

# “Accessing” LTPP Data

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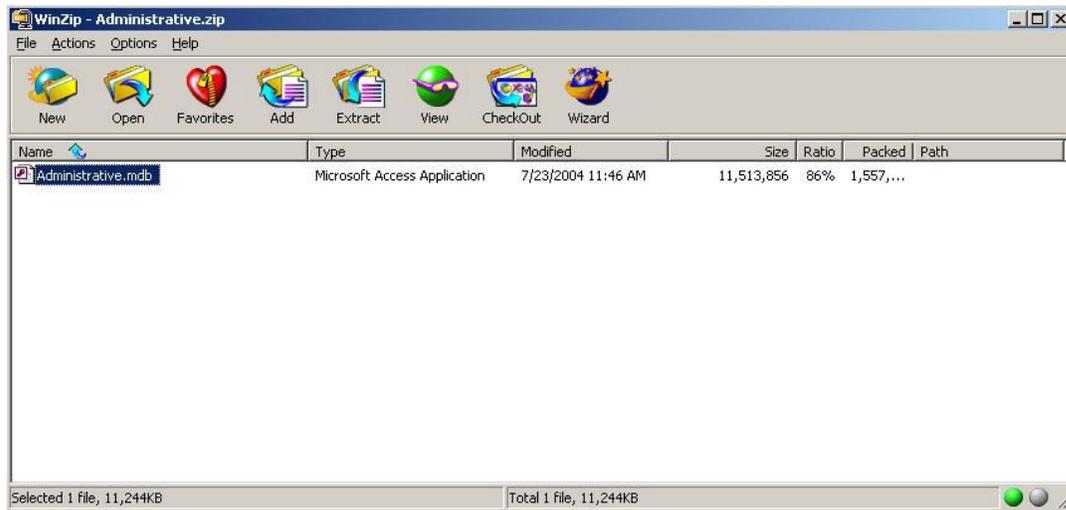
## Introduction

Data from the LTPP Program has been distributed to the public for more than 10 years. In the early 1990's, data was provided in ASCII or Excel files, and much work was required to get the data into a usable format. Microsoft Access became a popular tool for analyzing the LTPP data by the late 1990's. By 2001, most data requestors wanted data in Access format. The LTPP Standard Data Release (SDR) is now distributed in Access 2000<sup>®</sup> databases.

The LTPP tables are grouped into modules based on their data content (see module listing sheet in Appendix A). For example, all of the tables containing materials testing results are in the Material\_Test module. Each module is stored in a separate database file.

## Extracting Compressed Files

The database files in the SDR CD's have been compressed to save space. These can be unzipped by double-clicking on each module file. The screen in Figure 1 will be displayed when the user double-clicks on the Administrative.zip file.



**Figure 1. Winzip Window showing contents of Administrative.zip**

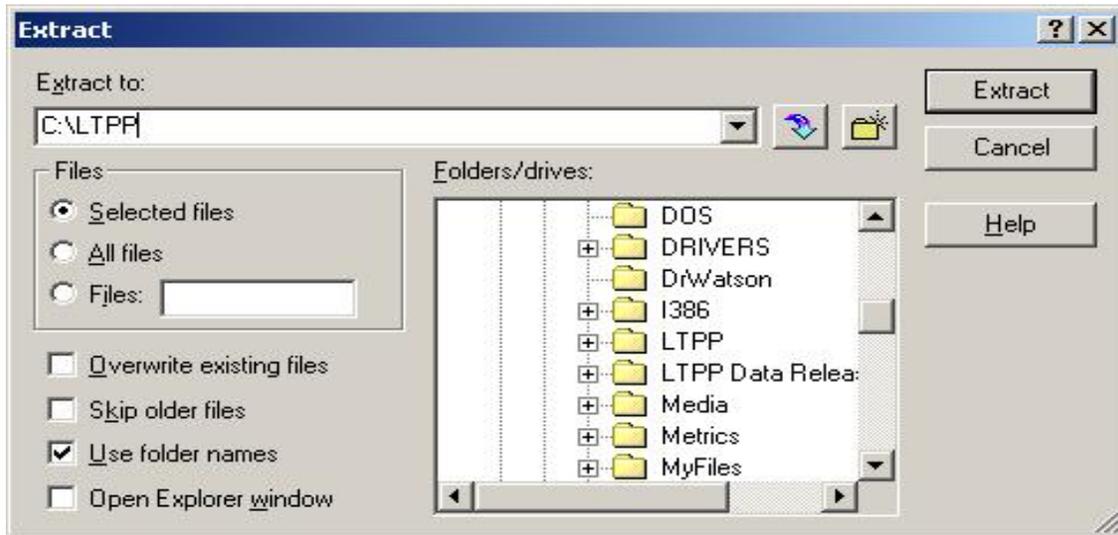
At this point, the database contents can be viewed by double-clicking on the database file (Administrative.mdb), or the database file can be extracted and saved to the hard-drive. Saving these files to the hard-drive is recommended because once the database file is saved to rewritable media, the database can be customized to the user's needs.

### *Saving LTPP Database Files*

To extract LTPP data from the SDR CD's to a hard-drive, follow the steps listed below. Uncompressed, all data modules from CD 1 of the SDR fill approximately 6.3 GB of data. Individual data modules can be extracted and saved if less space is available or some modules are not needed.

1. Check for necessary amount of disk space.
2. Create a folder in which to save the database files.

3. Single-click on the database file (\*.mdb) in the Winzip window and click on the “Extract” button. The screen in Figure 2 will be displayed.



**Figure 2. Screen to select extraction location**

4. Click on the down arrow in the “Extract to:” box to choose the folder into which the database file will be saved. In this example, a folder titled “LTPP” was specified.
5. Click the “Extract” button to save the file to the specified location.

## Opening an Access Database

There are several ways to open a database file in Access 2000. The easiest is to double-click on the file (\*.mdb) in Windows Explorer. The database will open in Access, displaying a list of tables as shown in Figure 4.

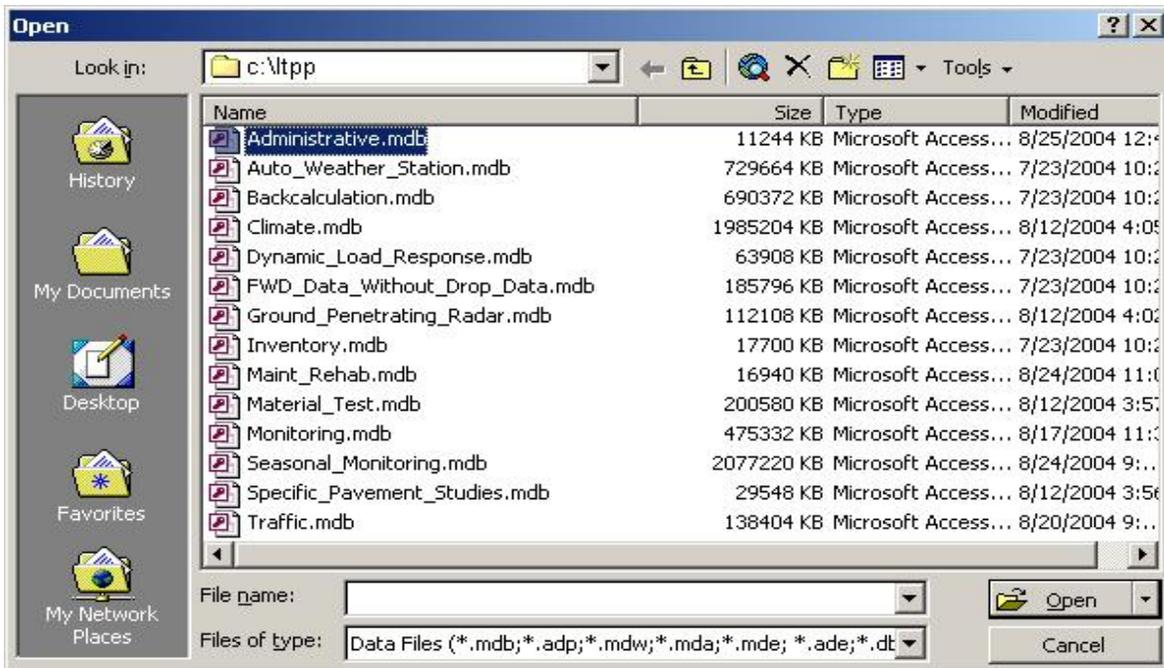
Alternately, the user can begin by starting Access 2000<sup>®</sup> from the Start/Programs Menu in Explorer and following these steps:

1. The initial Microsoft Access screen will prompt the user to create a new database file or open an existing file. Click “OK” to open an existing file.
2. The Open file window is displayed. Click the “Look In:” pull down menu and select the folder (directory) in which the database files are stored. All files matching the “Files of type” filter at the bottom of the window are listed (see Figure 3).
3. Select a database and click on the “Open” button. A list of the tables in the selected database will appear (see Figure 4).

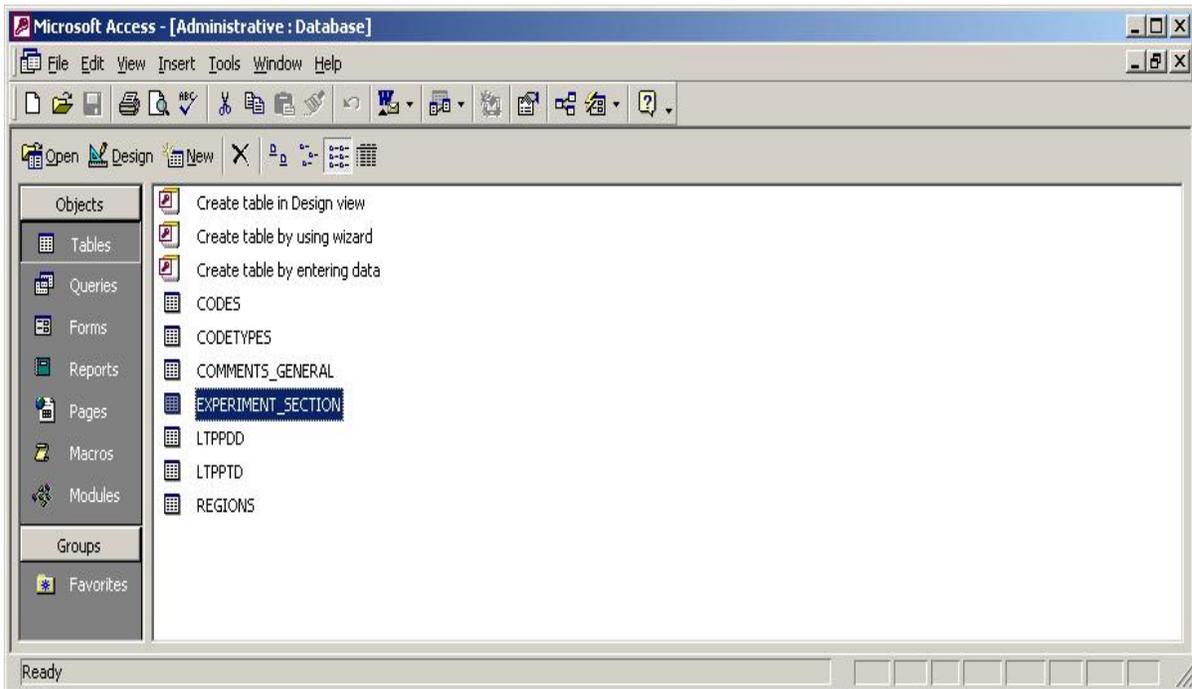
Otherwise, if Access 2000<sup>®</sup> is already running, the File>Open menu item or Open button



can be used to open a new file.



**Figure 3. Open File Window with Database Files Listed**



**Figure 4. Tables in the Administrative Module**

The tables contained in the Administrative module are shown in Figure 4. This screen provides options to open a table to view the data and to view/change the design of a table. Clicking on the “Open” button after selecting the EXPERIMENT\_SECTION table shows the data in the EXPERIMENT\_SECTION table (see Figure 5).

STATE_CODE	SHRP_ID	CONSTRUCTION_CN	ASSIGN_DATE	CN_CHANGE_FACTOR	RECORD_STATUS	GPS_SPS	EXPERIMENT	STATUS	ASSIGN_DATE	DEASSIGN_DATE	SEAS_ID	SUPPLEMENTAL_ID
1	0100	1	4/30/1991		E	S	1		4/30/1991			
1	0101	1	4/30/1991		E	S	1		4/30/1991		A	
1	0102	1	4/30/1991		E	S	1		4/30/1991		B	
1	0103	1	4/30/1991		E	S	1		4/30/1991			
1	0104	1	4/30/1991		E	S	1		4/30/1991			
1	0105	1	4/30/1991		E	S	1		4/30/1991			
1	0106	1	4/30/1991		E	S	1		4/30/1991			
1	0107	1	4/30/1991		E	S	1	O	4/30/1991	5/3/2002		
1	0107	2	2/7/2001	22	E	S	1	O	4/30/1991	5/3/2002		
1	0108	1	4/30/1991		E	S	1		4/30/1991			
1	0109	1	4/30/1991		E	S	1		4/30/1991			
1	0110	1	4/30/1991		E	S	1		4/30/1991			
1	0111	1	4/30/1991		E	S	1		4/30/1991			
1	0112	1	4/30/1991		E	S	1		4/30/1991			
1	0161	1	4/30/1991		E	S	1		4/30/1991			S
1	0162	1	4/30/1991		E	S	1		4/30/1991			S
1	0163	1	4/30/1991		E	S	1		4/30/1991			S
1	0500	1	1/1/1987		E	S	5		1/1/1987			
1	0502	1	1/1/1987		E	S	5		1/1/1987			
1	0502	2	12/19/1991	43	E	S	5		1/1/1987			
1	0503	1	1/1/1987		E	S	5		1/1/1987			
1	0503	2	12/16/1991	43, 10	E	S	5		1/1/1987			
1	0504	1	1/1/1987		E	S	5		1/1/1987			
1	0504	2	12/10/1991	19, 10	E	S	5		1/1/1987			
1	0505	1	1/1/1987		E	S	5		1/1/1987			
1	0505	2	12/19/1991	19	E	S	5		1/1/1987			
1	0506	1	1/1/1987		E	S	5		1/1/1987			
1	0506	2	12/9/1991	51	E	S	5		1/1/1987			
1	0507	1	1/1/1987		E	S	5		1/1/1987			
1	0507	2	12/9/1991	51, 10	E	S	5		1/1/1987			
1	0508	1	1/1/1987		E	S	5		1/1/1987			
1	0508	2	12/9/1991	55, 10	E	S	5		1/1/1987			
1	0509	1	1/1/1987		E	S	5		1/1/1987			
1	0509	2	12/9/1991	55, 10	E	S	5		1/1/1987			
1	0563	1	1/1/1987		E	S	5		1/1/1987			S
1	0563	2	12/9/1991	51	E	S	5		1/1/1987			S
1	0564	1	1/1/1987		E	S	5	O	1/1/1987	3/31/1999		S
1	0564	2	12/9/1991	55	E	S	5	O	1/1/1987	3/31/1999		S
1	0600	1	11/18/1997		E	S	6		11/18/1997			
1	0601	1	11/18/1997		E	S	6		11/18/1997			
1	0601	2	6/25/1998	11	E	S	6		11/18/1997			
1	0602	1	11/18/1997		E	S	6		11/18/1997			
1	0602	2	4/11/1998	4, 12, 11, 2	E	S	6		11/18/1997			
1	0603	1	11/18/1997		E	S	6		11/18/1997			
1	0603	2	6/23/1998	11, 19	E	S	6		11/18/1997			
1	0604	1	11/18/1997		E	S	6		11/18/1997			
1	0604	2	6/27/1998	19, 11	E	S	6		11/18/1997			

**Figure 5. Contents of EXPERIMENT\_SECTION table**

Database tables contain data organized in rows (records) and columns (fields or elements). All elements in a single row of data are related and are kept together. Each element is identified by the column header or field name. As the user tabs through the elements, a description for each element is displayed at the bottom of the screen. In Figure 5, there is a description for the STAE\_CODE element at the bottom of the screen. The current record number and the total number of records contained in the table are in the lower left corner of the table screen.

### The EXPERIMENT\_SECTION Table and Key Fields

The EXPERIMENT\_SECTION table (Figure 5) contains at least one row or record for each highway section in the LTPP Program. This table is considered the master table for the entire database. Each record has data related to the section identified by the STATE\_CODE and SHRP\_ID fields (columns).

Most tables in the LTPP database have the STATE\_CODE and SHRP\_ID fields. These two fields are always "key" fields. In other words, these two fields are required, along with other "key" fields, to identify a single row or record in a table. This group of key fields is also called the "primary key."

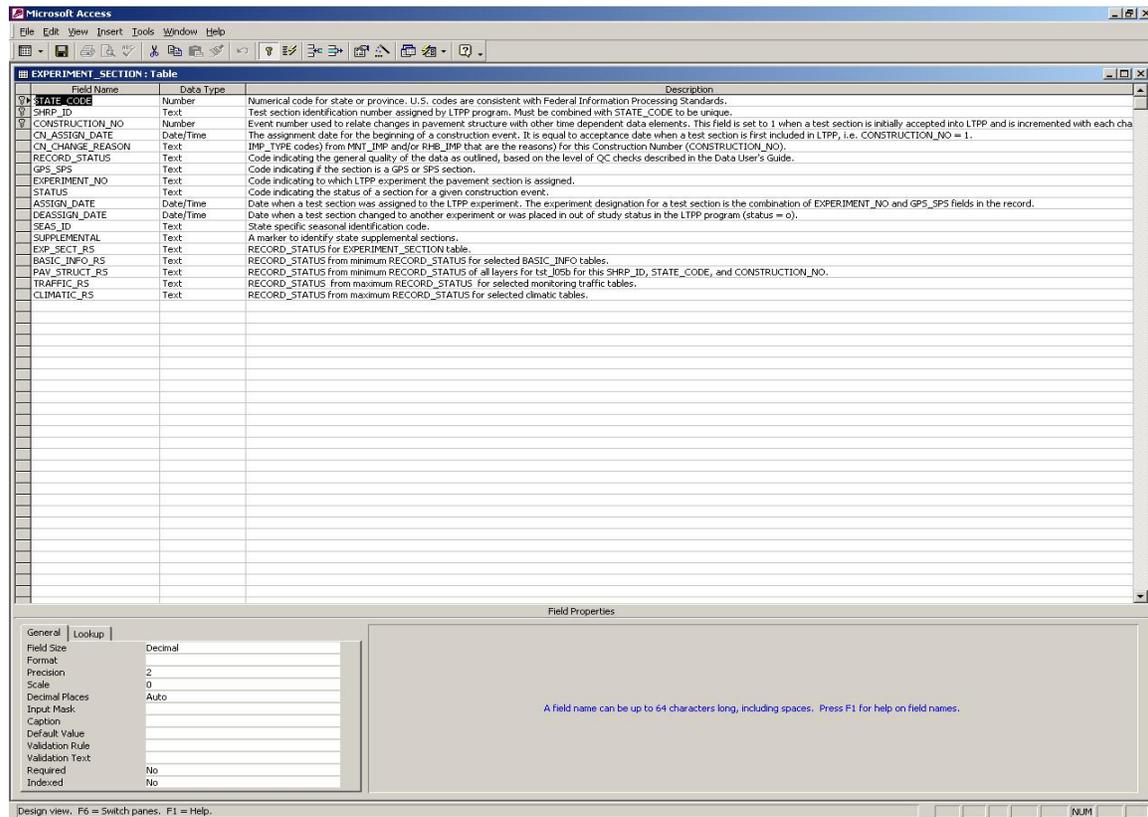
## Primary Key

Access defines the primary key as the fields that hold data that uniquely identifies each record in a table. Access automatically creates an index on the primary key of a table and uses it to find records and to create joins between tables. The primary key index requires an entry in each primary key field and allows no duplicates. The order of the fields in a multiple field primary key determines the default sort order for the table.

The key fields in a table can be identified in the design view of the table. The design view is displayed when a table is selected or open and the Design View Button  is clicked. The design view of the EXPERIMENT\_SECTION table is shown in Figure 6.

The design view shows all of the fields that make up the table, the data type of each field, and a description of each field. Each field that is part of the key has the key symbol  in the far left column.

The contents of the table are displayed by clicking on the Datasheet button .

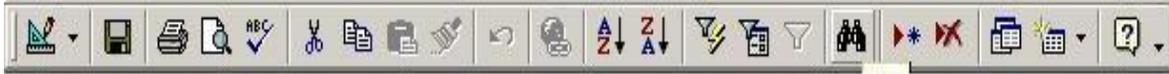


Field Name	Data Type	Description
STATE_CODE	Number	Numerical code for state or province. U.S. codes are consistent with Federal Information Processing Standards.
SHRP_ID	Text	Test section identification number assigned by LTPP program. Must be combined with STATE_CODE to be unique.
CONSTRUCTION_NO	Number	Event number used to relate changes in pavement structure with other time dependent data elements. This field is set to 1 when a test section is initially accepted into LTPP and is incremented with each change.
ON_ASSIGN_DATE	Date/Time	The assignment date for the beginning of a construction event. It is equal to acceptance date when a test section is first included in LTPP, i.e. CONSTRUCTION_NO = 1.
ON_CHANGE_REASON	Text	IMP_TYPE codes) from RMT_IMP and/or RHE_IMP that are the reasons) for this Construction Number (CONSTRUCTION_NO).
RECORD_STATUS	Text	Code indicating the general quality of the data as outlined, based on the level of QC checks described in the Data User's guide.
GPS_SPS	Text	Code indicating if the section is a GPS or SPS section.
EXPERIMENT_NO	Text	Code indicating to which LTPP experiment the pavement section is assigned.
STATUS	Text	Code indicating the status of a section for a given construction event.
ASSIGN_DATE	Date/Time	Date when a test section was assigned to the LTPP experiment. The experiment designation for a test section is the combination of EXPERIMENT_NO and GPS_SPS fields in the record.
DEASSIGN_DATE	Date/Time	Date when a test section changed to another experiment or was placed in out of study status in the LTPP program (status = 0).
SEAS_ID	Text	State specific seasonal identification code.
SUPPLEMENTAL	Text	A marker to identify state supplemental sections.
EXP_SECT_RS	Text	RECORD_STATUS for EXPERIMENT_SECTION table.
BASIC_INFO_RS	Text	RECORD_STATUS from minimum RECORD_STATUS for selected BASIC_INFO tables.
PAY_STRUCT_RS	Text	RECORD_STATUS from minimum RECORD_STATUS of all layers for tst_055) for this SHRP_ID, STATE_CODE, and CONSTRUCTION_NO.
TRAFFIC_RS	Text	RECORD_STATUS from maximum RECORD_STATUS for selected monitoring traffic tables.
CLIMATIC_RS	Text	RECORD_STATUS from maximum RECORD_STATUS for selected climatic tables.

Figure 6. Design View of EXPERIMENT\_SECTION Table

## Manipulating Data with Access 2000®

Whenever a table is opened, the following toolbar is displayed:

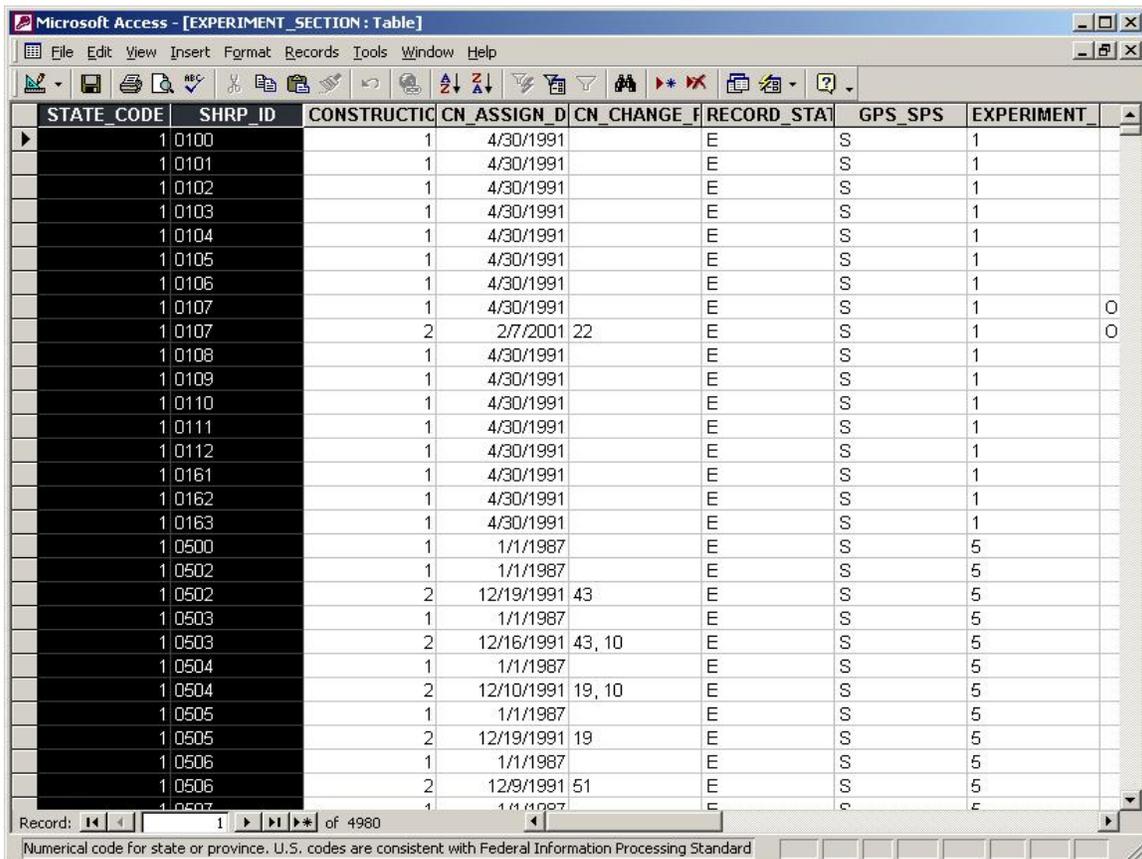


### Sorting Data

Several of the buttons in the toolbar can be used to manipulate data in a table. For example, to sort records, select one or more fields in the table (click on the field name(s)

at the top of each column) and then click on the Sort Ascending  or Sort Descending  button. Each column used for sorting will be highlighted, as shown in Figure 7. All

of the records will be sorted based first on the values in the leftmost selected column and then on selected columns to the right. When sorting by multiple columns, the columns must be adjacent to each other. Click and drag column headers to reorder columns. In the example below, the EXPERIMENT\_SECTION table will be sorted by the STATE\_CODE column and then the SHRP\_ID column. Sorting can take some time, depending on the size of the table.



STATE_CODE	SHRP_ID	CONSTRUCTIC	CN_ASSIGN_D	CN_CHANGE_F	RECORD_STA	GPS_SPS	EXPERIMENT
1	0100	1	4/30/1991		E	S	1
1	0101	1	4/30/1991		E	S	1
1	0102	1	4/30/1991		E	S	1
1	0103	1	4/30/1991		E	S	1
1	0104	1	4/30/1991		E	S	1
1	0105	1	4/30/1991		E	S	1
1	0106	1	4/30/1991		E	S	1
1	0107	1	4/30/1991		E	S	1
1	0107	2	2/7/2001	22	E	S	1
1	0108	1	4/30/1991		E	S	1
1	0109	1	4/30/1991		E	S	1
1	0110	1	4/30/1991		E	S	1
1	0111	1	4/30/1991		E	S	1
1	0112	1	4/30/1991		E	S	1
1	0161	1	4/30/1991		E	S	1
1	0162	1	4/30/1991		E	S	1
1	0163	1	4/30/1991		E	S	1
1	0500	1	1/1/1987		E	S	5
1	0502	1	1/1/1987		E	S	5
1	0502	2	12/19/1991	43	E	S	5
1	0503	1	1/1/1987		E	S	5
1	0503	2	12/16/1991	43, 10	E	S	5
1	0504	1	1/1/1987		E	S	5
1	0504	2	12/10/1991	19, 10	E	S	5
1	0505	1	1/1/1987		E	S	5
1	0505	2	12/19/1991	19	E	S	5
1	0506	1	1/1/1987		E	S	5
1	0506	2	12/9/1991	51	E	S	5
1	0507	1	1/1/1987		E	S	5

Figure 7. Sorting EXPERIMENT\_SECTION by STATE\_CODE and SHRP\_ID fields

## Filtering Data

Rows of data can be filtered according to specific data values. Filtering will allow the user to view specific rows of data while hiding the remainder of the data. The table can be filtered either by selection or by form. To filter by selection, find a data value of interest in a column (such as STATE\_CODE = 1) and highlight the data value with the



cursor. Go to the toolbar and click , filter by selection. The table will then display only those rows that contain that data value in that column. In this case, only the rows with a “1” in the STATE\_CODE field will be displayed. The user will notice that the number of records at the bottom of the screen is modified to show only the number of rows displayed with the filter applied. To remove the filter and have all records

displayed again, click on the filter on/off button .

To filter by form, click on the Filter by Form button  to display a form that accepts a value for each field in the table. One or more fields can have values specified on this form. Wildcards can be used on the form to get related or similar values in a particular field. For example, if “like ‘01\*’” is entered in the SHRP\_ID field, all records with the first two digits of the SHRP\_ID equal to “01” will be displayed.

### Syntax Errors

Access will often correct syntax errors when criteria are specified. For example, in the filter form, if the user types “01\*” for a value, Access interprets it as “like ‘01\*’”

## Creating A Customized LTPP Database

A database of selected LTPP tables can be useful because only tables of interest can be pulled together, saved together, and manipulated together, without using unnecessary hard-drive space. To create a new database in Access, select File > Open or click on the  button. Select “Database” and click “OK”. The File New Database Screen will appear to allow the user to create a new database file (Figure 8).

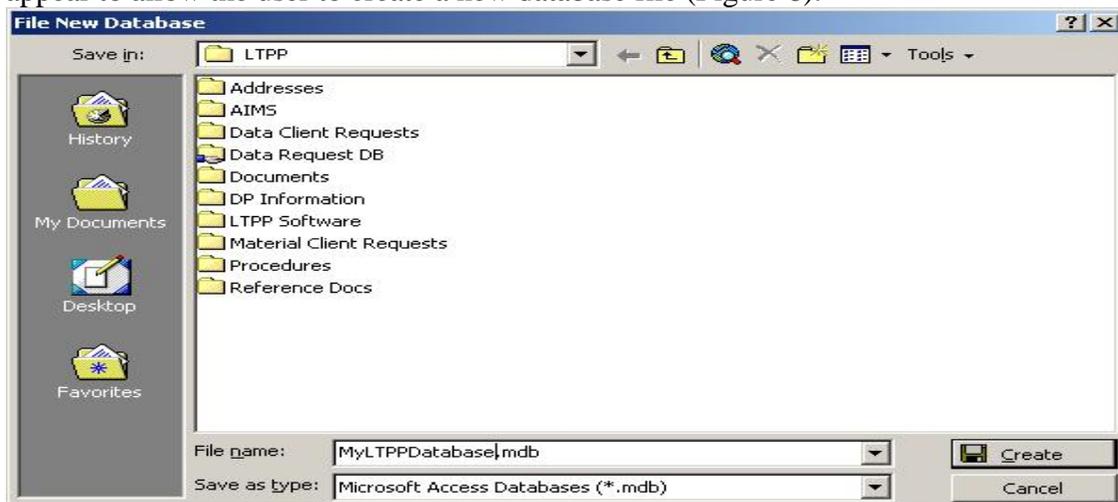
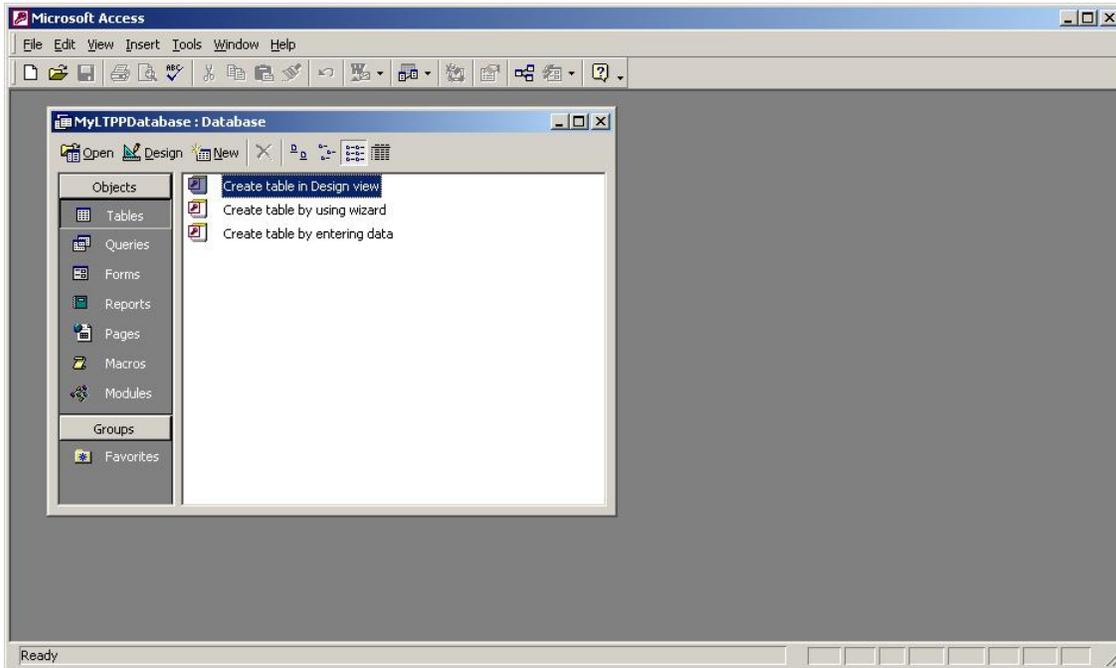


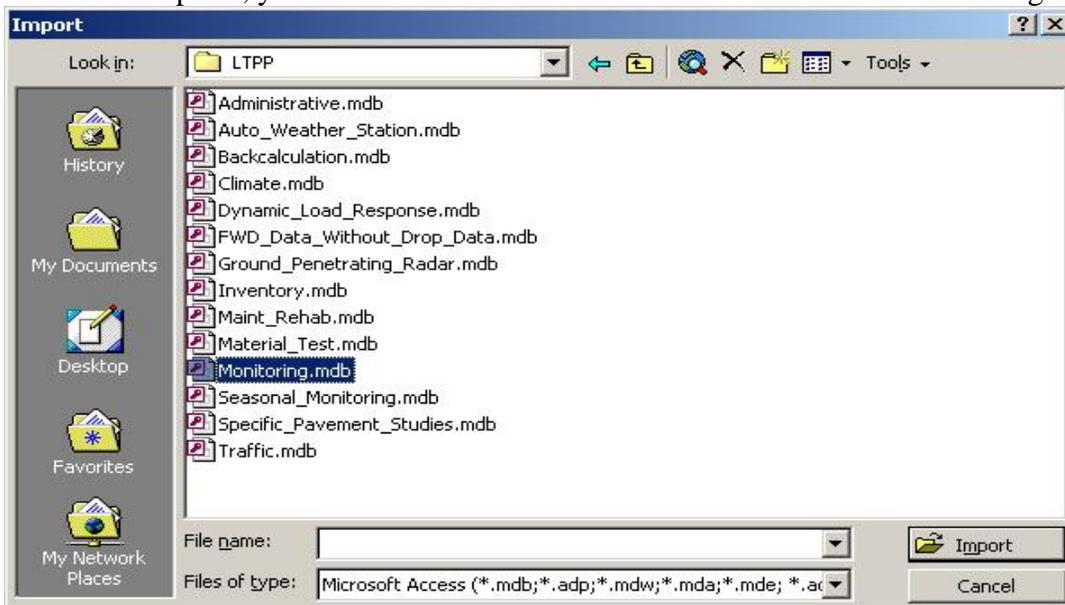
Figure 8. Screen to specify filename for new database

Click on the “Save In:” pull-down box to select the directory to which you want to save the new database file. Type a descriptive name for the new file in the “File Name:” pull down box. Figure 8 shows an example of creating the database “MyLTPPDatabase” in the “LTPP” directory. Click the “Create” button, and the Database Screen will be displayed (Figure 9).



**Figure 9. Database Screen**

Next, select File > Get External Data > Import from the main menu. Click on the “Look in:” drop down box and select the directory to which you have saved your LTPP database files. At this point, you should see a list of database files similar to the one in Figure 10.



**Figure 10. Import Window with LTPP Database Files Listed**

You can select an entire database to import by clicking on a database file in the list and clicking the “Import” button. Or, you can import individual tables by double-clicking on a database file to display a list of tables included in that database. Double-clicking on the Monitoring.mdb file will display the tables shown in Figure 11. Select one or more tables (or queries or forms, etc.) from the list and click ok. This will import the selected objects into the MyLTPPDatabase.mdb file. Repeat these steps for all desired tables.

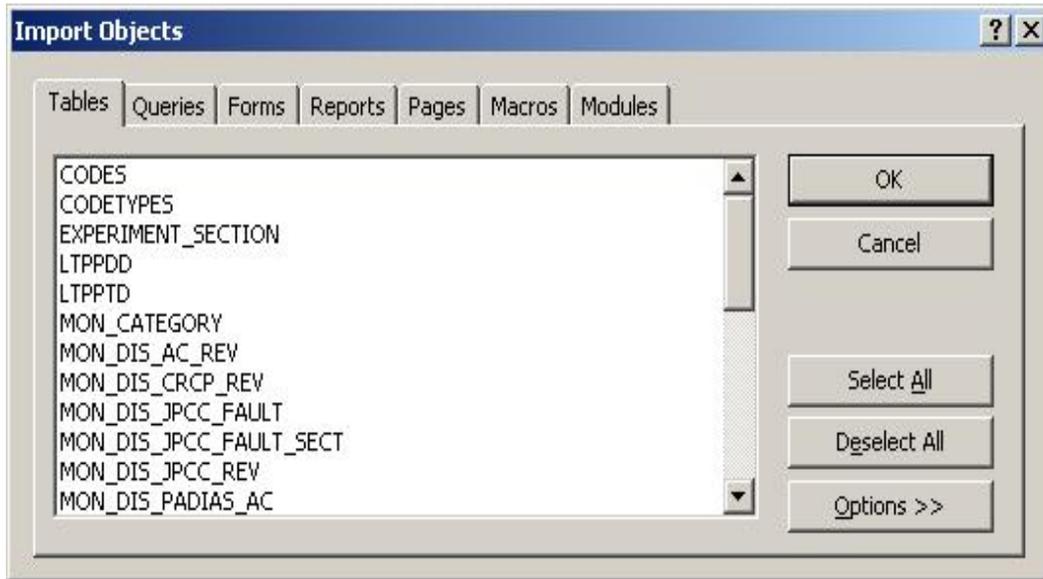


Figure 11. Tables in the Monitoring Database

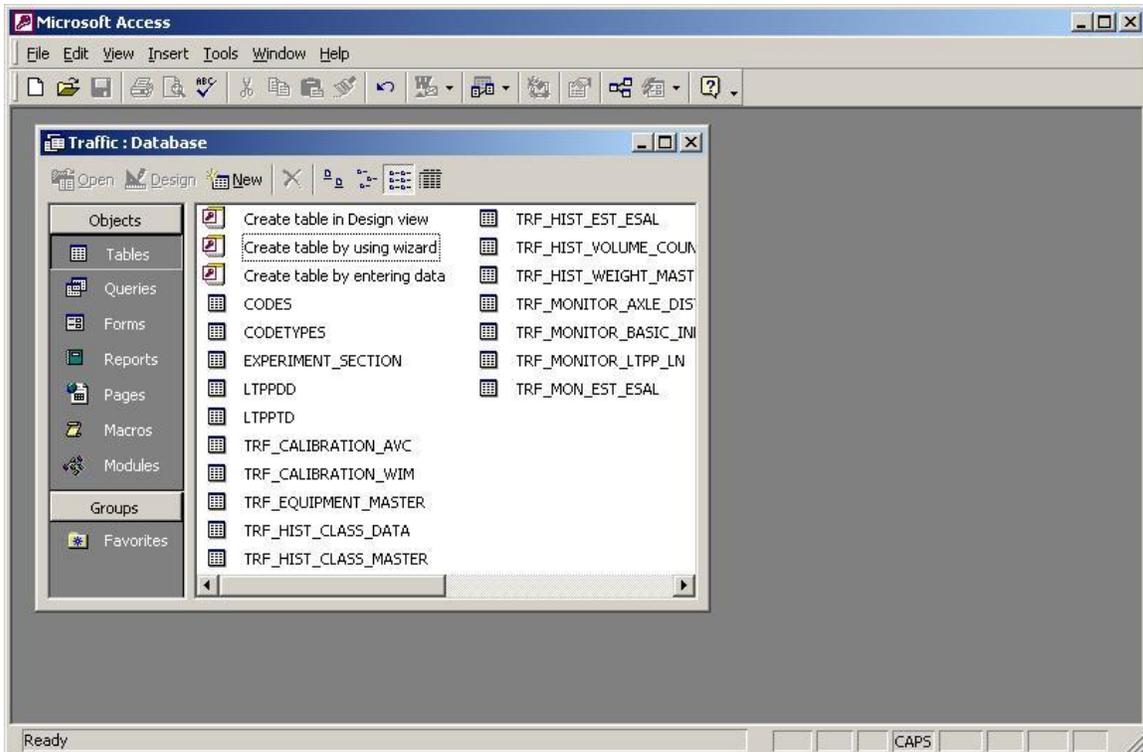
## Adding Tables to an Existing Database

The procedure for adding tables to an existing database is identical to the procedure for creating your own database, described above, except for the first step. Before importing any tables, open an existing database with any of the methods described in the “Opening an Access Database” section. Then import additional tables as described in “Creating a Customized LTPP Database.”

For example, a few sets of SDR 18.0 are missing the TRF\_BASIC\_INFO table<sup>1</sup> from the Traffic data module. To import this table into the Traffic.mdb database file stored in the C:\LTPP directory on your hard-drive, follow the steps listed below.

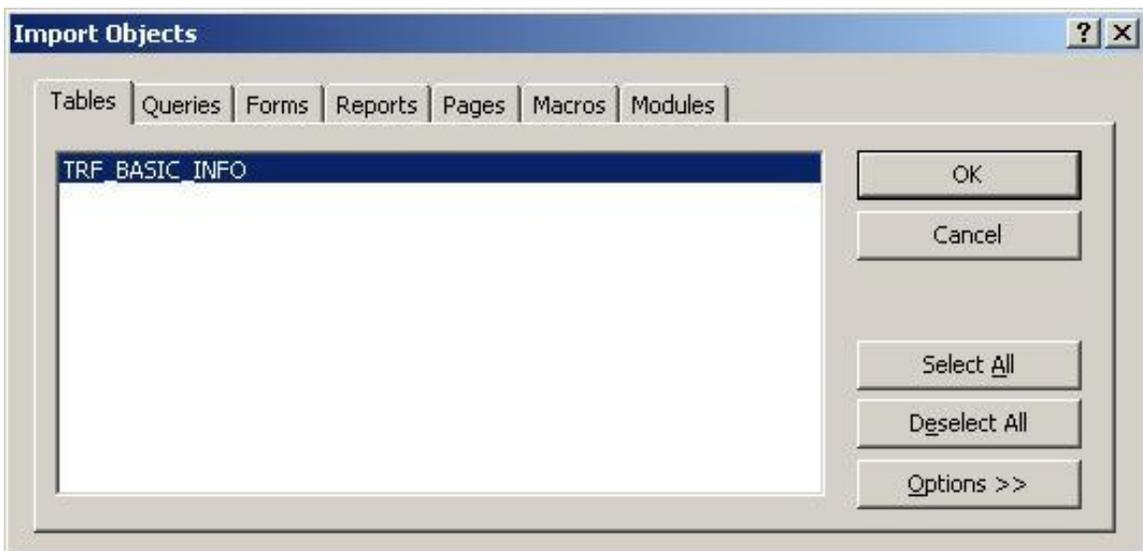
1. Through Explorer, find the directory in which the Traffic.mdb file is stored on your hard-drive (e.g., C:\LTPP).
2. Double-click on the Traffic.mdb file to open it in Access. The tables in Figure 12 will be displayed.
3. Select File > Get External Data > Import from the main menu. Click on the “Look in:” drop down box and select the directory to which you have saved the TRF\_BASIC\_INFO.mdb file.

<sup>1</sup> Contact LTPP Customer Support at [LTPPInfo@fhwa.dot.gov](mailto:LTPPInfo@fhwa.dot.gov) to request the TRF\_BASIC\_INFO table if you need it. The table will be delivered by e-mail in an Access database file, TRF\_BASIC\_INFO.mdb.



**Figure 12. Tables in Traffic.mdb file**

4. Double-click on the TRF\_BASIC\_INFO.mdb file. Select TRF\_BASIC\_INFO from the table list and click OK (see Figure 13).



**Figure 13. Import TRF\_BASIC\_INFO table**

TRF\_BASIC\_INFO is imported into the Traffic.mdb file and is listed with the other tables as shown in Figure 14.

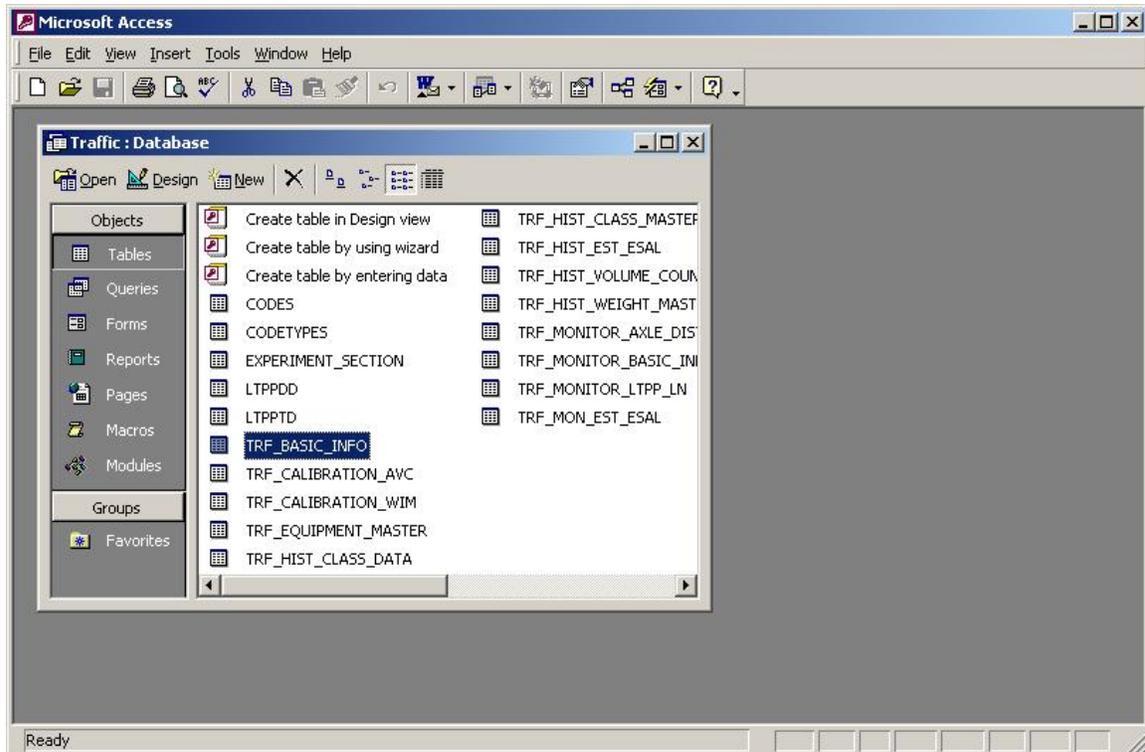


Figure 14. TRF\_BASIC\_INFO in the TRAFFIC database

## Database Objects in Access

An “object” in Access is any of the things listed under the Object heading in Figure 14, above. Tables are objects; reports are objects; queries and forms are objects. Clicking on each object type in the object list will display a list of that object type contained in the current database file. The LTPP SDR 18.0 only contains table objects. However, users of the LTPP data are encouraged to create their own queries and reports to support analysis of the data.

## Simple Queries

### *Query*

You use queries to view, change, and analyze data in different ways. You can also use them as the source of records for forms, reports, and data access pages. The most common type of query is a select query. A select query retrieves data from one or more tables by using criteria you specify and then displays it in the order you want.

A query is a question asked of a database. It can combine data from one or more tables or even other queries. This section will discuss single-object queries.

### *Create a Single-Object Query*

The simplest and most common type of query is similar in result to the filters discussed in the Filtering Data section. A SELECT query creates a subset of data that matches certain

criteria specified by the user. For example, you could select all of the data in the EXPERIMENT\_SECTION table for highway sections located in Alabama (STATE\_CODE = 1). The results of this query would be identical to the records displayed by the filter we used in our earlier example.

Listed below are the steps required to create the subset of data records in EXPERIMENT\_SECTION for Alabama highway sections.

1. Using the Traffic.mdb data file, click on “Queries” from the Object list in the database screen (Figure 14). Any queries you have created and saved will be listed.
2. The first two items in the list are query-building options. Double-click the “Create Query in Design View” option, which is the recommended option.
3. The Show Table window is displayed and allows the user to select one or more tables (or queries) on which to base a new query. Select EXPERIMENT\_SECTION and click the “Add” button. Close the window.
4. Figure 15 shows the design view of a query based on the EXPERIMENT\_SECTION table. The windows can be enlarged to display table and fieldnames completely. The “\*” represents all fields in the table.
5. Highlight all fields listed under EXPERIMENT\_SECTION except the “\*” and drag them onto the grid. Alternately, drag the “\*” onto the grid as well as the STATE\_CODE field; unclick the Show check box on the STATE\_CODE field, so it doesn’t display twice.
6. Type a “1” in the Criteria row in the STATE\_CODE column of the grid.
7. Preview the records selected by the query by clicking on the datasheet view button  in the toolbar. All records with a “1” in the STATE\_CODE field should be displayed. Click on the design view button  to return to the design grid.
8. The SQL view of the query is displayed by selecting View > SQL View from the main menu. Users familiar with SQL can make changes to the query in this window.

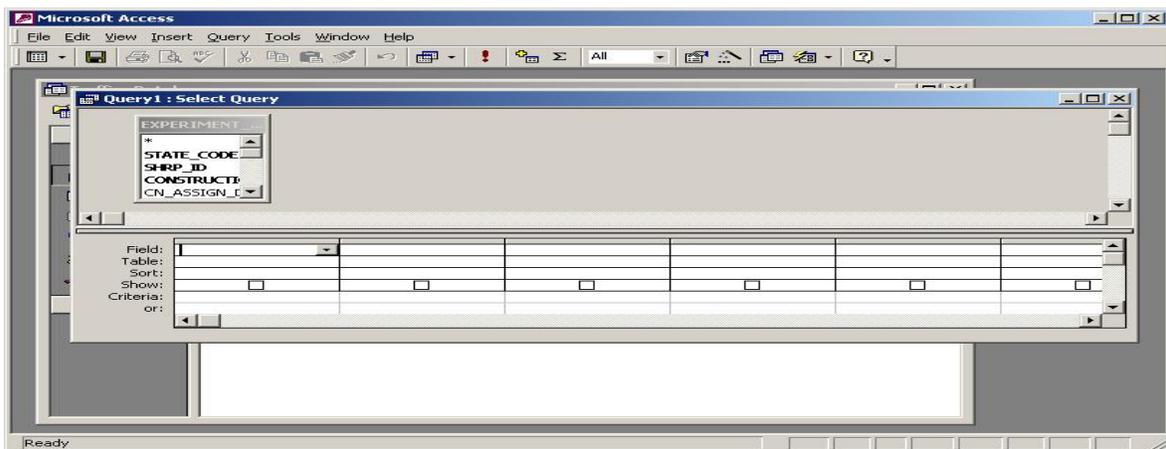


Figure 15. Query Design View Window

9. Click the Run button  on the toolbar to run the query. This will again display the datasheet view of the selected records.
10. If the query requires additional changes, return to the design view to change criteria, fields displayed, or table relationships.
11. Once the results are satisfactory, save the query by clicking on the Save button . Give the query a descriptive name and click OK.

## Complex Queries

Queries that are based on more than one object (table or query) can be very long and complex. In the beginning, it is best to allow Access to build the query rather than using the SQL View to manually enter fieldnames and selection criteria. Successful query development is dependent on the user's understanding of table relationships and table joining.

### *Table Relationships*

MS Access is a relational database package. In other words, rather than storing all related data in one table, which would be very large and cumbersome, data is divided into discreet chunks that can be linked together when necessary. For example, in a product database, suppliers and products should be stored in two different tables. Otherwise, the supplier information would be repeated for each of its products, wasting a lot of space. Fields such as SUPPLIER\_ID and PRODUCT\_ID could be used to link suppliers and products across tables.

In Access, links (also relationships or joins) between tables can be defined from the

Database screen by clicking the Relationships Button . The Show Table Window

will be displayed (see Figure 16), or the Show Table Button  can be clicked to select tables for which relationships will be defined. Once tables are selected, close the Show Table Window. Click and drag fields from one table list to the matching field in another table list to begin defining the relationship between the two tables. The Edit Relationships Window is displayed and the remainder of the relationship should be defined in this window. See more information in Access about the different types of relationships (joins) that can be defined.

Table relationships can also be defined in the Query Design View Window. This is easy to do by clicking and dragging a field from one table list to the matching field in another table list. Lines will appear between the matching fields to indicate the relationship (see Figure 17). Join type can be defined by double-clicking on each join line.

**Note: Each field in the relationship between two tables must be defined with the same type of join or the following error message will be displayed when the query is executed:**

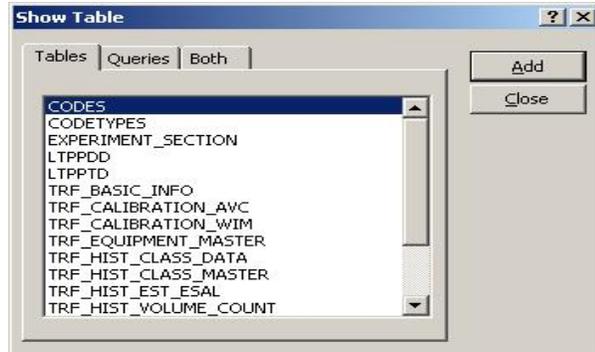


Figure 16. Show Table Window

### ***Joining Tables***

Joining tables is done in a query to select and display related data from two or more tables (or queries). If table relationships are defined correctly, Access will generate the join statements when the query is generated. In the product database example, mentioned above, a query to list all suppliers that carry a particular product would require the Products and Suppliers tables to be joined. Before designing the query to select and display the product/supplier data, the relationship between the tables must be defined.

Advanced users may use the SQL View in the Query Design Window to write their own queries. Join statements must be written properly to ensure reasonable and accurate results.

### ***Cartesian Product***

It is critical that relationships between tables be defined completely. If tables in a query aren't joined to one another, either directly or indirectly, Access doesn't know which records are associated with which, so it displays every combination of records (called a "cross-product" or "Cartesian product") between the two tables. Therefore, if each table had 10 records in it, the query's results will contain 100 records (10X10). It also means the query might take a long time to run and would likely produce less meaningful results.

### ***Joining LTPP Tables***

In the LTPP database, joining tables is important for creating subsets of data to be analyzed. For example, a study of concrete highways overlaid with asphalt might require the annual number of KESALs along with other information. The LTPP GPS 7A and 7B Experiments include asphalt overlaid PCC sections. Experiment information for each section is found in the EXPERIMENT\_SECTION table. Annual KESALs can be found in the TRF\_MON\_EST\_ESAL table in the ANL\_KESAL\_LTPP\_LN\_YR field.

The EXPERIMENT\_SECTION and TRF\_MON\_EST\_ESAL tables can be joined to get KESALs for only the GPS7A and GPS7B sections. The Traffic.mdb database file contains both of these tables, so it can be used as the starting point. Before creating a

query to get the required data, a relationship between the two tables must be defined (Figure 17). Listed below are the steps required to define the relationship between these two tables.

1. Open the Traffic.mdb database file in Access.
2. Click on the Relationships Button , select the EXPERIMENT\_SECTION and TRF\_MON\_EST\_ESAL tables in the Show Table Window, and click "Add." Close the Show Table Window.

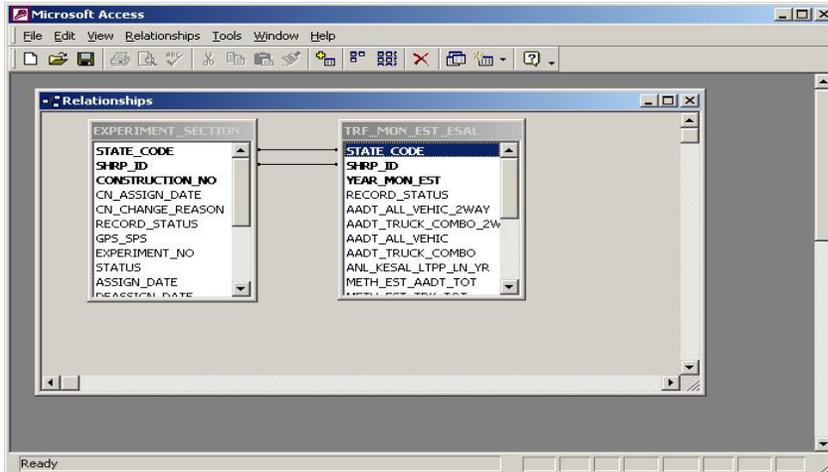


Figure 17. EXPERIMENT\_SECTION and TRF\_MON\_EST\_ESAL with join lines

3. All related fields (key and non-key) should be included in the table relationship. (Key fields are bolded in the table lists.) Click and drag the STATE\_CODE field from the EXPERIMENT\_SECTION table over to the STATE\_CODE in the TRF\_MON\_EST\_ESAL table. The Edit Relationships Window will be displayed with the STATE\_CODE portion of the join shown (Figure 18).

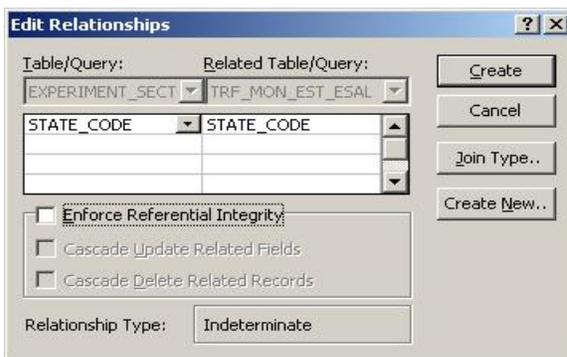


Figure 18. Edit relationship for EXPERIMENT\_SECTION, TRF\_MON\_EST\_ESAL

4. The SHRP\_ID fields in the two tables are related and must be included in the join. Therefore, click in the second cell in the grid under EXPERIMENT\_SECTION, click the down arrow, and select SHRP\_ID from the list.
5. Select SHRP\_ID in the second cell under TRF\_MON\_EST\_ESAL.

6. Click the “Create” button. Notice that the keys CONSTRUCTION\_NO and YEAR\_MON\_EST have not been included in the join. Both of these fields are date references, but they cannot be matched up directly.
7. Save and close the Relationships Window.

**Create a Multi-Object Query**

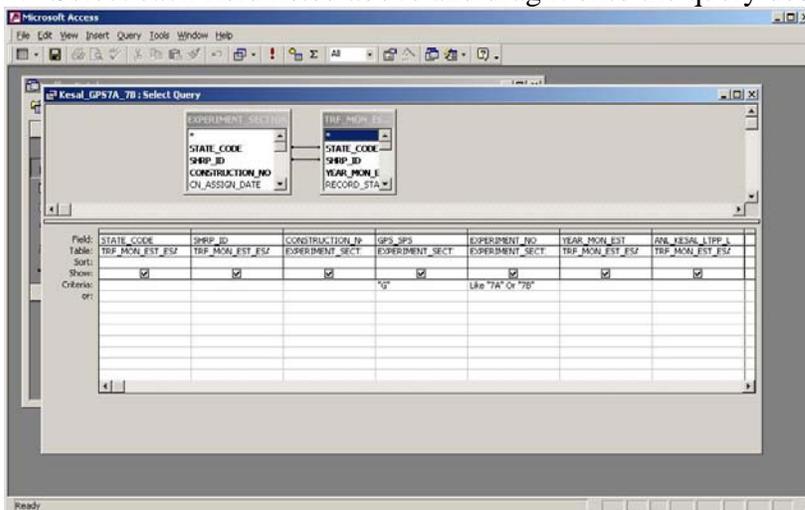
Once relationships have been defined, a query can be generated through the Query Design View Window by following the steps below.

1. In the Database Window, click on “Queries” in the “Objects” list.
2. Double-click “Create query in Design view” in the query list. The Query Design View Window (Figure 15) will be displayed with the Show Table Window (Figure 16) on top.
3. Select and Add EXPERIMENT\_SECTION and TRF\_MON\_EST\_ESAL.

The user must decide at this point which fields from each object to include in the query results. All fields that are needed for specifying query criteria must be included, along with any fields that could be useful to analysis. The field list should generally include all key fields except for duplicates. Fields can be added or removed as necessary. In this example, the following fields will be included (notice the table.field notation):

EXPERIMENT\_SECTION.STATE\_CODE  
 EXPERIMENT\_SECTION.SHRP\_ID  
 EXPERIMENT\_SECTION.CONSTRUCTION\_NO  
 EXPERIMENT\_SECTION.GPS\_SPS  
 EXPERIMENT\_SECTION.EXPERIMENT\_NO  
 TRF\_MON\_EST\_ESAL.YEAR\_MON\_EST  
 TRF\_MON\_EST\_ESAL.ANL\_KESAL\_LTPP\_LN\_YR

4. Select each field listed above and drag it onto the query design grid (Figure 19).



**Figure 19. Design View of KESAL Query**

5. In the Criteria row on the grid, specify the following values:  
GPS\_SPS                    “G”  
EXPERIMENT\_NO        Like “7A” or “7B”
6. Click the Datasheet View Button  for a preview of the selected records. Notice that there are records that are exact duplicates except for the CONSTRUCTION\_NO field.
7. To see one record for each available KESAL value per year per section, remove CONSTRUCTION\_NO from the query design grid (select column and press Delete) and set the UniqueValues property to “Yes” in the query’s property sheet. To display the query’s property sheet, select the query by clicking anywhere in query Design view outside the design grid and the field lists; click the Properties button  on the toolbar.

***UniqueValues  
Property = Yes***

If the query's results include more than one field, the combination of values from all fields must be unique for a given record to be included in the results.

8. Preview the records.
9. Click the Save icon , give the query a descriptive name, and click OK.
10. Close the query window.

Once the Query is created, it will be added to the Queries Object list. Double-clicking on the name of the query will run the query and display the results on the screen.

**More Information**

For more information about the LTPP data or LTPP program, contact John Rush or Miriam Pitz at the LTPP Customer Support Service Center:

LTPP Customer Support Service Center  
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Fax: (865)481-8555  
Email: [ltpinfo@fhwa.dot.gov](mailto:ltpinfo@fhwa.dot.gov)

## Appendix A

Listed below are the contents of each CD enclosed in this data package. Each zip file expands to an Access 2000 database with the same name, and the name indicates the type of data in the database. Each database also contains the administrative tables CODES, CODETYPES, EXPERIMENT\_SECTION, LTPPTD (Table Descriptions), and LTPPDD (Data Dictionary).

### Volume 1: Primary Data Set

Administrative.zip	Maint_Rehab.zip
Auto_Weather_Station.zip	Material_Test.zip
Backcalculation.zip	Monitoring.zip
Climate.zip	Seasonal_Monitoring.zip
Dynamic_Load_Response.zip	Specific_Pavement_Studies.zip
Ground_Penetrating_Radar.zip	Traffic.zip
Inventory.zip	

### Volume 2: FWD Measurement Data

FWD\_DATA\_WITHOUT\_DROP\_DATA.zip  
FWD\_DROP\_DATA\_STATES\_AL\_ID.zip  
FWD\_DROP\_DATA\_STATES\_IL\_MO.zip  
FWD\_DROP\_DATA\_STATES\_MT\_TN.zip  
FWD\_DROP\_DATA\_STATES\_TX\_SK.zip

### Volume 3: Profile Data - 1

Profile\_Data\_States\_AL\_AZ  
Profile\_Data\_States\_AR\_CA  
Profile\_Data\_States\_CO\_HI  
Profile\_Data\_States\_ID\_IA

### Volume 4: Profile Data - 2

Profile\_Data\_States\_KS\_MI  
Profile\_Data\_States\_MA\_MN  
Profile\_Data\_States\_MT\_NM  
Profile\_Data\_States\_NY\_OK

### Volume 5: Profile Data - 3

Profile\_Data\_States\_OR\_TN  
Profile\_Data\_States\_PR\_SK  
Profile\_Data\_States\_TX  
Profile\_Data\_States\_UT\_VA  
Profile\_Data\_States\_WA\_WY