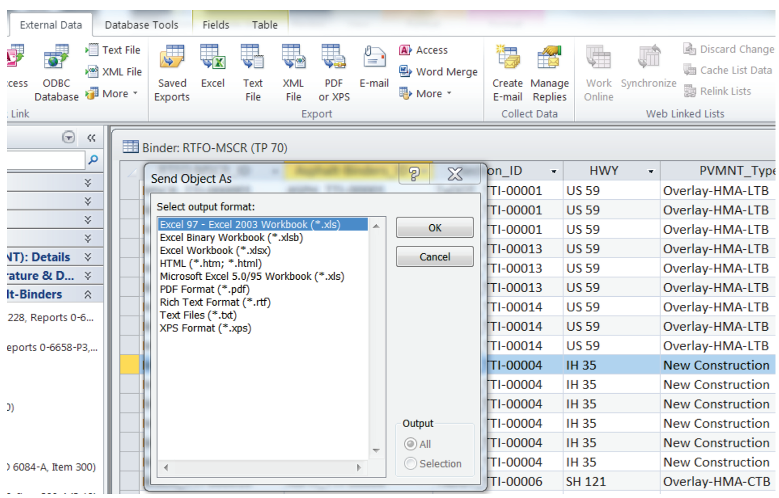
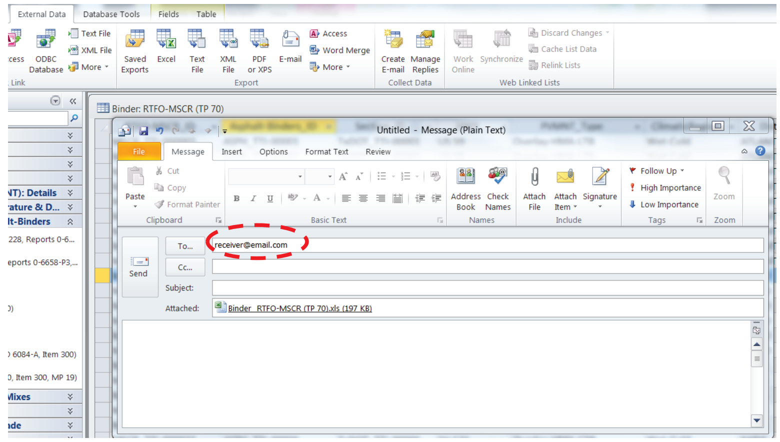
Note that the current MS Access emailing option works only with MS Outlook.</td>
<td>
</td>
</tr>
<tr>
<td>2. On the External Data tab, in the Export group, click E-mail.</td>
<td>
</td>
</tr>
<tr>
<td>3. In the Send Object As dialog box, select one output format and click OK.</td>
<td>
</td>
</tr>
</table>

Table V-3. Emailing a DSS Table (Continued).*

4. Add the email address(es) to which you want to send the data and click send.	

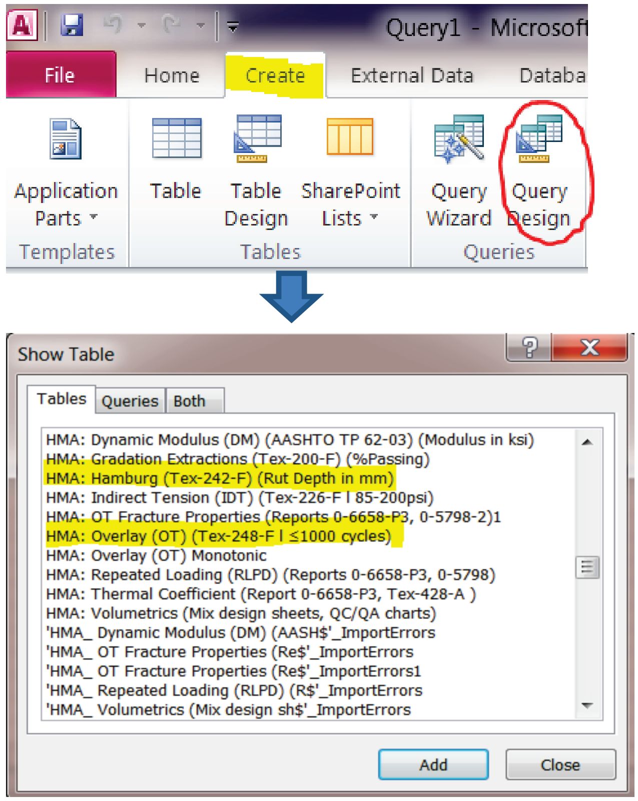
* To email a DSS table, users must have Outlook installed and configured on their computer.

APPENDIX VI. EXAMPLE OF ACCESSING MULTIPLE DSS DATA

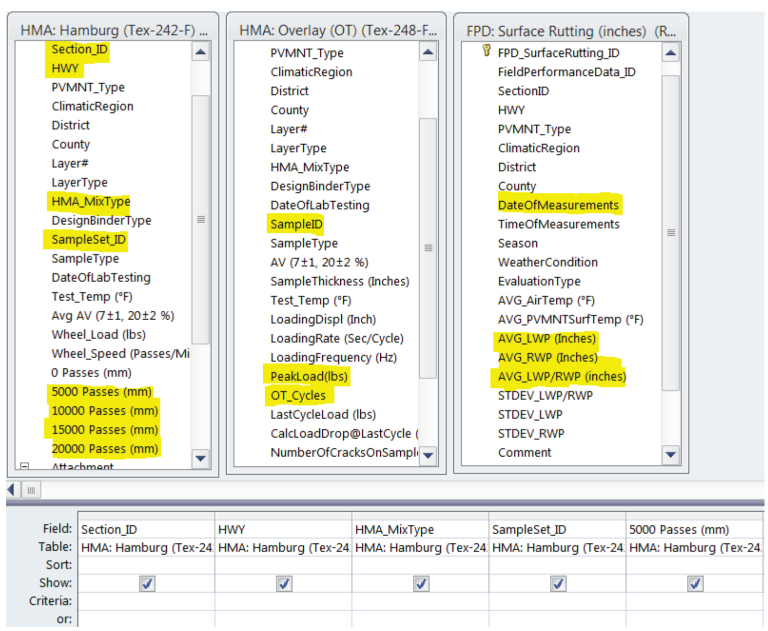
Table VI-1. Accessing Multiple Data.

<table>
<tr>
<td>
1. To create a Query Table with multiple data columns from different DSS tables, select Query Design in the Create tab. The Show Table dialog box will open. Select the tables where the desired data are stored.

In the example, we'll open the following tables to compare the HWTT, OT, and field rutting data from the DSS:

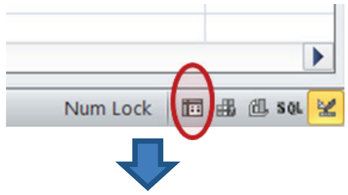
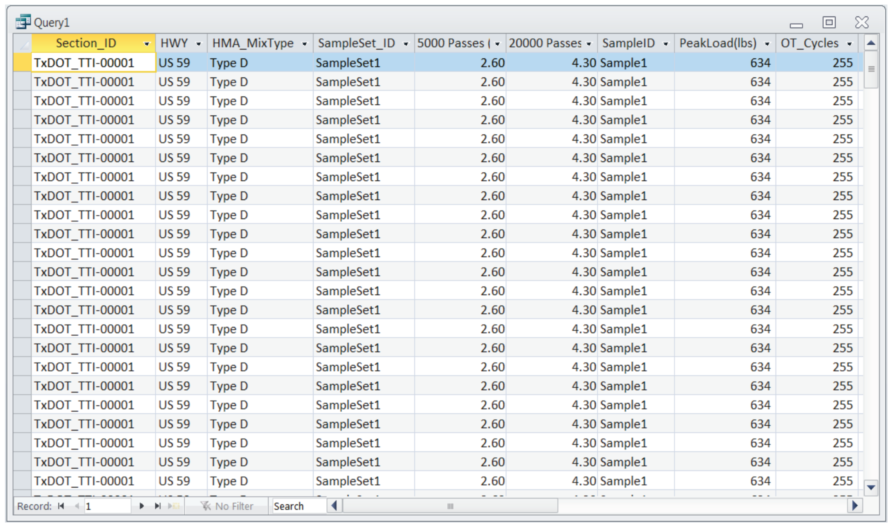
1. HMA: Hamburg (Tex-242-F) (Rut Depth in mm).
2. HMA: Overlay (OT) (Tex-248-F 1 ≤1000 cycles).
3. FPD: Surface Rutting (inches).
</td>
<td>


</td>
</tr>
<tr>
<td>
2. From each table, double click on the desired fields to add them to the query. The order of the columns can be adjusted by simply selecting the column and dragging to its desired position.

In the example, the following Data columns were included: Section ID; Hwy; HMA_Mix Type; Sample_ID; HWTT rut depth at 5000, 10000, 15000, and 20000 cycles; OT_Cycles; Peak Load(lbs); AVG field rutting at LWP, RWP, and LWP/RWP.
</td>
<td>


</td>
</tr>
</table>

Table VI-1. Accessing Multiple Data (Continued).

3. Once the order of the columns is finalized, select the **Data Sheet View** in the bottom right corner to view the final Query Table.	 
4. You can also filter to show only selected rows of data. For example, if you want to see the data for Section 1 only, type **"TxDOT_TTI-00001"** in the **Criteria** for **Section_ID** field.