Great Lakes Maritime Information Delivery System

Data Viewer User’s Guide
Great Lakes Maritime Information Delivery System

Introduction

The Midwest FreightView DataView uses GIS technology to display a variety of spatially referenced data including ports, docks, weather information, economic data (employment and land use), population characteristics, and networks including waterways, railways, and highways. This is all managed within the DataView. In addition, a large volume of data is managed by the project team which is not available in the DataView but can be distributed to users upon request. These data are listed on the web site under the Data tab. The University of Toledo project team has prepared the information delivery web page and provided the link to the GIS-based Midwest FreightView DataView. The following presentation illustrates how to use the DataView.

Web-Access Directives

To access the DataView, users must contact Dr. Peter Lindquist, of the Department of Geography and Planning from the University of Toledo or Samir Dhar. Dr. Peter Lindquist can be reached by his work phone, (419)-530-4287 or email, peter.lindquist@utoledo.edu. Samir Dhar can be reached by his work phone, (419)-530-4716 or email, samir.dhar@utoledo.edu. After contacting them, a username and password will be given to specified users along with an executable file.

Step 1. http://maritime.utoledo.edu/ This web page currently provides overview of the project and also provides information about the government agencies, universities, and other agencies involved in the effort of researching several aspects of regional freight transportation. In addition, the web page provides access to the GIS DataView managed at the Toledo web server.

Click on the DataView link located on the Home tab of the web page to navigate to the Citrix server OR enter the following URL in your web browser http://gisag94.uhw.utoledo.edu/Citrix/MetaFrame/auth/login.aspx
This screen appears

The **DataViewer** is accessible by connecting through the Citrix server at the Geographic Information Science and Applied Geographics (GISAG) lab at the University of Toledo, Department of Geography and Planning. With the Citrix server capabilities, users can access the **DataViewer** without having to purchase or install ArcView 3.3. The **DataViewer** can be utilized by PC or Mac computer operating systems. However, a high speed internet connection is essential for efficient use of the **DataViewer**’s resources.

**Step 2.** Login to the Citrix Server; type in the user name and password provided.

User Name: *(Email to get Username)*

Password: *(Email to get Password)*

Domain: gisag94

The following display appears, click on the “**MWFC**” icon as shown below. The program will ask the user to install the MetaFrame Presentation Server Client (Plugin). Please go ahead and do it, as it is needed to view the **DataViewer** OR you could download it from the link provided on the page under Message Center section. OR [http://gisag94.uhw.utoledo.edu/Citrix/MetaFrame/ICAWEB_common/en/ica32/ica32t.exe](http://gisag94.uhw.utoledo.edu/Citrix/MetaFrame/ICAWEB_common/en/ica32/ica32t.exe)
The **DataViewer** -- User Guide

The Midwest FreightView (MWFV) *DataViewer* is an online Geographic Information System (GIS) application. A GIS is a computerized method to store, analyze, manipulate, capture and display spatially referenced information. From the spatially registered data, maps or cartographs can be produced for enhanced observations, understandings, analysis, modeling, and other activities. The Midwest FreightView GIS provides a variety of information of the entire United States and the Upper Midwest Freight Corridor which includes Ohio, Michigan, Kentucky, Indiana, Illinois, Iowa, Wisconsin, Minnesota, Missouri and Kansas.

Initial View of the Data-Viewer
The **DataViewer Contents**

To the left of the viewer is the **Table of Contents**. This is a way to manage the **themes, layers or shapefiles** you want to work with. Automatically in the Table of Contents, from top to bottom, are themes of the Great Lakes, US State Boundaries, US County Boundaries, Mexico_states.shp and Canadian Boundary. These themes can be turned on or off, copied and pasted, deleted or new ones can be added to your preference. By positioning your mouse over the box to the left of the Mexico_states shapefile where the checkmark is visible, click it once to turn it off. The checkmark disappears and so does the respective shapefile. Click the empty box again the checkmark and its respective shapefile is restored.
You can also click on the shapefile you want to work with by clicking on the theme within the Table of Contents. After clicking on a shapefile, you will see the button of the shapefile raised in the Table of Contents. This action simply selects the layer for a user’s particular GIS activities in the DataView. You can also select multiple layers by holding the Shift key. Selecting layers will be required when working with a specific shapefile(s).

A Geographic Information System works by stacking georeferenced information on top of one another. In the Table of Contents, all five shapefiles are stacked on top of one another in a default order. The shapefiles can be rearranged so that the themes on top will be on the bottom. Begin by clicking on the Great Lakes shapefile in the Table of Contents and drag its position from the top to the bottom in the Table of Contents. Now that the Great Lakes theme is on the bottom of the other stacked layers, it is not visible in the view because the Canadian Boundary shapefile is now on top of the Great Lakes shapefile. Click and drag the Great Lakes theme back to the top so that is visible in the view again.
Data

The Midwest FreightView GIS has organized efforts to bring various economic, transportation, social, and freight movement data together in a Geographic Information System. The DataViewer offers a data warehouse which users can select to view and map for their preferences. New data is continually being created to provide users with accurate information that can integrated in the MWFV GIS. This new data will continuously be added and changed in the DataViewer.

The data can be found on the Toolbar at the top of the screen. By clicking on one of the file headings of these data categories, a drop down list appears of the various types of shapefiles you can select.

“Transportation Networks”: This is comprised of data relating to Railroad, Highway, and Waterway networks.

Transportation Network

Highway/Streets

ORNL North American Highway Network -> Oak Ridge National Laboratory highway network shapefile containing characteristics of the highway segment and speed limit, length, and travel time on the highway segment

FAF2 National Highway Network -> Freight Analysis Framework shapefile of highway network containing characteristics of the highway segment

Integrated Highway Network -> National Integrated Highway Network shapefile containing characteristics of the highway segment

Canadian Street -> Canadian street network shapefile containing characteristics of the streets

Canadian Major Highway -> Major Canadian Highways shapefile containing characteristics of the highway segment

Railroads

ORNL Operating Rail Network -> Oak Ridge National Laboratory rail network shapefile containing characteristics of the railroads

ORNL Interlining Network -> Oak Ridge National Laboratory interlining railroad network shapefile containing characteristics of railroad segments

Railroad Depot Locations -> Shapefile of railroad depot locations throughout the United States containing characteristics of the depots

Canadian Railroad Network -> Canadian railroads shapefile containing characteristics of the railroads

Waterways

BTS Waterway Network -> USACE waterway network shapefile containing characteristics of the waterway segments

“Ports/Docks/Airports/Terminals”: This is comprised of data relating to US Ports and Commercial Airports, Ports, Docks, and Locks specific to the Great Lakes, and Intermodal Terminals.

Ports/Docks/Airports/Terminals

US Ports -> United States Ports shapefile containing characteristics of the ports

Great Lakes Ports -> Great Lakes Ports shapefile containing characteristics of the ports

Great Lakes Docks -> Great Lakes Docks shapefile containing characteristics of the docks

Great Lakes Locks -> Great Lakes Locks shapefile containing characteristics of the locks

US Commercial Airports -> Shapefile of all commercial airports in the United States containing characteristics of the airports

Intermodal Terminals -> Shapefile of intermodal terminals in the United States containing characteristics of the terminals
"Regional Data": This is comprised of data relating to Boundaries such as state boundaries and congressional districts, Population and Housing Characteristics, and Canadian Regional Boundaries

**Regional Data**

**Boundary Data**
- **State Boundaries**: State Boundary shapefile containing characteristics of the about the states.
- **County Outlines**: County Boundary shapefile containing characteristics of the about the county.
- **Metropolitan Area Boundaries**: Metropolitan Area Boundary shapefile containing characteristics of the area.
- **Metropolitan Planning Organization Boundaries**: Metropolitan Planning Organization Boundary shapefile containing characteristics of the organizations.
- **Congressional Districts**: Congressional District Boundary shapefile containing characteristics of the districts.
- **Zip Code Boundaries**: Zip Code Boundary shapefile containing characteristics of each of the five-digit numerical zip codes defined by the U.S. Postal Service.

**Census Tracts**: Census Tracts shapefile containing characteristics of the Census tracts which are small, relatively permanent statistical subdivisions of a county.

- **Block**: This is only available in the Corridor Scale.
- **Major Urban Areas**: Major Urban Area shapefile containing characteristics of the major urban areas in the United States.
- **AC Nielsen Designated Market Areas**: DMA shapefile containing characteristics of the DMAs.
- **Arbitron Areas of Dominant Influence**: Same as above.
- **Freight Analysis Framework Zones**: FAF Zones shapefile containing characteristics of the FAF Zones.
- **Freight Analysis Framework Zones Centroids**: FAF Zones Centroids shapefile.

**Population and Housing Characteristics**
- **Popn/Housing Data by County**: County Boundary shapefile containing population and housing characteristics of the county.
- **Popn/Housing Data by Tract**: Tract Boundary shapefile containing population and housing characteristics of the tract.

**Canadian Regional Boundaries**
- **Canadian Regional Municipality Boundaries**: Shapefile of Canadian Regional Municipality Boundaries.
- **Canadian Municipality Boundaries**: Shapefile of Canadian Municipality Boundaries.

"Economic and Flow Data": This is comprised of data relating to the Freight Analysis Framework, County-Level Economic Data, Tract-Level Economic Data, Point Based Data.

**Economic and Flow Data**

**Boundary Data**
- **Flow Data**
  - **FAF Zone 2002 OD Flows**: Shapefile of the FAF freight flows from Origin to Destination.
  - **FAF2 Provisional 2007 Domestic Flows**: Shapefile of the FAF2 Provisional freight flows from Origin to Destination.
  - **FAF2 Truck Data on Network**: Shapefile of FAF2 Truck Data from Origin to Destination.

**County-Level Economic Data**
- **Establishments by NAICS**: Shapefile of establishments by county and divided by their North American Industry Classification System code with data from the Quarterly Census of Employment and Wages.
- **Employment by NAICS**: Shapefile of employment by county and divided by their North American Industry Classification System code with data from the Quarterly Census of Employment and Wages.
- **Wages by NAICS**: Shapefile of wages by county and divided by their North American Industry Classification System code with data from the Quarterly Census of Employment and Wages.
- **Business Establishments by SIC Code**: Shapefile of establishments by county and divided by their Standard Industrial Classification code.
- **Employment by Land Use Type**: Shapefile of employment by Land Use Type.
- **Agriculture Production**: Shapefile of agriculture census data.
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Tract Level Economic Data
- Business Establishments by SIC Code: Shapefile of establishments by county and divided by their Standard Industrial Classification code
- Business Establishments by Land Use Type: Shapefile of establishments by land use type
- Employment Data by SIC Code: Shapefile of employment by county and divided by their Standard Industrial Classification code
- Employment by Land Use Type: Shapefile of employment by Land Use Type

Point Based Data
- EPA eGRID Power Plant Locations: Shapefile of every power plant in the United States

“Physical Data”: This is comprised of data relating Weather and also shapefiles of the Great Lakes and Major US rivers.

Hydrology
- Major Rivers: Shapefile of the major rivers in the United States
- Great Lakes: Shapefile of the Great Lakes

Weather
- Great Lakes Temperature Data: Shapefile of minimum and maximum temperatures from 2000 to the present

“International Trade Data”: This is comprised of data relating to the United States’ Export and Import Data by air, container, and vessel. Exports and Imports by air and vessel are done by state, port, and custom district. Exports and Imports by container are done by port.

International Trade Data

US Air Exports by State
- Export to Africa
- Export to Asia
- Export to Europe
- Export to Latin America

US Air Export-Import by Port
- Export-Import to Africa
- Export-Import to Asia
- Export-Import to Europe
- Export-Import to Latin America

US Air Export-Import by Custom District
- Export-Import to Africa
- Export-Import to Asia
- Export-Import to Europe
- Export-Import to Latin America

US Container Export-Import by Port
- Export-Import to Africa
- Export-Import to Asia
- Export-Import to Europe
- Export-Import to Latin America

US Vessel Exports by State
- Export to Africa
- Export to Asia
- Export to Europe
- Export to Latin America

US Vessel Export-Import by Port
- Export-Import to Africa
- Export-Import to Asia
- Export-Import to Europe
- Export-Import to Latin America

US Vessel Export-Import by Custom District
- Export-Import to Africa
- Export-Import to Asia
- Export-Import to Europe
- Export-Import to Latin America
The *DataViewer* also contains functionality tools. These functions can also be found on the Toolbar.

**“Network Analysis”**: When a network dataset such as “BTS Waterway” is added to the display, the “Network Analysis” function can map out the best route, closest facility, and service area.

**“Employment Data Documentation”**: The Employment Data Documentation file heading will allow you to look at an Employment Metadata file. Under the Economic and Flow Data are a series of Employment data themes. Each employment sector/industry is abbreviated as a type of code. These codes are seen in the Employment Data Documentation files. Each code will be accompanied to a specific sector/industry so that you can understand what you are mapping.

**“Query/ Analysis”**: With this function a user can select objects or sets of objects on the basis of their location or their attribute characteristics.

**“QUICK MAP”**: With this function a user can quickly map County Level Economic data by three digit NAICS code

**“Map Composition/Layout”**: Finished map compositions can be prepared under the “Map Composition/Layout” option for printed maps or maps prepared in graphics file formats for Power Point presentations.
Maneuvering around the *DataViewer*

There are many functions which can help you move around in the *DataViewer*. The buttons which will assist you in your analysis are displayed as icons below the file headers and above the view. The *Zoom In* button will let you zoom in on any area on the map. Click on the *Zoom In* button. As you move your cursor over the map, the cursor changes from a pointer to a magnifying glass. Click and drag a box over the area you want to view more closely. A smaller box dragged gives you a smaller area with more detail as a larger box gives you a larger area with less detail.
Now click the *Zoom Out* button. This button will zoom your view out of your current view. Click and drag to zoom out. A smaller dragged box will result in zooming out much further and a larger dragged box will zoom out less.

To examine your map to its fullest extent, click the *Zoom to Full Extent* button. This zooms the view out so that all data layers can be seen.
In the Table of Contents, click the Great Lakes theme once to select it. Then click on the *Zoom to Active Theme(s)* button. After clicking, the map zooms directly to the Great Lakes theme. To use this button, it is necessary to have a theme selected.

To zoom in, you can also click the *Zoom In (arrows)* button. This button zooms in at an automatic scale. You can click it repeatedly to zoom in at the desired scale. You can also click the *Zoom Out (arrows)* button. This will zoom out at an automatic scale.

If you are working between two areas on the map with different scales, you can click the *Zoom to Previous Extent* button. By clicking this button, your map will move to the previous scale you were at previously.

To move around the map without zooming in or out you can click the *Pan* button. When you move your cursor on to the map, your cursor changes from a pointer to a hand. Click and drag your mouse on the map in the direction that you want to move on the map. You can pan in the map in any direction.
Using Tools in the DataViewer

There are many tools available in the DataViewer which users can operate to select, measure, identify and retrieve information. This section will continue to cover the buttons and tools in the main toolbar above the View to the desired functions of the user.

In the DataViewer, users can measure distances. Click the Measure button. When you place your cursor over the map, your cursor turns into a right angle. Click once on the map and drag your cursor to another area on the map. In the bottom left corner of the window, the DataViewer displays the segment length in miles and the total distance in miles. You can continue drawing multiple segments the Measure tool. The length will always display the current segment you are drawing with the tool and it will also display the aggregate length of the line you have created.
Click the Identify button in the toolbar. This option allows you to click on a feature in the map; its individual attributes will appear in a window for a user to quickly view information for a desired feature. Once you click the Identify button, your cursor will change to a crosshair with the identify symbol next to it. Make sure when you are identifying a feature, your shapefile button is raised in the Table of Contents. Click on the US County Boundaries shapefile to raise its button in the Table of Contents. The US County Boundaries theme has now been selected. Click a county on the map. The county you have selected will quickly flash and a window will appear. These are the attributes that describe this feature. They are the same features in its attribute table.

The Attribute Table can be viewed by clicking the Open Theme Table button. This will display all of the records associated with the selected shapefile in the table of contents. The attribute table will be discussed in further detail in this manuscript. Close the Attributes of US County Boundaries and close the Identify Results window.
When creating a map, you can also label any amount of features in the View in any style. Click the **Label** button. Your cursor turns into a crosshair with the label icon. Select the Great Lakes theme in the Table of Contents. Move your label cursor over one of the Great Lakes shapes and click. Automatically, a label appears over its respective area.

You can also label features automatically for an entire theme. Select the Great Lakes theme in the Table of Contents. Click the Theme file heading on the toolbar and go to Auto-Label under the Labeling section. The Auto-Label Great Lakes window appears. You can let the **DataViewer** find the best label placement automatically. Make sure that you have overlapping labels turned off and remove duplicates turned on. Click **OK**. You will see all of the Great Lakes labeled with their appropriate names. Click the Theme file heading again and click on Remove Labels.
Create another label with the *Label* tool. Click the *Pointer* button. This button allows you to select graphics that you have created in the View such as the label you have just created. Double click the label you have created. A Text Properties window pops up. You can change what the label reads by typing what you would like in the window. There are also alignment options, vertical spacing options if you would like your text to take up two lines and an option to edit the angle of your text. You can change the size of your label by stretching the corners of the label to your desired size. The *Pointer* button will also let you select multiple graphics at once to perform a single action or you can move your graphics anywhere in the View by dragging the graphic.

If you would like to delete your label or any other graphics, select the graphics you have created and click the *Edit* file heading. You can undo the previous property change to your graphics, copy, cut or delete your graphics. Click on *Delete Graphics*. If you’re still trying to remove labels, you can go to the *Theme* file heading and remove labels that way.

You can also write your own text to anywhere in the View. Click the *Text* button in the toolbar. Drag your cursor into the view and click. The same Text Properties window when using the *Label* button pops up. You can enter your text and change its properties to your content. Once again if you want to make changes or move them around, click the *Pointer* button.
Users can also create their own shape graphics to be a part of the View. Click the *Draw Point* button. As default, the point symbol is on top of the draw options but you can select other types of graphics to draw. For now, select the draw point option. Your cursor turns into a crosshair when you drag your cursor into the View. Click your mouse once to make a point. You can create as many points as you want by clicking your mouse.

You can change the symbology of the graphics you have made as well. This manuscript will cover more in detail about symbology properties. Click the *Pointer* button and double click the point graphic you have just made. The Marker Palette window appears so that you can change how your point looks. Close the Market Palette window.

Click and hold on the *Draw Point* button again to create new graphic shapes. A list of graphic shapes appear on your screen. Scroll down on the list and release the mouse when you have selected the shape you want to create. Play around and experiment with the new shapes. Again for all of these shapes, you can click the *Pointer* button to move your graphics, change the size of your graphics, change the properties or permanently delete them.
Symbology

In a GIS, there are three main types of shapes you can display. In the DataView, you can display points, lines and polygons.

**Polygons**

Underneath each shapefile is an object or square reflecting the symbology of the shapefile. For example, underneath the Great Lakes shapefile, the square is blue which is what color it is in the view. You can change this by double clicking the shapefile. Double click the shapefile and the Legend Editor window appears. Double click again underneath the word Symbol where the square is. Click the paintbrush icon (second from the left of the icons) to change the color. This brings up the Color Palette window. Choose whichever color your prefer and exit the window. The color under the Symbol automatically changes to which color you have chosen. Click Apply in the Legend Editor window then exit the window. You will notice that the color for the Great Lakes have changed according to your color choice.
Double click the symbology of the selected shapefile again. This time click the first icon on the right in the row. This is the Fill Palette window. Here you can change the pattern of which color you have chosen. Choose the polka dot design on the top right of the fill pattern options. Next, go to the Outline section at the bottom of the window. Click the drop down arrow to change the thickness of the boundary lines of the theme. Exit out of the Fill Palette window and click Apply in the Legend Editor Window. The Great Lakes theme now changes to the fill pattern with the color you have selected along with the degree of thickness you have chosen for the outlining boundary.

You can also change the symbology by clicking on the View file heading. From the View heading, you can click on “Open Legend Editor” to go to the Legend Editor window or you can click on “Open Symbol Editor” to directly change the symbology of your themes.
Under the Transportation Networks file heading, click under the RAILROADS section, “Add ORNL Operating Rail Network”. The shapefile is automatically displayed within the view and visible on top of the other layers in your Table of Contents. Note that the name of the shapefile in the Table of Contents is not the same of the shapefile under the Transportation Network file heading. Double click the symbology of the North_American_ORNL_railnet.shp in the Table of Contents.

In the Legends Editor window, double click the symbology of the theme. This time the Pen Palette window automatically comes up because you are working with a line layer. Scroll down until the railroad symbols are visible. Select an appropriate railroad symbol. At the bottom of the Pen Palette window are Size, Cap and Join options. The Size option lets you change how thick the lines are. Click the drop down arrow and select a desirable thickness for your railroad theme. The Cap option lets you change how the ends of the lines are drawn. The Join option lets you choose how lines are joined together. You can start experimenting with these symbology options and examine the cartographic results. Click Apply in the Legend Editor window and the view displays the railroad network based on your mapping choices.
Points

Next, we will change the symbology of a point feature. Currently there are not any point feature shapefiles in our Table of Contents therefore we will add one. Under the Ports/Docks/Airports/Terminals file heading, click “View Intermodal Terminals”. The intermodal facilities in the United States are now visible. In the Table of Contents, double click the Usa_intermodals.shp.

In the Legend Editor window, double click the symbol to change its symbology. The Marker Palette window automatically is brought up. Scroll through the point symbols until you find one appropriate for intermodal facilities. You can also change the size of the point by clicking the drop down arrow of the Size option. The angle of the point can also be changed by entering a value up to 360 in the Angle option.
Within the Legend Editor window, you can also alter the text of labels. Click on the Font icon and it brings you to the Font Palette window. You can scroll through the list of font styles, change the size in the Size option and change the boldness or italics in the Style option.

![Font Palette](image)

The Color Palette window has other color options for your symbology. Click on the Custom button on the bottom of the window. Here you can create your own color based on mapping preferences. In the Specify Color window, you can change all three values by dragging the bars of the Hue, Saturation and Value options. Values can also be manually entered into the boxes to the right of each color property. Values can only range from 0 – 255. Click OK to accept your customized color choice. Lastly, click the drop down arrow in the Color option of the Color Palette window. Here you can apply your chosen color to the foreground, background, outline, or the text within the theme. Close the Color Palette window and click Apply in the Legend Editor to map your chosen symbology.
Mapping Data

Now that you have gone through changing the symbology for polygon, line and point shapefiles, you can now map your themes based on the attributes of a shapefile. This section will show you how to access the attribute table to view the characteristics of your themes on your view and follow how to display shapefile characteristics and values.

Viewing the Attribute Table

In the Table of Contents, select the US County Boundaries theme by clicking once on it to select it. Then click the Open Theme Table button to view the shapefile’s attributes. Another window appears named Attributes of US County Boundaries. You can change the size of the window by dragging the sides or corners of the window to see more of the attribute information.

This attribute table depicts all of the socioeconomic data for each county in the United States. Along the vertical side of the table are called rows or tuples. These rows list every single county in the United States. Along the horizontal side of the attribute table are columns or fields. The fields display what kind of category or data are associated with each county. As you can see in this attribute table every county has population, demographic, housing and other information associated with each row. These are the data that you will be mapping.
Since this is a controlled GIS, some of the functions are not available in the DataViewer as would a normal ArcView program allow. Clicking the “File” file heading at the top of the window. You can choose to close, print or export the table. Clicking on close would automatically close the table and return back to the View. Printing the table would allow you print your table. You can export your table as a dBase, INFO, or a delimited text file if you want to.

The “File” and “Edit” file headings in the window are visible but their capabilities are limited to the Viewer constraints. Many of their actions are self explanatory such as close, print or undo. You won’t be able to export the tables as different files or edit the tables in any way. In addition, DataViewer does not allow you as a user to delete or add records to the shapefiles. You can edit fields but their edits will not be permanent as when you close the Viewer you will lose your edits.

First, let’s select some information in the table. You can do this by clicking a record in the attribute table or you could hold the Shift key and click multiple records. The attribute table has a lot of the similar selection features as it does in the View. You can click on the “Table” file heading and click either Find or Query as well to search for exact information. For this step, select 5 records. Move on to the next step when you have selected your desired records.
Click the “Table” file heading and scroll to and click Chart. This allows you as a user to make a bar graph of the selected fields in the attribute table. You could also do this by clicking the Create Chart button. After clicking, the Chart Properties window appears. Under the Fields section, click the Pop1990 and Pop1999 fields.

This will compare the populations of the records you have chosen by the 1990 and 1999 population. Click the Pop1990 field and then click the Add button to transfer it to the Groups section. Do the same for the Pop1999 field and click the OK button.

A new window appears with the information you have selected in a bar graph with a variety of new options. Click the “Gallery” file heading to select a wide array of graphing options. The same options to graph your data are presented in buttons below the file headings. Click the “Chart” file heading. This option gives you the choice to hide the legend, title, x axis, or y axis. If you click the Series from Fields, it will switch what axis of the graph your data is currently lying on.
Click the **Chart Element Properties** button in the lower left corner of the toolbar on top of your graph. This will assist you in making edits to your graph. You can click the **Erase** button to erase any of the records that are in your graph. Point your cursor on one of the records to erase it. You can also change the colors of your records. Click the **Chart Color** button. Just like in the symbolization process, the Fill Palette window appears. Select the color that you want. Close the Fill Palette window. Take your cursor and click on the area of the graph that you want to change its color. The color will automatically change to which color you have chosen.

Click the “Window” file heading. There are many options to layout the windows so you can view and analyze them at your preference. Click the Tile section. This will divide your screen evenly into how many windows you have open.

Change the window layout to Cascade. This will stack your windows on top of each other with the title bar of each window showing. At the bottom of the “Window” file heading, you can also click on one of the windows to view.

Click “Attributes of US County Boundaries” and the attribute table will be displayed. This finishes up the section of charts in the **DataViewer**. Close the window of your chart.
Many of the operations in the Attribute table are simple and comparable to other computer programs. If you want to sort your table by a certain field, click on the field you want to sort. You can either click the Sort Ascending or Sort Descending buttons depending on which way you want your data to read. You can also click the “Field” file heading and go to Sort Ascending or Sort Descending.

The DataView will also let you summarize statistics and information in the Attribute table. Select 5 records in the attribute table. Click on “Name” then click the “Field” file heading and finally click Summarize. The Summary Table Definition window appears. Under the Field section, select the Hse_units (Housing Units) field. Click the Add button to transfer the Hse_units field to the other group. The Summarize by section will always be Average. Click the OK button.

The output file lists all of the records that you have selected. If you did not select any records it will show all of the counties. The output file summarizes the file by how many counties are in each state and the average value of housing units. This finishes the discussion of the Attribute Table section.
Double click on the US County Boundary theme in the Table of Contents. In the Legend Editor window, click the drop down arrow in the Legend Type section. There are five types to classify the attribute data associated with the theme: *Single Symbol*, *Graduated Color*, *Unique Value*, *Dot* and *Chart*. This section will briefly go over the types of data classification and presentation but more in detail later. The *Single Symbol* gives your theme one standard symbolization that applies to the entire theme you are working with. Currently, the US County Boundary theme is shown as a *Single Symbol*.

The *Graduated Color* type is a way to show disparity of values for a mapped field. This is common when showing aggregate values of items in a map, such as a population. The *Unique Value* type is a way to display data based the different values. An example of when to apply the *Unique Value* method would be when mapping operational statuses of railroad networks. The *Dot* type prepares a dot density map for your theme. ArcView randomly distributes locations of dots that represent a numerical value for your theme. Lastly, the *Chart* prepares a pie chart of variables that the user chooses to proportionately show percentages of values.
After scrolling through the data classification and symbolization options, click on the *Graduated Color* option. The Legend Editor window changes custom to the *Graduated Color* properties. Click in the Classification Field section and scroll through the fields. These are the same fields that you saw in the attribute table earlier. Click on the field name “White”. Automatically, ArcView classifies the White population and assigns a gradual color ramp for your data. Click on the Normalize By section. This option allows you to convert the White population into a percentage. You can normalize the data as a percentage of the total or any of the other fields within the attribute table for a desired percentage.

![Legend Editor screenshot](image)

Notice the other options and icons at the bottom of the Legend Editor window. The *Add Classes* button allows users to add additional classes to their themes. However, a good rule of thumb cartographically is to use a maximum of 5 classes, you can add additional classes if you wish. After clicking the *Add Classes* button, another class is displayed with the initial classes under the Symbol section. After adding a new class, you will need to fill in the value and label information. Click in the Value box and type in what range of values you want the new class to represent. Next, click in the Label box and type how the range of values will be displayed. You can change the range of values and labels for all classes if you desire. If you wish to delete a class, select the symbol in the Legend Editor window. The class will be highlighted in black. Click the *Delete Class* button and the class will be removed.

An easier way to manage the way your data is classified is by clicking the *Classify…* button on the right side of the Legend Editor window. After clicking this button, the Classification window appears and gives you more detailed options of how to classify your data.
Click on the Type drop down arrow. It offers classifying options based on Equal Area, Equal Interval, Natural Breaks, Quantile and Standard Deviation. The Equal Area classification designates class breaks to create equal-interval classes, but the exact range is not used to select the class breaks. A practical interval width is selected arbitrarily, based on rounded-off class break values. The Equal Interval classification uses the difference between the largest and smallest values in a set of data. The Natural Breaks classification is how your data is classified by default. This classification identifies the large gaps or breaks within your data and classifies them into groups by the difference of values between records. The Quantile classification takes the total number of values and divides them equally as possible into the desired number of classes. Lastly, the Standard Deviation classification classifies groups of data by how far away they deviate from the average or mean. You will notice that if you use this classification, that the labels change from values to how far a group is away from the mean. Labels that read -1 – 0 Std Dev. are much lower than the mean as values that read 1 – 2 Std. Dev. are much more than the mean. It is suggested to experiment and test these classifications with your data as it may visually aid in user understanding.

The next buttons are the Sort Ascending and Sort Descending buttons. These buttons will rearrange the classes from smallest to largest or from largest to smallest classes based on value. You can switch back and forth from these buttons if you decide to change your mind.

The next button is the Null Values button. This option allows users to exclude a certain value from the classification. Ignore the checkbox for the Include No Data Class in Legend option.

The next button is the Inverse Colors button. This option allows users to inverse the color scheme for the data. Click the Inverse Colors button. You will notice that the darker colors now represent the smaller values and the lighter colors now represent the larger values.

The last button option is the Change Colors button. This option allows users to quickly change the color scheme of the classified data. There are more color changing options in the Color Ramps section below these icons. Click the drop down arrow the Color Ramps and it will display all of the color coding options for your data. There are color ramps that increase darkness of one color and there are other ramps that apply three different types of colors. The data that you are mapping should logically follow the nature of your data and be cartographically pleasant.
There are a few more options below the Color Ramp section. You can click the *Statistics* button to read a brief list of some major statistics. Statistics include the minimum and maximum values, the count of how many records there are (in this case how many counties in the US), the sum, mean and standard deviation of all values. You can also click the *Undo* button to cancel any classification or cartographic options you have ordered ArcView to perform.

Click *Apply* for whatever classification and cartographic options you have altered. You will see these changes in your view.
Mapping a new theme to the current view

For the most part this user’s guide has been using themes already in the Table of Contents. There are a variety of data to add to the view which a user can choose from the various drop down lists on the toolbar. Here we will add the USACE Waterway Network to the current view.

Click on the *Transportation Networks* menu and choose “BTS Waterway Network” from the drop down list.

The display below should appear: The USACE Waterway Networks will appear in the Table of Contents.
**Mapping using QUICK MAP Function**

Once a network, such as the BTS Waterway Network, is added to the View, there is the option of using QUICK MAP to show County-Level Economic Data. First click on QUICK MAP on the Toolbar. A list of data will appear.

Click on “Display 3 Digit NAICS Employment by County.” Once the user does this, another box will appear. Scroll down to “Food Manufacturing” and double-click on this heading. Then type in “FoodManuf” in the text box.

Click on “View Map” and the user will hear a beep. Then the data will appear in the View.
Now the use can change the Legend Type to “Dot”. Click on the “V” on the Toolbar. A box will appear.

Click on “Legend Type” and change the type to “Dot”. Now the use must change the Density Field. Click on “Fispnum” on the drop down box. Now the user must calculate the new Legend Type. Click on “Calculate” and a number will appear in the text box.

Now click “Apply” and exit out of the Legend Editor.
At this time the user may want to reset the View and delete the current data added to the Table of Contents. To do this click on “R” on the Toolbar. “R” stands for “Reset” and is located next to “V”.

To Reset the View the theme which the user wishes to delete must be highlighted in the Table of Contents (Shown below with the arrow). Once the theme is highlighted clicking “R” will purge it from the View.
Mapping a theme with the *Graduated Symbol* method.

Under the file name, International Trade Data, click on “Export to Africa” under the US AIR EXPORTS BY STATE: Its theme named air_exp_af_by_st.shp appears in the Table of Contents and you see its points distributed on the states in the View. Double click on the shapefile in the Table of Contents.

In the Legend Editor window, click the drop down arrow of the Legend Type section and scroll to *Graduated Symbol*. (1) In the Classification Field section, click the drop down arrow and navigate to Exp_1996.(2) This field represents annual exports in 1996 from the US to Africa. You immediately see the larger values in the classification are symbolized as larger circles.
You can change the color or shape of the symbols by double clicking on the Symbol section below the Data Management icons. You can also change the symbol size in the Size Range section next to the Symbol section. Click the drop down arrows of both boxes to change the sizes to reflect the data you are mapping. As with the *Graduated Color* symbolization, you can also normalize the data.
**Mapping a theme using the *Unique Value* method.**

Double click the Great Lakes layer in the Table of Contents to bring up the Legend Editor window. Under the Legend Type section, click the drop down arrow to map by *Unique Value*. In the Values Field section, scroll down to “Name”. After click on “Name”, you will see a different shade of color for every Great Lake.

As with the other symbolization categories, you can modify the presentation of your symbols. By clicking the *Paintbrush* icon, you can automatically change the color of all symbols. The *Palette* icon next to it gives your symbols a more detailed with striped or checkered patterns. Under the Color Schemes section, ArcView provides some default color ramps for specific mapping schemes. After choosing your symbolization for the Great Lakes shapefile, click *Apply* and view your map.
Mapping a theme with the *Dot* symbolization.

The dot density is useful for showing a random distribution of points that equal a certain value by your discretion.

Double click on the US State Boundaries theme in the Table of Contents. In the Legend Type section, scroll to *Dot*. In the Density Field section, click which field you want to map. For this scenario, click on “Population 1990” field. Again, you can also normalize this field by clicking on another field for a percentage. In the Dot Legend: 1 dot = section, you can enter how much one dot will equal in your map. **It is strongly recommended to click the Calculate button to configure your dot density value.** If you enter a small number, you run the risk of crashing or freezing your computer. You can change the symbology of the dot, the background of the dot and any null symbols when you double click on the respective symbols in the Legend Editor window.

Click *Apply* to map your dot density.
Mapping a theme with the Chart type.

This style of mapping will create a pie chart or bar graph based on the values you choose for your map.

Double click the US State Boundaries shapefile in the Table of Contents. In the Legend Editor window, click the drop down arrow in the Legend Type section and scroll to Chart. Automatically, the Legend Editor window changes so that you can add fields to your chart map.

In the Fields section on the left, scroll down until you see the Age related data. Click on the “Age_under5” field. Then click on the Add button. The added field is now displayed on the right with an assigned symbol. Continue adding the rest of the age related fields (Age_5_17, Age_18_29, Age_30_49, Age_50_64, Age_65_up). You can hold the Shift key and click on each field to quickly transfer the data to your selected fields.
In the Chart Type section, you can choose whether to have a bar graph or pie chart describe the US State Boundaries shapefile. Click on the pie chart symbol. Click the Properties button. Here you can change the minimum and maximum size of your chart. If you were using a bar graph to display your data, you could also change the minimum and maximum size of your bar graph including how width of the bars. Click the Apply button to see your map.
Selecting and Finding Spatial Information

The capabilities of a GIS can assist users in finding specific spatial records and displaying in the *DataViewer*. In MWFV, records can be selected by attributes and by their geographic locations.

Select the US County Boundaries theme in the Table of Contents. In the main toolbar, click the *Select Feature* button. Click once on any county in the Viewer. You will see that the county you have clicked on turns yellow. You can also click and drag a box to size of your preference to select multiple counties. All counties that you select will all turn yellow.

It is also possible to select features in more than one theme. You can simply do this by holding the Shift key and select additional themes in the Table of Contents. Lastly, you can select multiple features by holding the Shift key and clicking on different features.
In the **DataViewer**, you can erase your selection in three different ways:

1. Click the **Clear Selected Features** button in the main toolbar.
2. Under the Theme file heading, click **Clear Selected Features (Unselect)**.
3. Under the Query/Analysis file heading, click **Clear Selected Features**.

Using the **Select Feature** button, click on one US County with the US County Boundaries theme selected in the Table of Contents. After the selected feature turns yellow in the View, click the **Zoom to Selected** button in the main toolbar. This will zoom your view to a closer and detailed view of the selected feature.
If you know the name of the feature, you can use ArcView to find the spatial feature. For example if you wanted to find a specific county you could use the Find feature in the main toolbar. Start by selecting the US County Boundaries shapefile in the Table of Contents. Click the Find button in the main toolbar. The Find Text in Attributes window appears. Under Search For, type in “Kendall” (without the quotation marks). This will select Kendall County located in Northeastern Illinois. Click the Clear Selected button to clear your selection.

**Select by Attributes**

Lets now work with some specific data that is available in MWFV. You want to know which counties produce at least 500,000 bushels of barley. You will do this by selecting by attributes. Under the Economic and Flow Data file heading, click the Agriculture Production (2006) theme.
You can either click the Query Builder button in the main toolbar or click the Query/Analysis file heading and click the Select Features by Attribute (Query). A query building window appears in the MWFV. In the Fields section, scroll down until you see Barl_prod. This is the field that describes the amount of barley production by county. You might also want to look at this shapefile’s attribute table to help you understand its information and writing a query.

Double click Barl_prod in the Fields section. Since you want to see which counties produce more than 500,000 units of barley, click the greater than symbol. Automatically, the Values section displays units of barley production that you can select. You can also write which value you want to use. Type in 500000 (no comma) in the query builder box.

Click New Set. The View will display which counties produce more than 500,000 units of barley.
Open the attribute table for the Agriculture Production (2006) theme. You will notice records that have met the selection requirements will be highlighted. To group all of the highlighted records together, click the **Promote** button in the attribute table toolbar. This manuscript will go over more in detail some of the functions available in the Attribute Table.

Let's say on top of the barley production selection, you also want to know which counties produce at least 500,000 units of hay. Click the **Query Builder** button in the main toolbar. With the barley production selection you just made, find the Hay_prod field in the Field section. Click the greater than symbol and enter 500000. This time click **Add Set**. This will add both selections in the View. The selected counties increase as you are now looking at counties that produce at least 500,000 units of barley and hay. These changes are also visible in the attribute table if you look at them.
Now let's demonstrate how to make a selection within a selection. Click the *Query Builder* button. Let's say you want to know which counties produce at least 500,000 units of barley and hay in North Dakota. Under the Fields section, double click State_name. Click the equal sign in the operator symbols area. The Values list will populate based on state names. Find and double click on North Dakota.

Click *Select from Set*. The View changes the selection to North Dakota counties that produce at least 500,000 units of barley and hay. Click *Clear Selected Features* when you are done looking at your selection.
Select by Proximity (Location)

In the DataViewer, you can also select features by their spatial location and relationships by other features in the View. Under the Transportation Networks file heading, click Add BTS Waterway network to your View. Select the US County Boundaries in the Table of Contents. Under the Query/Analysis file heading, click Select by Proximity (Select by Theme). This selection will show which counties are intersected with the features of the BTS waterway network.

In the drop down list under “Select features of active items that”, make sure that it says intersect.

This drop down box gives other options of spatial relationships between two shapefiles such as features being completely within another theme, being completely contained by another theme, having their geographic center within another theme, containing the geographic center of another theme or are within the distance of another theme.

Under “the selected features of” make sure it says Usa_waterways.shp. This drop down box is comparing the spatial relationship of the selected shapefile in the Table of Contents with the other theme that you are choosing. Click New Set. The View will now display which counties intersect with the features of the BTS Waterway network.
Great Lakes Maritime Information Delivery System

Creating Buffers

As a user you can create buffers within the View. A buffer is an area/polygon with a specified area/radius that you identify. Let’s say that you want to see what a 10 mile radius of US ports looks like. Under the Ports/Docks/Airports/Terminals file heading, click View US Ports. The US ports shapefile is now visible in the View and in your Table of Contents. Make sure that the US ports shapefile is also selected in your Table of Contents.

Click the Theme file heading and click Create Buffers. The Create Buffers window appears. You can create buffers of graphics that you can create or the shapefiles in the Table of Contents. Under “What do you want to buffer?” click the features of a theme. If the US Ports shapefile is not selected, click the drop down arrow and select it.

Below this drop down arrow box, it informs you that there are 9199 US Ports features. You can also create buffers of selected features; right now it says there are 0 features selected. Click the Next> > button.
The next window shows how to specify the distances and create buffers. You can create a single buffer with one ring, or a buffer with multiple rings. At the “At a Specified Distance” bullet, enter 10 for the distance of the buffer. Make sure the Distance Units section are set to miles. You can change the unit by clicking the drop down arrow.

You can also select a distance from an attribute field for your buffer. You can do this by selecting the bullet next to this section and select the unit in your attribute table. In addition you can create multiple rings within a single buffer. You can enter as many rings as you would like in the number of rings section and enter the distance between rings in the distance between rings section. We won’t do any of these steps in this manuscript, but feel free to try them out on your own. Click the Next>> button.

The next option lets you dissolve barriers between multiple buffers. When there are multiple buffers that overlay on top of each other, you can merge their boundaries so it looks like one single polygon/shape. Click Yes to dissolve barriers.
It will then ask where you want to save your buffer polygons. You can select Save As Graphics in the View, which will display your buffers as a graphic. You can merge them into an existing theme in the Table of Contents by selecting a theme in the drop down box. Lastly, we can also create a brand new theme by clicking the Browse button and saving it to your computer directory. For this exercise, you will save them as graphics. Select Save As Graphics and click the Finish button.

The buffers will take a couple moments to generate as you will see progress bars on the bottom of your window. When these are finished you will see the buffer polygons in your View. Zoom in for better look. You can see that the buffer polygons were successful and that they have dissolved into each other. You may also want to measure the distance from the edge of a buffer to a port to make sure that they are 10 mile buffers.
Great Lakes Maritime Information Delivery System

If there are any questions within the *DataViewer*, you can click the *Help* button in your toolbar. After clicking on this button, click on any area in the map or buttons to clarify any confusion you may have. You can also click the Help file heading to read through or search for answers you may have as a user.

Periodically this User’s Guide will be updated/modified with new information. For more information on this project please contact:

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