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User Guides for PPMM and GIS for PMIS: Final Report

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Part A. User's Guide for Web-based Pavement Performance Maintenance Management System

BRIEF OVERVIEW

The Pavement Performance and Maintenance Management (PPMM) is a web-based application that aims to use the existing data from the Pavement Management Information Systems (PMIS) database to monitor and analyze current pavement performance. PPMM comprises two primary tools: Section Tool and Network Tool.

GETTING STARTED

The PPMM application is a web-based program that the user must log into to use. The program can be found at "http://128.83.208.190/pmis/login.php" and begins with the screen shown as Figure A1.
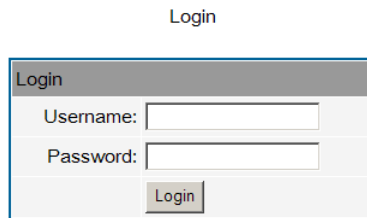

Figure A1. Login Screen

After logging in, PPMM's initial screen allows the user to decide which of the tools is preferred from the available modules. The opening page is shown as Figure A2.
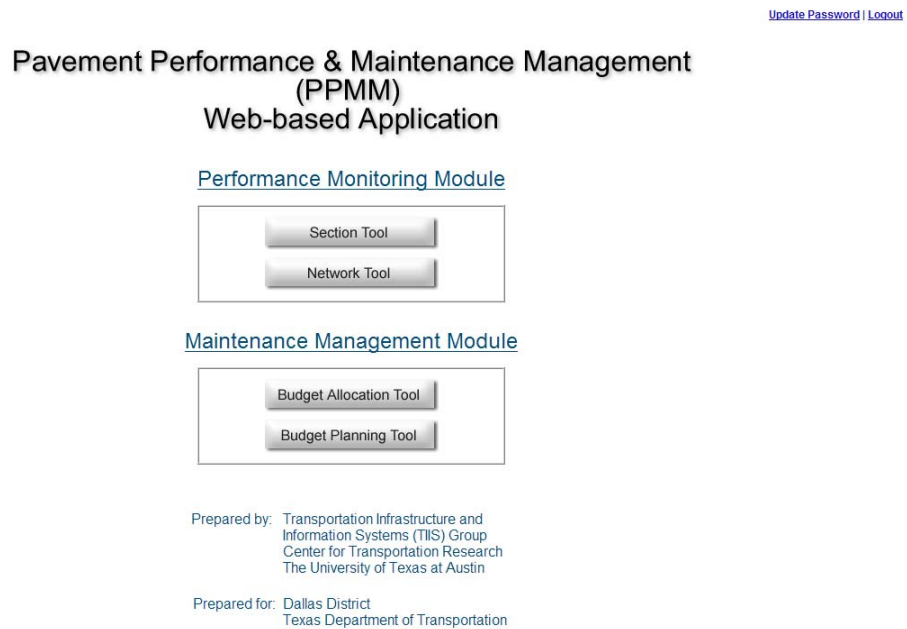

Figure A2. PPMM's initial screen

By selecting the appropriate button the user can open the desired tool. By selecting the "Back to the Index Page" button located on the bottom left of each of the tool pages, the user is transported back to the opening page to use another module or tool.

SECTION TOOL
By selecting the Section Tool from the initial application screen, the user is directed to the opening screen shown as Figure A3.

Figure A3. General Section Performance Monitoring Tool sample screen

In the Section Performance Monitoring Tool, the user should follow three steps to identify any unique section within the database:

- **Step 1: Select Year, District, and County Information**
  The user should begin by selecting the desired year, district, and county from the drop-down boxes. Currently, the PPMM contains data for all counties of the Dallas District of TxDOT.

- **Step 2: Select Highway System Information**
  Next, the user must identify the unique section of interest by using the drop-down menus to locate the data. The program first requires the PMIS Data Key from the following options: Business Route (BR), Farm to Market (FM), Interstate Highway (IH), Principle Arterial (PA), Park Road (PR), State Highway (SH), and U.S. Highway (US). Then the user must select the Highway System, Beginning Reference Marker, Beginning Reference Marker Displacement, End Reference Marker, and End Reference Marker Displacement. Each of these drop-down boxes builds upon previously entered data to provide the list of all available sections with matching characteristics.

- **Step 3: Plot Observed Data**
  After all data classes are entered, the button Plot Observed Data appears. By selecting this button the user is directed to the data plot for the selected section; details about the performance plot can be found in the last section of Part A, Plotting of Observed Data.

NETWORK TOOL
By selecting the Network Tool from the initial application screen, the user is directed to the opening screen shown as Figure A4.

Figure A4. General Network Performance Monitoring Tool initial screen

In the Network Performance Monitoring Tool, the user should follow four steps to categorize pavement sections for any pavement type.

- **Step 1: Select Performance Criteria**
  The user needs to select the desired performance criterion from the available options of Ride Score, Distress Score, and Condition Score.

- **Step 2: Select District, County, Pavement Type, and Fiscal Year**
  The user must define the sections that should be analyzed with the Network Performance Monitoring Tool. The user should first select the desired district from the drop-down list. After selecting the district, the county drop-down box will supply all possible counties for consideration, including the option of considering all counties in the analysis. Next the user must select the desired types of pavement from the available drop-down box: CRCP, JRCP, JPCP, Thick AC, Intermediate AC, Thin AC, Composite (AC over CP), AC over old CP, AC over old AC, AC over flexible base, All Flexible, or All Rigid. Finally, the user must specify the fiscal year under consideration during the analysis; the list includes the most current year contained in the database back to the first data set in the PMIS.

- **Step 3: Review Classification Criteria and Network Classification Matrix**
  The user should now review the Classification Criteria to determine if any changes are desired within the parameters. The program assigns priority to sections using the condition parameter assigned in Step 1 along with the drop in the condition parameter between the fiscal year under consideration and the previous year. The road sections are evaluated based upon the condition parameters (Good, Fair, and Bad) and the drop in condition (Slow, Medium, and Fast). In order to categorize sections, the program considers the combination of each of these measures to determine the category that sections should be placed. The user can therefore review and amend the categories that the Classification Criteria describe by adjusting the Network Classification Matrix. The Network Classification Matrix considers

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each of the nine possible combinations of the classification criteria into one of three possibilities (No Attention [NA], Vigilance [VG], and Immediate Attention [IA]).

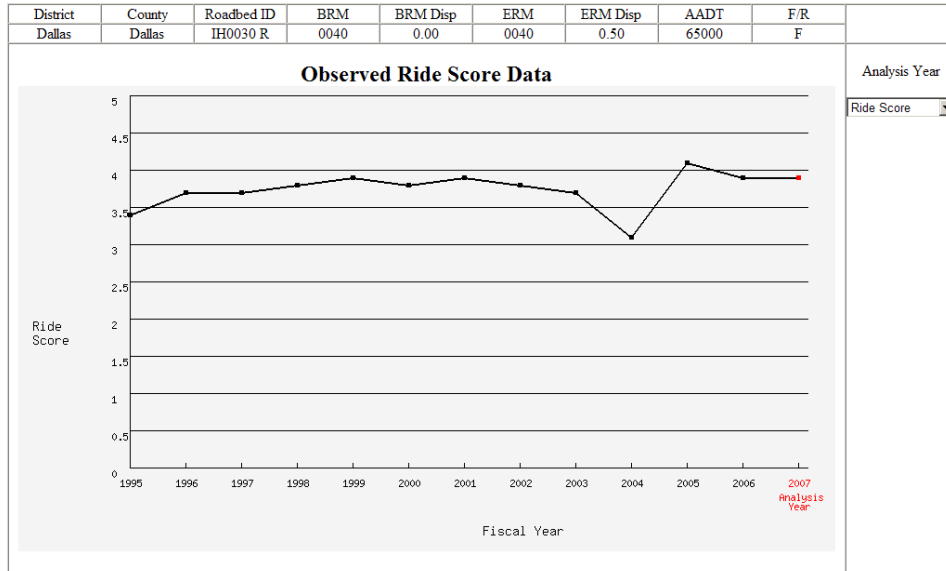- **Step 4: Run Query and Sort Data**
  The user should now select "Run Query." This step will consider all the sections according to the chosen performance criteria and apply the provided rules to slot the sections into the appropriate categories. The drop-down box below this option allows the user to sort the data within each of the three categories according to key characteristics: Performance Criteria, Performance Criteria Drop, and Highway Roadbed ID.

Upon the completion of Step 4, the program has fully sorted all sections within the suggested criteria into the appropriate action category. The resulting classification categories can also be sorted according to user preference based on any of the available options found in the "Sort results by" drop-down menu located underneath the "Run Query" button (Performance, Performance drop, Highway Roadbed ID). The performance plot for any section can be generated by selecting the section from any category; details about the performance plot can be found in the next section, Plotting of Observed Data.
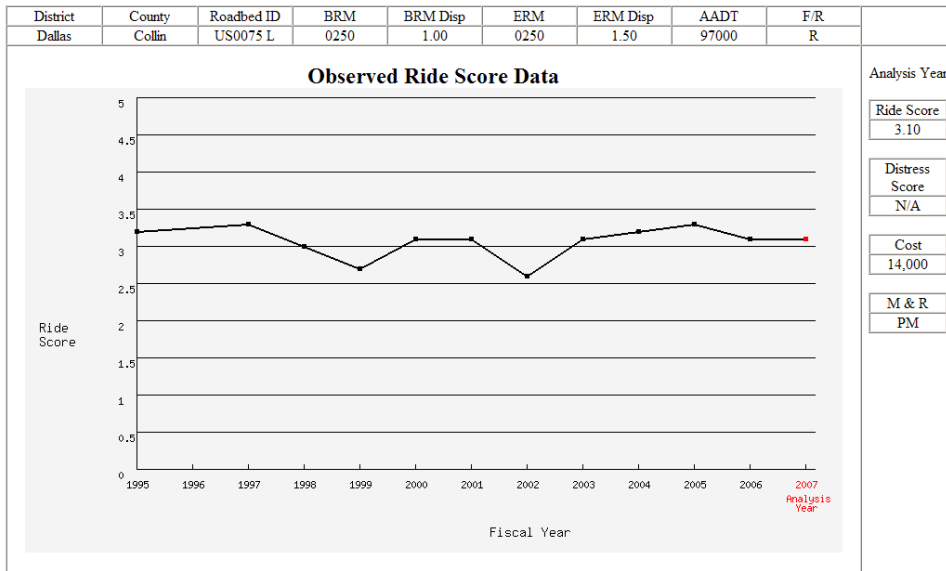
PLOTTING OF OBSERVED DATA
When any section throughout the PPMM is selected, the system has the ability to plot the pavement performance from throughout the database history. To generate the plot, the user need only select the section once and the window will appear with the section characteristics listed. In order to customize the graphing utility to the type of data being processed, the program uses two different plots. The first plotting function is for the Performance Monitoring Module and appears as Figure A5.

This plot provides the user with the identifying characteristics of the selected section along the top of the page including the Responsible District, County, Roadbed ID, Beginning Reference Marker, Beginning Reference Marker Displacement, Ending Reference Marker, Ending Reference Marker Displacement, the Average Annual Daily Traffic, and the material type (Flexible/Rigid). Additionally, the column to the right of the plot provides a drop-down box that allows the user to switch between the different performance characteristics (Ride Score, Distress Score, and Condition Score).

District	County	Roadbed ID	BRM	BRM Disp	ERM	ERM Disp	AADT	F/R
Dallas	Dallas	IH0030 R	0040	0.00	0040	0.50	65000	F

Observed Ride Score Data

Analysis Year

Ride Score

Ride Score (y-axis), Fiscal Year (x-axis)

Figure A5. Plotting Function for Performance Monitoring Module

The second plotting function is for the Maintenance Monitoring Module and appears as Figure A6.

District	County	Roadbed ID	BRM	BRM Disp	ERM	ERM Disp	AADT	F/R
Dallas	Collin	US0075 L	0250	1.00	0250	1.50	97000	R

Observed Ride Score Data

Analysis Year

Ride Score
3.10

Distress Score
N/A

Cost
14,000

M & R
PM

Ride Score (y-axis), Fiscal Year (x-axis)

Figure A6. Plotting Function for Maintenance Monitoring Module

This plot also provides the user with the identifying characteristics of the selected section along the top of the page including the Responsible District, County, Roadbed ID, Beginning Reference Marker, Beginning Reference Marker Displacement, Ending Reference Marker, Ending Reference Marker Displacement, Average Annual Daily Traffic, and the material type (Flexible/Rigid). Additionally, the column to the right of the plot provides details for the analysis year from which the data is being considered. This data includes the Ride Score, the Distress

Score, Cost for the recommended Maintenance and Rehabilitation, and the recommended Maintenance and Rehabilitation. Additionally, the analysis year under consideration (as selected in the Budget Allocation Tool or Budget Planning Tool) is clearly identified with a red indicator on the graph itself to remind the user of the year being examined. Also, the Budget Planning Tool provides a red curve to signal the predicted condition of the system during the planning horizon if the prescribed treatments are performed.

Part B: User's Guide for Web-based GIS Access to PMIS Pavement Condition Data

This document introduces users to the steps involved with accessing the web-based dynamic information system and using its various features to access the information. The dynamic information system offers tools for viewing and querying the spatial and attribute data on the state highway network as retrieved from PMIS. Those tools can be used to perform spatial analysis tasks, such as selecting and buffering features, and to analyze information. The following sections will discuss how to use those tools to retrieve the information.

1. Viewing the Website

The website of the dynamic information system can be accessed by opening the web browser and typing the Uniform Resource Locator (URL) in the address or location text box. A screenshot of the website's opening page is shown in Figure B1. As is shown, the website displays the title of the information system on the top and has the tools for panning and zooming the map's extent, querying spatial and attribute data, creating buffers around features, and measuring distances on the map. All the features are labeled in the figure and explained subsequently.

2. Features of the Web-Based Dynamic Information System

This section explains the various features shown in Figure B1 and how they are used to access and manipulate data and information.

    a) <u>Overview Map:</u> This appears in the top left corner of the website and gives the overview of the entire map. It can be turned on and off with the "Toggle Overview" button, which is located at the top right corner of the toolbar.
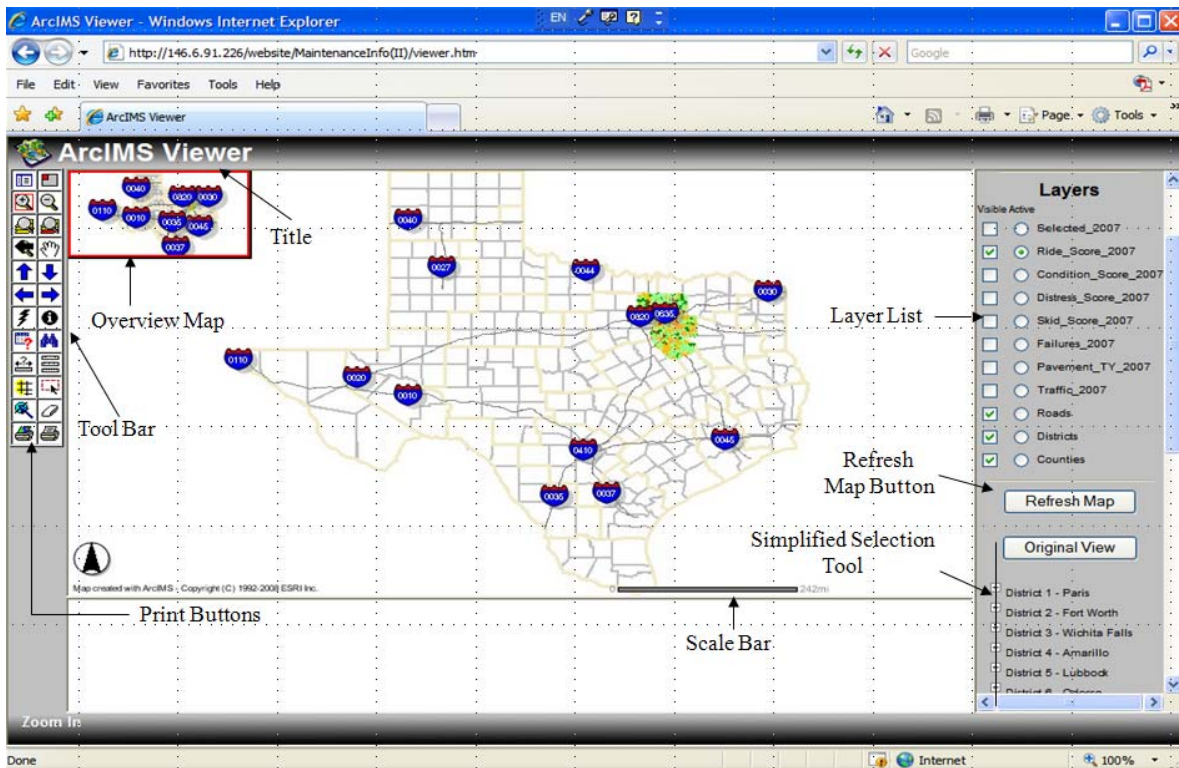
Figure B1. Features of the Online Dynamic Information System

b) <u>Layer List Button:</u> The layer list button is used to show the symbology for each layer in the information system. Users can toggle between the layer list and legends using this button.

c) <u>Layer List</u>: It supplies the users with the different layers present in the map and indicates which layers are active. Users have to check one particular layer to make it an active layer before they can extract any information regarding its features. This can be done by checking the radio buttons provided in front of each layer.

d) <u>Simplified Selection Tool:</u> This feature presents the user with a simplified tool to select and view the information for a particular district/county. When a user clicks on the name of the district/county, the system automatically focuses on the map for the selected district/county. Tables presenting the information for the focused features are also generated. The selection tool can also be used to extract the data pertaining to a particular county by clicking on the '+' sign next to the name of the respective district. This generates the list of counties in the particular district. Then, the name of the desired county can be selected to have the map of the county as the focused feature.

e) <u>Refresh Map Button</u>: After checking or unchecking the radio button for any of the layers, this function button must be pressed to see the changes in the map. For example, if users have changed the active layer from   "Ride_Score_2007" to "Condition_Score_2007," then the map must be refreshed to reflect any change.

f) Scale Bar: The scale bar shows the relationship between the actual distances on the earth and the map distances. In the dynamic information system, both the mile and kilometers scale bars are included to facilitate users with distance measurement.

g) Tool Bar: It carries various tools for the data extraction and map manipulation. Their functions and usage are discussed in detail in subsequent sections.

h) Print Buttons: The two buttons of the tool bar are used to generate printable versions of the maps and tables. The left print button allows the user to print the map; the right one is for printing the table.

3. Working with the Dynamic Information System

This section provides users with the information regarding the various tools for viewing, extracting, and manipulating map information.

3.1 Selecting and Extracting Map Information

The dynamic information system provides the users with a simple tool to extract the desired information. The desired maps can be generated using the "Simplified Selection Tool" provided in the right corner of the screen.

When users first access the dynamic information system, they see a screen as shown in Figure B1. To focus on a particular district/county, the user should select that district/county on the map. The user can retrieve the information for all highway sections in PMIS for a particular district/county by clicking on the name of the district/county.

To extract information pertaining to a particular county, the user can click on the "+" sign next to the corresponding district to which the county belongs to generate a list of that district's counties. Figure B2 presents the generated list of counties present under the El Paso District as an example.

Figure B2. List of Counties

Clicking on the name of a district/county generates the map of the particular district/county (Collin in this particular example) as shown in Figure B3. A table is also generated at the bottom of the screen, providing information for all the selected roadway links. The table presents location data and a description of the individual links in a selected area. The user can select a particular link by clicking on the corresponding row in the 'HIGHWAY' column and receive detailed information about the selected section. At the top of the popup webpage, a table presents basic information about the location, type, and traffic of the selected

section. At the bottom of the webpage is a graph showing the trend of scores of the selected section from the year 1995 to 2007. The generated screen is shown in Figure B4.
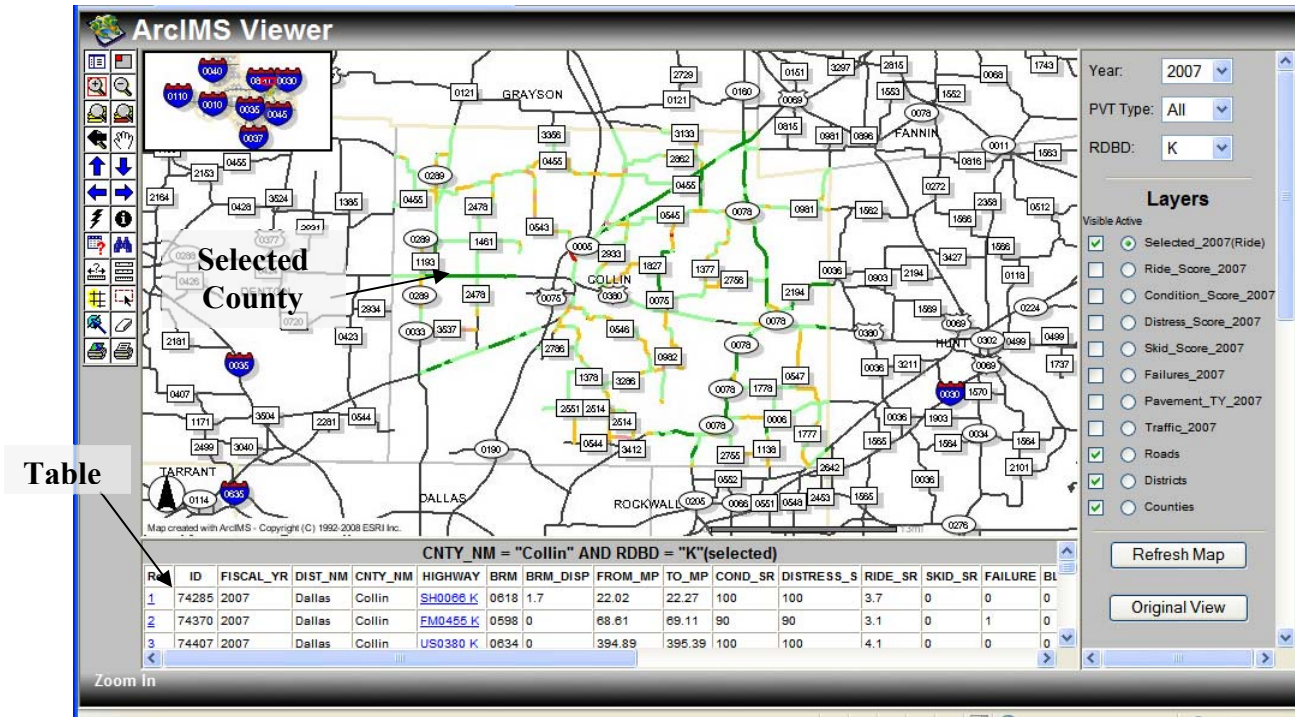

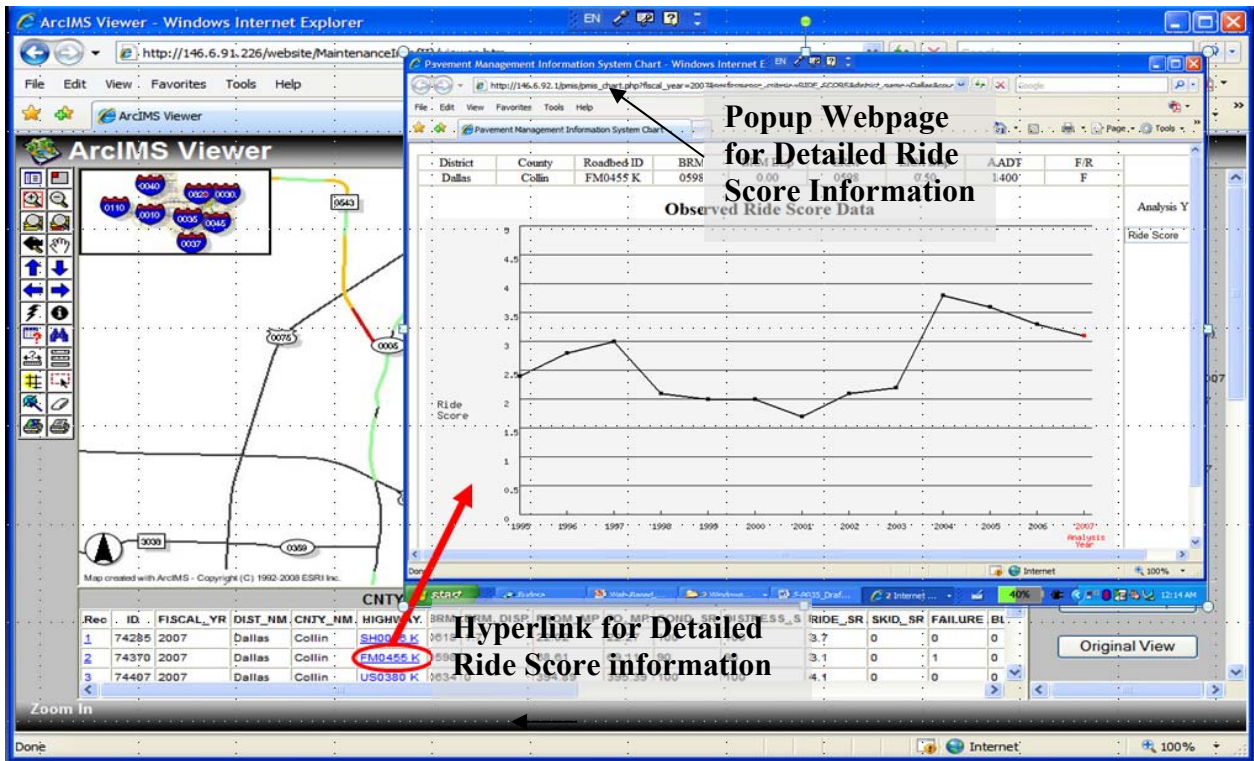*Figure B3. Extractions of Data for a Particular County*

Figure B4. Popup Webpage for Detailed Ride Score Information

3.2 Printing Maps and Tables

The generated maps and tables can be printed by using the two print buttons located at the bottom of the tool bar on the left side of the screen. By clicking the left print button, a mechanism to generate a printer-friendly page is initialized and appears at the bottom of the screen. The user then presses the "Create Print Page" button to generate a printer-friendly page in a new window, as shown in Figure B5.

Figure B5. Generating Printer-Friendly Page

A printer-friendly page can be created for tables in a new page by clicking on the right print button.

3.3 Exporting the Tables

The generated tables can be exported by using the button directly under the tables. By clicking the "Export Records to Excel Spreadsheet" button, a mechanism is initialized to generate a pop-up page for exporting the above table to an Excel spreadsheet, as shown in Figure

B6. The user then can open the spreadsheet directly by clicking "Open" button, or save the spreadsheet by clicking "Save" button.
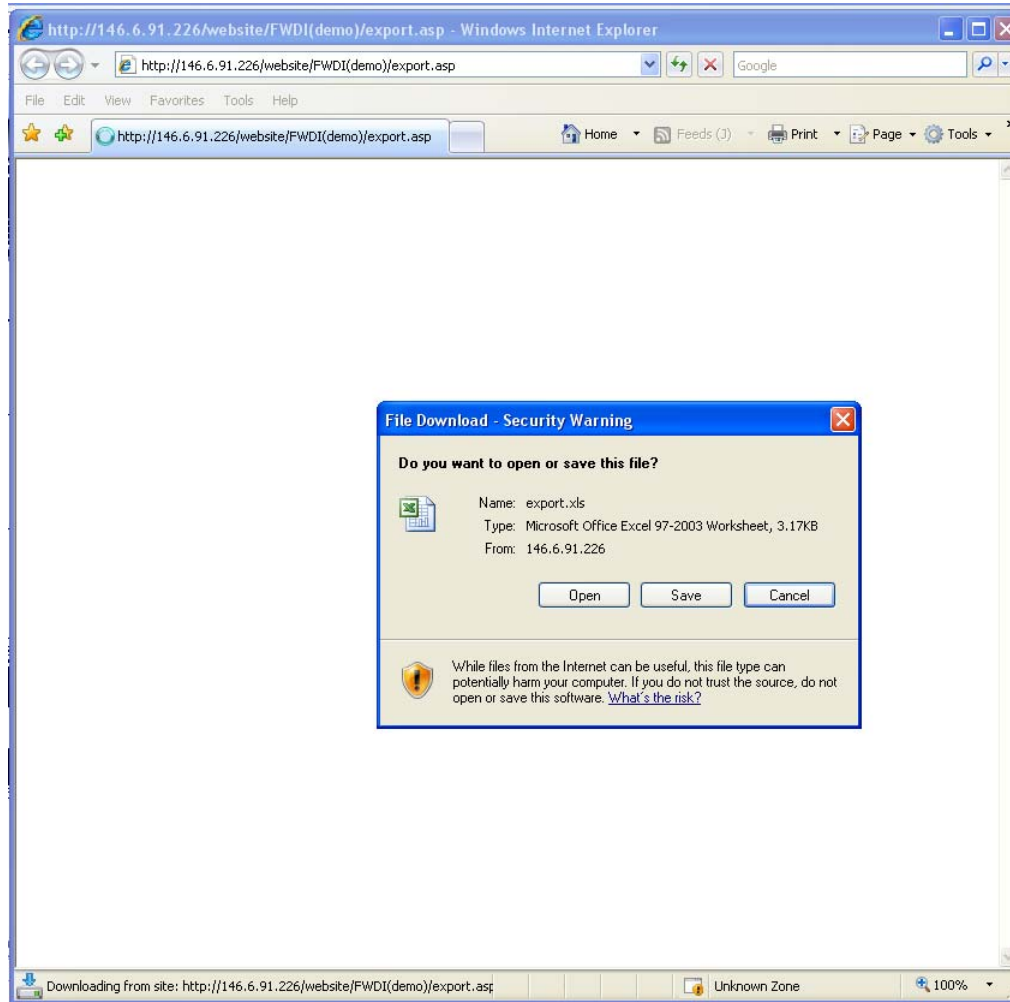

Figure B6. Data Export Page for Tables

3.4 Other Features of Dynamic Information System

The dynamic information system contains several other tools and features. Table B1 shows the icons of the various tools, their names, and brief descriptions.

Table B1: Various Tools in the Dynamic Information System

TOOL ICON	TOOL NAME	FUNCTIONAL DESCRIPTION
	Zooming Tools	Used to zoom in or out to any particular region or can be used to change the map extent. To see the extent of any layer, that layer first has to be made active before using the zooming tool. Users can also zoom in to any particular region by clicking and dragging a rectangle on the desired region on the map.
	Back to Last Extent	Used for going back to the previous view. By Click the Back to Last Extent Button, the map returns to the last scale the map was in.
	Panning Tools	There are five panning buttons provided out of which four allow users to pan in each of the four directions and the fifth one (shown by hand) is used for dragging the map in any direction.
	Identify Tool	It helps users in getting attribute information about the feature. Users have to first select one layer to make that active and then click on the "Identify" tool. After that clicking on any feature on the map will give its properties.
	Find Tool	It is used to locate features based on their attribute values. It searches only the text strings and cannot be used to search on the basis of numeric attributes. "Find" tool can be used to search multiple layers at the same time provided they are selected. After clicking the "Find" button, it asks users to enter the string to find and then displays the results which matches the search. It should be kept in mind that the search is case-specific.
	Query Tool	It is used for querying features based on their attribute values. It is different from the "Find" in the sense that it can search for both the numeric and text strings.
	Graphics Selection Tool	It is used for selecting a particular region. This tool facilitates users with a choice of selecting a particular region either in a form of a line or a polygon and then viewing the attributes of the features lying in the selected area of the active layer.

TOOL ICON	TOOL NAME	FUNCTIONAL DESCRIPTION
	Clear Selection Tool	It is used for clearing the selections of features made in any of the layers.
	Buffer Tool	It is used for finding the features of one layer within a set buffer distance of the selected features of another layer. First of all, selection tools must be used to select some region of the selected layer. Then click on the "Buffer" button which prompts users to enter the desired layer whose features have to be highlighted within a specified distance of the selected region of the selected layer. After the "Create Buffer" button is pressed, it generates a buffer around the features of the selected area.
	Measure Tool	It is used for measuring the distances on the map. Click a point on the map then click a second point on the map to create a segment. The segment length appears in the measurement readout at the top of the Map Display Area. Total route lengths can be measured by clicking points along the route. The measurement readout will track the length of the last segment as well as a running total for the length of all connected segments.
	Set Units Tool	It is used for changing the measurement units. On clicking this button it asks the user to select the display units and then uses them for the measurement.

4. Demonstrations

This section provides demonstrations of some of the tools discussed in Table B1.

a) <u>Find Tool</u>: Figure B7 shows the dialogue box for "Find" tool.


Figure B7. Dialogue Box for "Find" Tool

b) <u>Query Builder Tool</u>: Once the desired layer is selected, and the "Query" button is pressed, a screen for building the queries appears (shown in Figure B8).

Figure B8. Query Builder Screen

After a query is defined, it is executed to yield the results satisfying the conditions. Each of the records in the result can then also be selected to highlight that particular feature.

c) Buffer Tool: Figure B9 shows the dialogue box prompting users to enter the desired layer in order to highlight its features within a specified distance of the selected region of the selected layer.
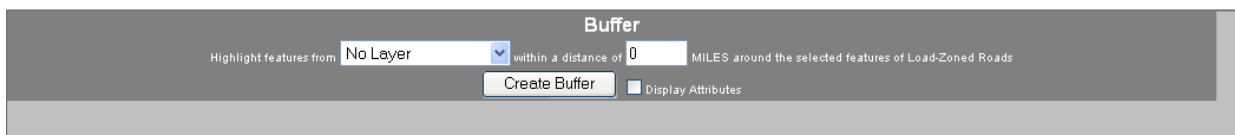
Figure B9. Buffer Dialogue Screen

d) Set Units Tool: Figure B10 shows the dialogue box for "Set Units Tool."

Figure B10. Dialogue Box for "Set Units" Tool