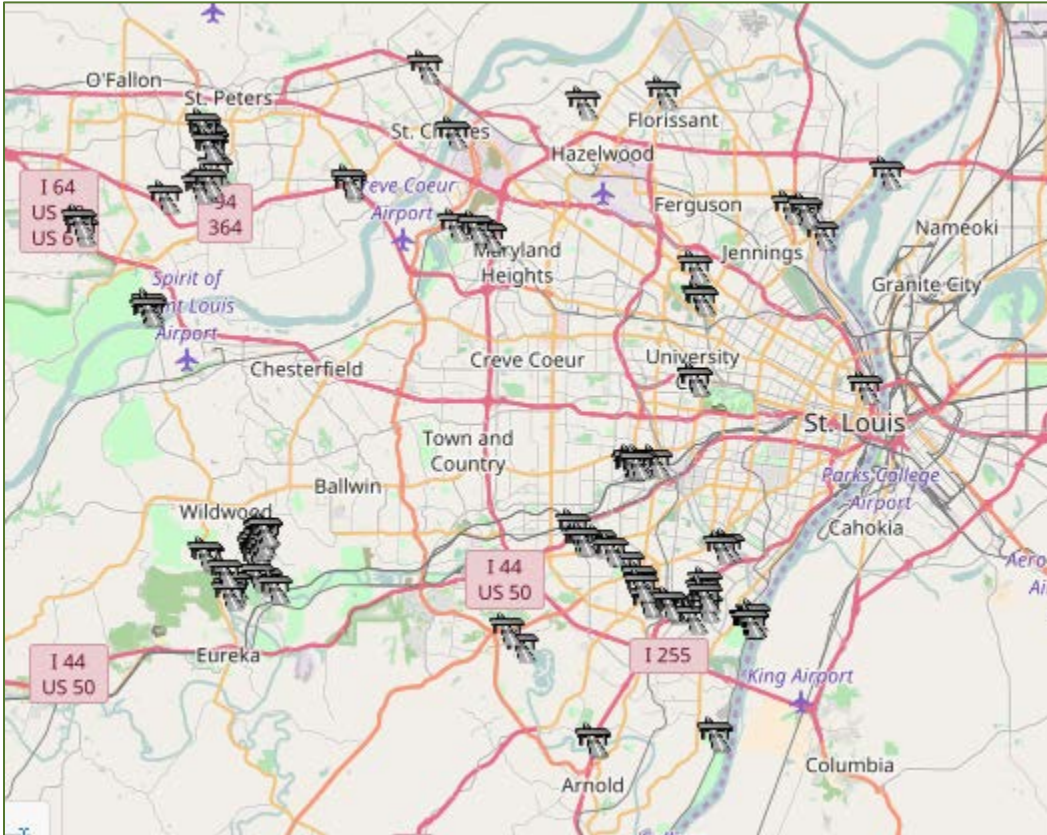




Great Rivers Greenway



GIS Bridge Layer Guide

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About this Guide

Section I of this guide offers a general tutorial on how to use Great Rivers Greenway's geographic information system asset inventory (GIS) to access and input information for bridges and other assets. Section II gives a run-through of what each data field in the *Bridge* layer means and how bridge conditions were classified. This guide focuses on the bridge layer, but can be applied to access other data as well. This is not a comprehensive manual and is only intended to serve as general guidance to perform basic functions. A general understanding of GIS terms is assumed. For help with questions regarding the functionality and use of the GIS, reach out to Ben Grossman or one of the GIS analysts from Horner Shifrin who help manage the GIS.

Section I: Tutorial

Accessing the bridge layer

When you boot up the GIS and sign in (using the *Sign in* link at the top-right hand of the page). You should now be able to see a toolbar with a line of icons and tabs saying "Navigation", "Identify", "Search", "Measure & Draw", "Editing", and "Tasks" at the top as shown in Figure 1.

Note: if you do not see the toolbar with the icons at the top, click the *Open toolbar* button (screwdriver and wrench icon) in the top-right hand corner of the page.

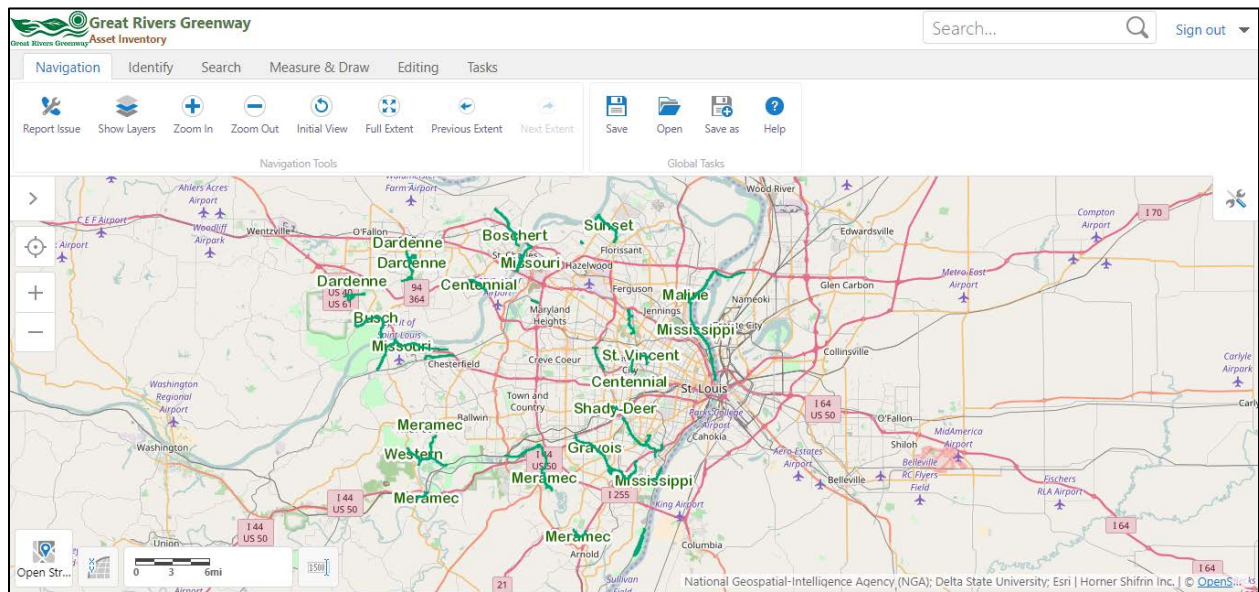


Figure 1: Main interface of Great Rivers Greenway's GIS Asset Inventory

Click the *Navigation* tab and then select the *Show Layers* icon on the toolbar. Upon selecting the *Show Layers* tab, a menu will pop up on the left hand side of the screen with a list of layers whose visibility can be turned on and off by clicking the white box next to the layer's icon and name. Click this box for the bridge layer. A checkmark should appear in the box and all of the bridges should show up on the map in their respective locations.

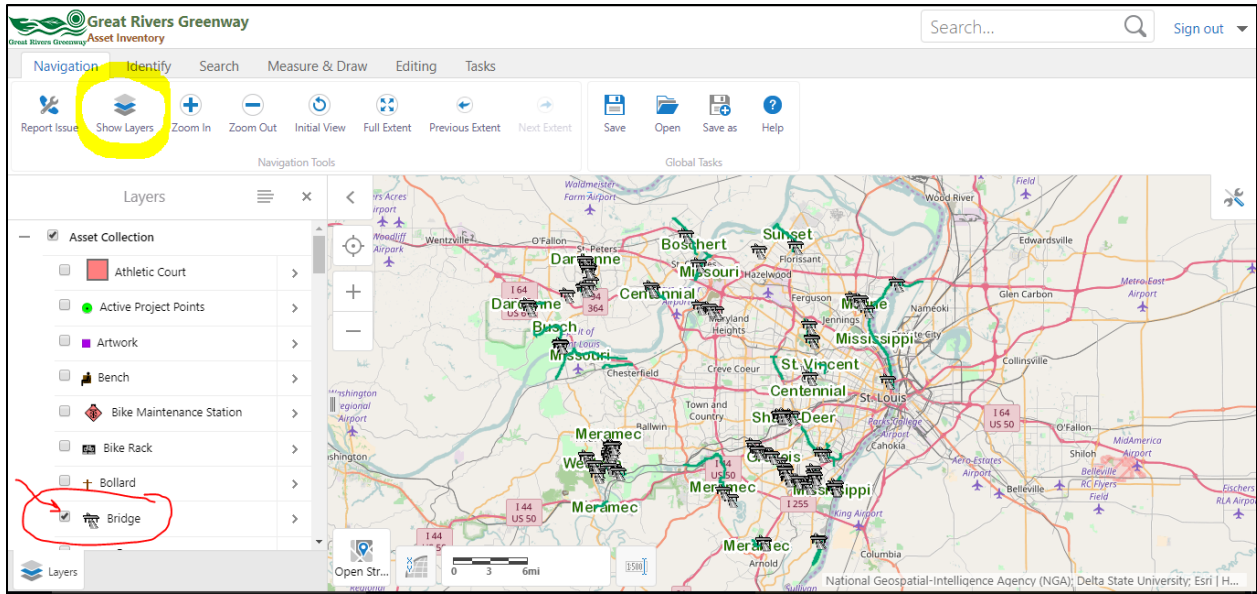


Figure 2: The *Show Layers* menu with the *Bridge* layer selected. Bridges are visible on the map to the right.

Once the *Bridge* layer is visible, click on any bridge you want to know more about. For the tutorial, a bridge on the Dardenne Greenway will be selected. You may zoom in on the map using the *Zoom In* and *Zoom Out* features on the toolbar or by using the scrolling button on your mouse. Selecting the bridge shown in Figure 3 will cause a red pin to appear on the bridge selected and a popup menu will appear displaying some of the data fields for the bridge, including the *Bridge ID*, *Bridge Name*, *Bridge Greenway*, *Bridge Serial Number*, and more. Information about what these fields mean is given in detail in Section II of this guide.

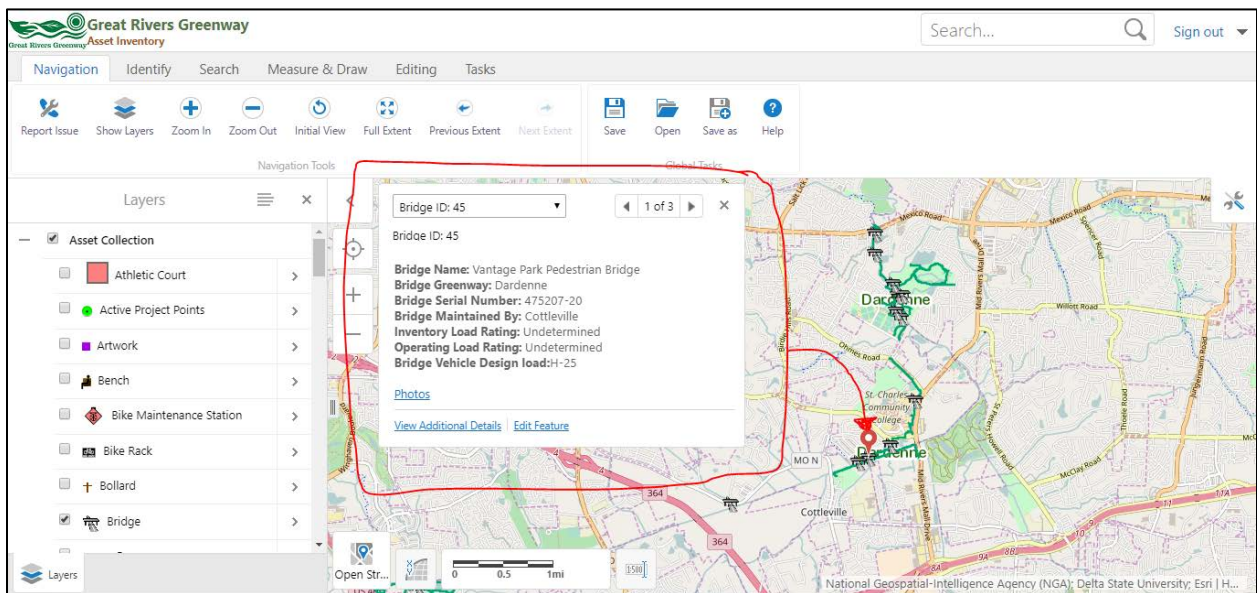


Figure 3: The popup menu. Showing some information about the selected bridge (bridge 45).

By clicking the Photos link on the popup menu you will be able to see pictures of the bridge selected. The photos can be opened in another tab on your internet browser if you click on them.

Note: The photos are automatically uploaded to the GIS in a low resolution, so if you want to access the full resolution photographs you will have to find them in their respective greenway folder on the projects drive on GRG's network server.

By clicking the View Additional Details link on the popup menu, you will be able to access all of the bridge data in a menu on the left hand side of the page. This menu can be scrolled through. Any documents that have been attached to the asset can be accessed at the bottom of this menu. This is where you can find PDFs of project plans, specifications, shop drawings, reports, etc. for each bridge. Clicking the attachments will open them in a separate tab on your internet browser.

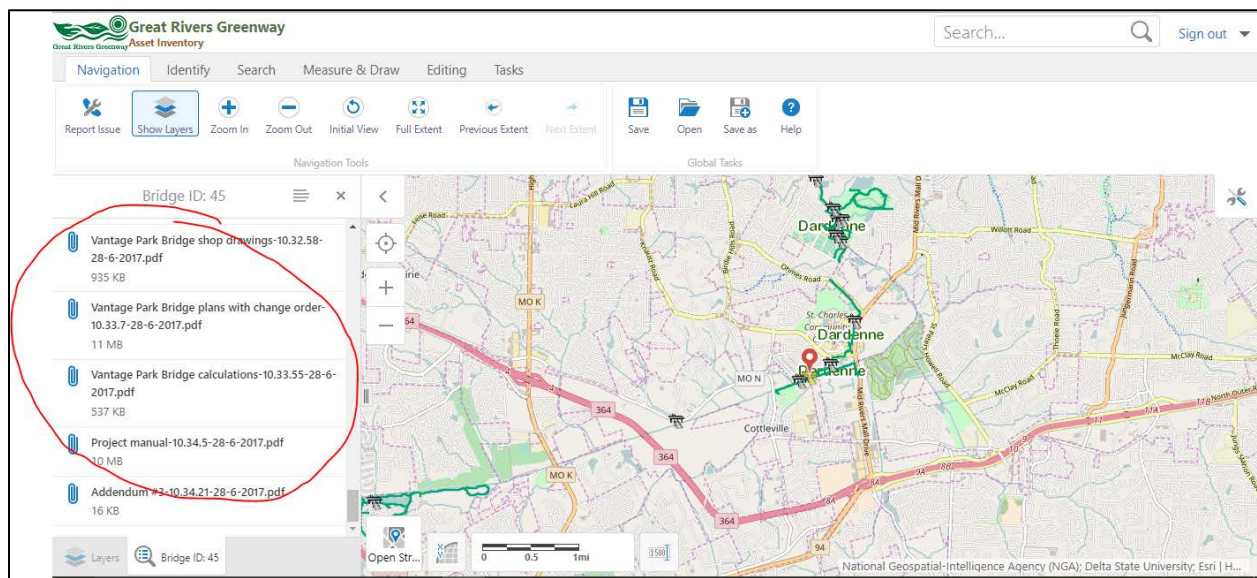


Figure 4: Some of the attachments for bridge 45.

Now the reader should be able to turn the visibility of layers on and off, and be able to access photos, attached documents, and data for a given asset on the map.

Adding and editing bridges

To add a new bridge, select the *Edit* tab on the toolbar. Click the *Create New Feature* icon on the toolbar and scroll down on the left hand menu until you see the *Bridge* layer. Click the Bridge layer.

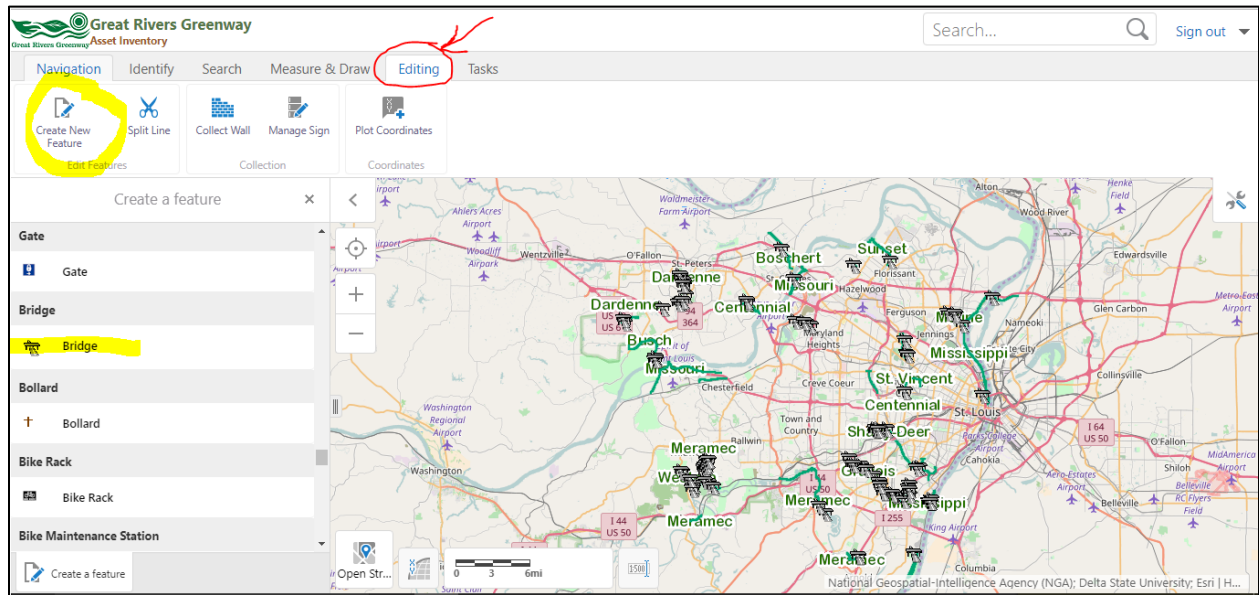


Figure 5: Create a new feature

You should now see a prompt at the bottom of your screen that says “Click or tap on the menu to add the feature”. You can either click on the map where you want the bridge to be, or you can click the *Use Geolocation* icon on the toolbar if you are using a device with GPS in the field and want the bridge to be located where you are. Once a location has been selected, the left hand menu will display a list of empty fields for you to input the data.

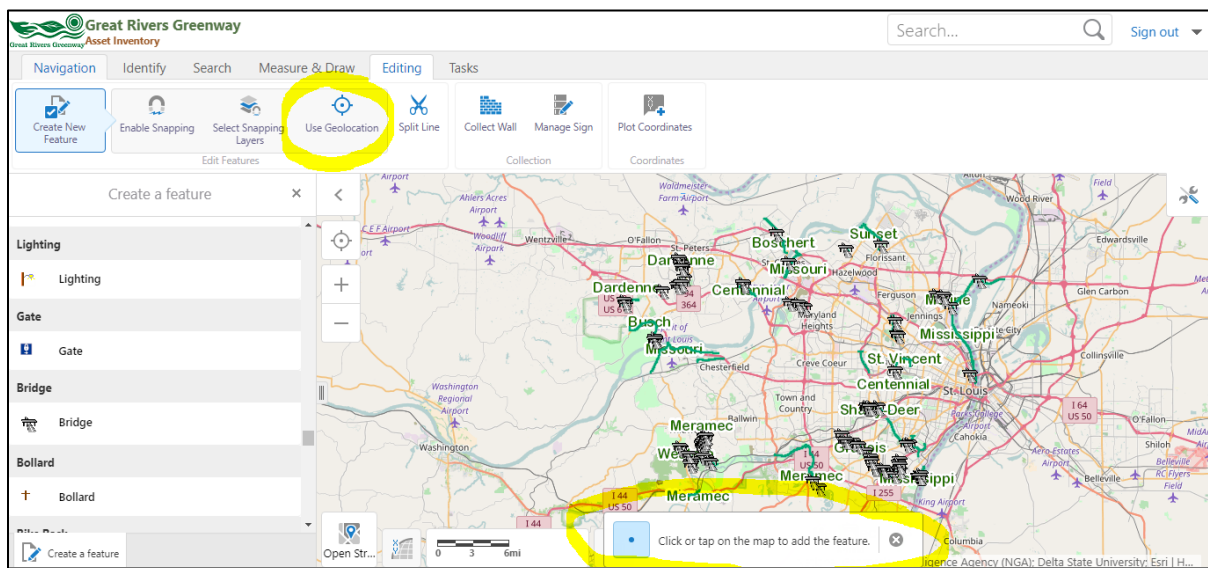


Figure 6: You can assign the location of the bridge using the *Use Geolocation* feature or by simply clicking or tapping on the location on the map

To edit an existing bridge, click on the bridge you want to edit, and in the popup menu, click the Edit Feature link. The menu on the left hand side of the page will appear and allow you to edit the data. Make sure to update the *Bridge Last Update* field and the *Bridge Editor* field before clicking *Save* at the bottom of the menu.

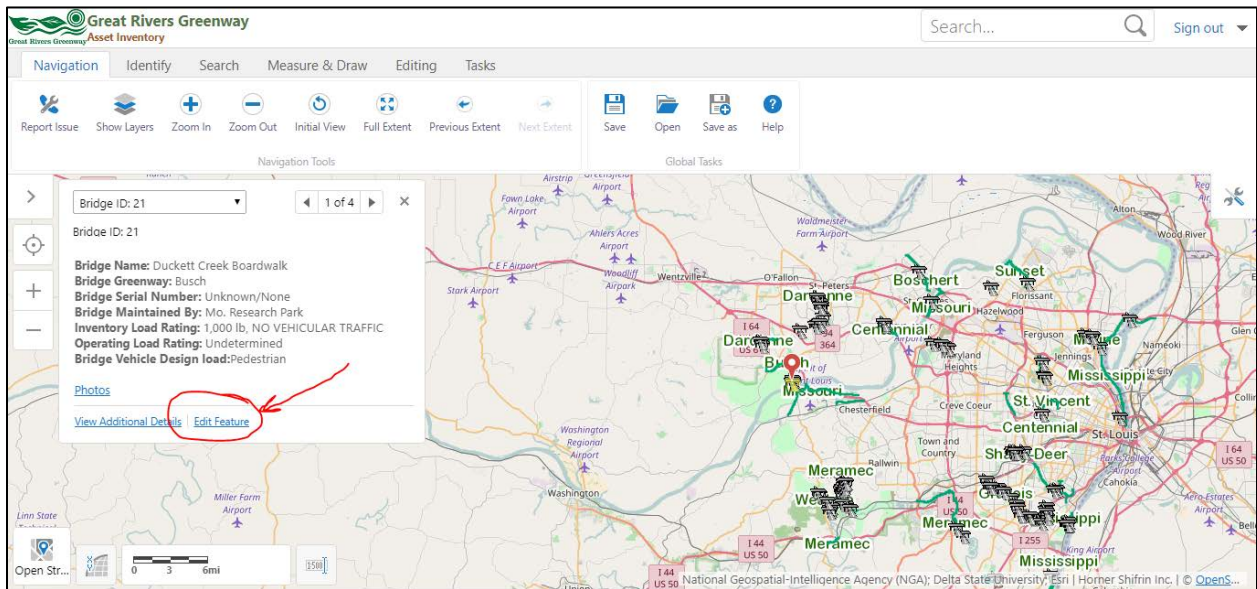


Figure 7: Edit Feature link in the popup menu

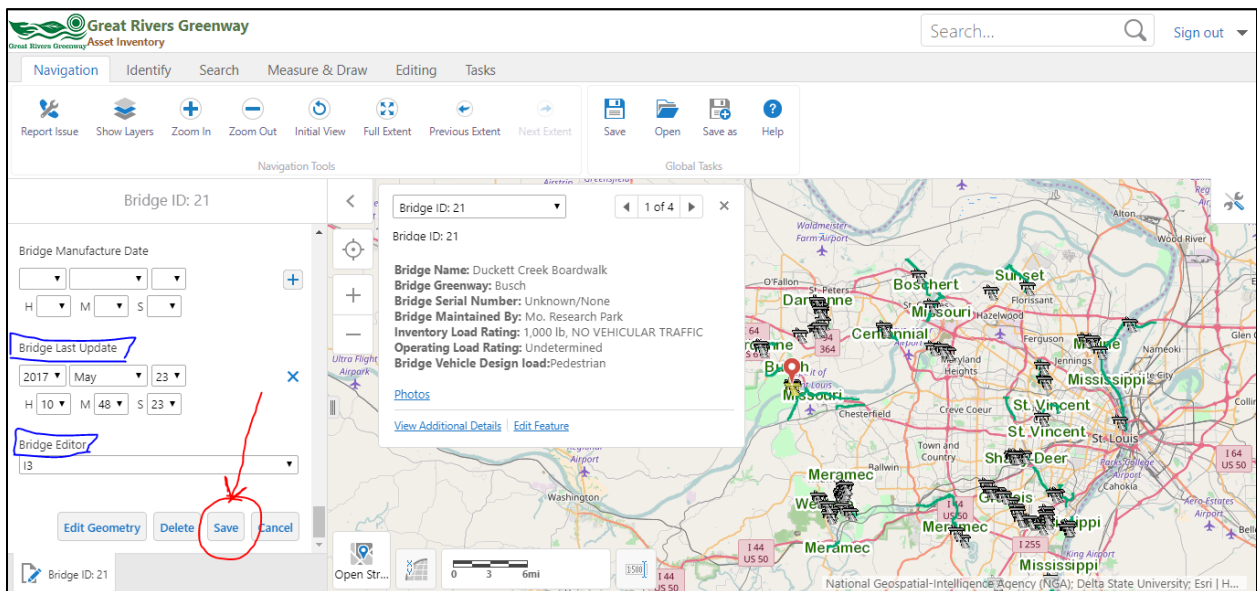


Figure 8: Bridge Last Update and Bridge Editor should be changed whenever an edit is made. Don't forget to save your edits too.

To add photos to a bridge, select the bridge you want to attach photos to and click the *Photos* link in the popup menu. You should see an icon that looks like a paperclip with a gear in front of it appear in a new popup menu. Click this icon, select the photo you would like to upload and it should give you a message confirming it has been attached to the bridge.

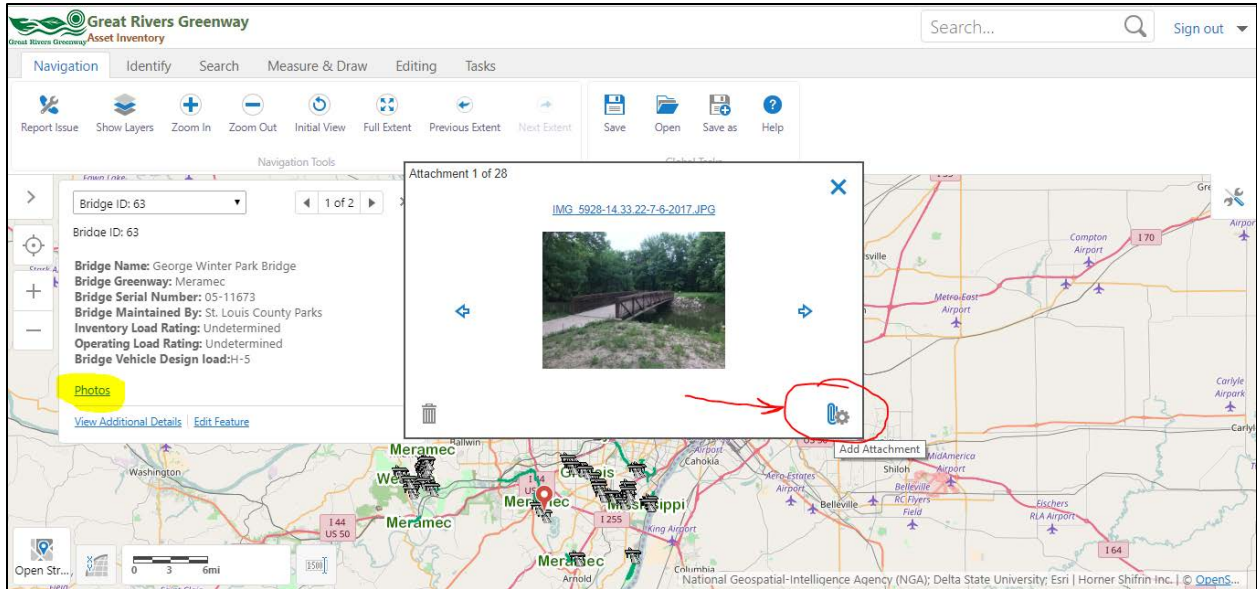


Figure 9: Add Attachment button on the Photos popup menu

To add attachments to a bridge, select the bridge you want to attach photos to and click the View Additional Details link in the popup menu. From the menu that opens up on the left hand side of the screen, click the Panel Actions Menu icon in the top right hand corner of the menu (it is shaped like four horizontal lines—see Figure 10). Clicking this will list a range of actions you can perform for the given bridge.

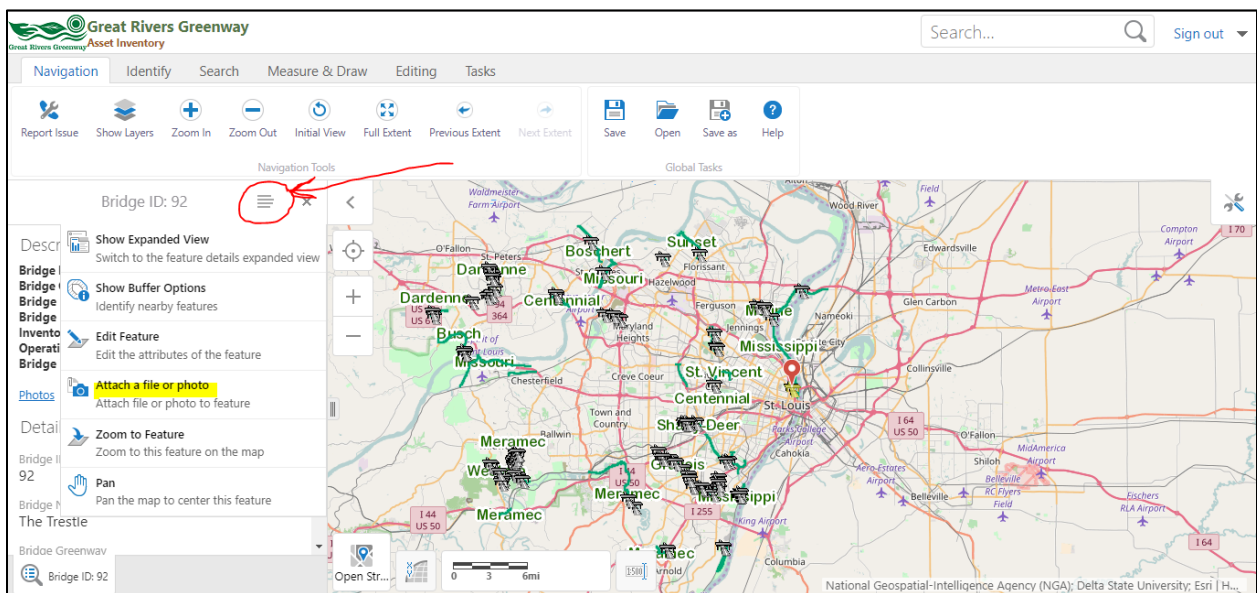


Figure 10: The Panel Actions Menu

Upon clicking the *Attach a file or photo* option a module will activate. Follow the steps in the module to upload the desired documents. Using this feature you can also upload photos at higher resolutions than is possible using the regular attach photos method.

Using a query to search bridges

Click the *Search* tab on the toolbar and select the *Query* icon. This will open a module on the left hand side of the screen. From this module you can specify the *Data Source* you want to search for (in this case, select *Bridge* in the dropdown menu). Below the *Data Source* box there will be a second dropdown menu that will display one of the fields for the selected layer. The default will be whichever field is first alphabetically (in the case of the *Bridge* layer, this will be *Bridge Average Daily Traffic*).

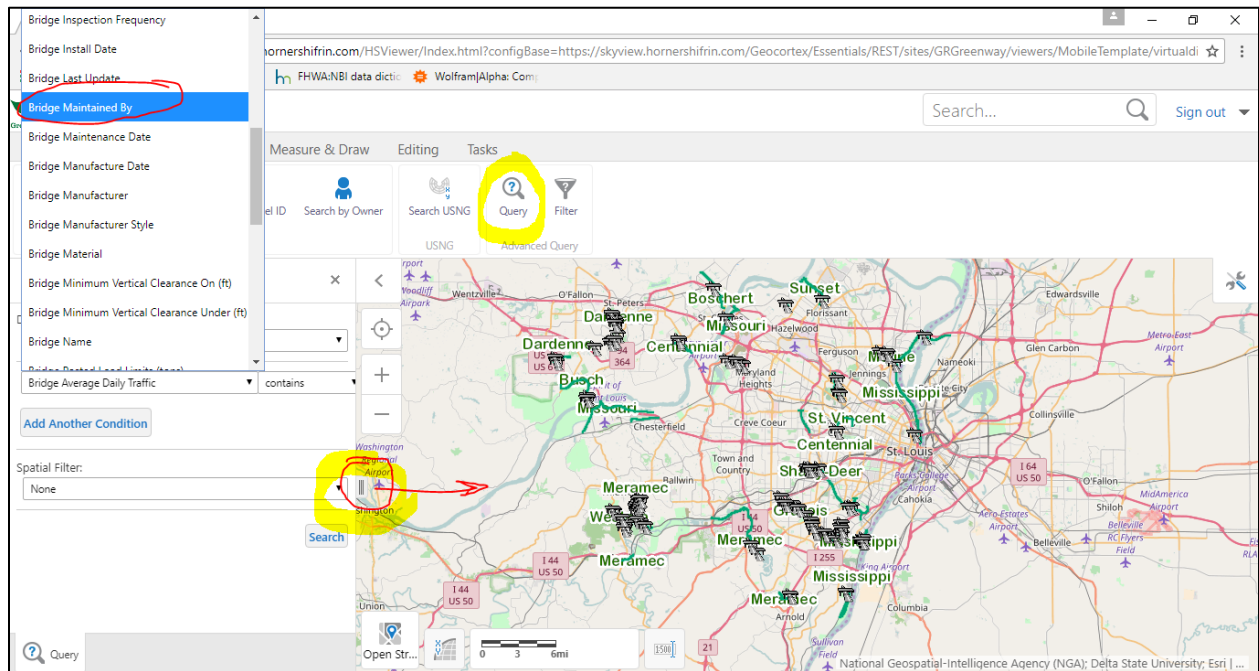


Figure 11: To see dropdown options you may need to filter to increase the width of the menu, which you can do by clicking and dragging the little side tab with three vertical lines to the right.

In this dropdown menu the user can select the data field they wish to search by. For example, the user may want to find all bridges maintained by St. Louis County Parks. To do this, select *Bridge Maintained By* in the dropdown menu, and in the space to the right of the equals sign (which you can change to greater than, less than, not equal to, etc.) select *St. Louis County Parks*, then click *Search*. The menu on the left hand side of the screen will display a list of all the bridges maintained by St. Louis County Parks.

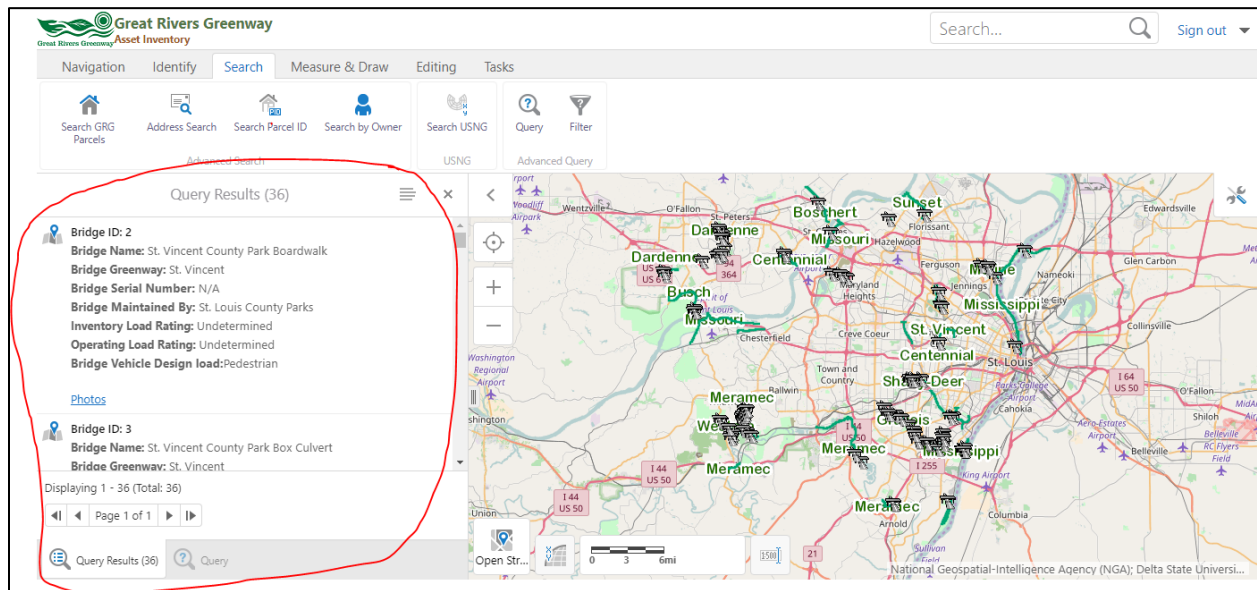


Figure 12: Results of query

Accessing tabular data for many bridges

A useful feature of the GIS is the ability to export tabular sets of data as a CSV or Excel file. To do this you must select multiple items. There are a few ways to do this. One way is to use the *Search* function. Another is to open the *Identify* tab in the toolbar. Use one of the *Identify* features to draw a shape around the assets you wish to have data for. For this tutorial, the *Rectangle* tool was used to draw a rectangle around all of the bridges on the map. Once the items have been selected, a list of the items highlighted using the Identify tool will appear on the left hand side of the screen. The selection shows 141 results (this is 107 bridges and 34 trails, because the Bridges and Trails Complete layers are turned on/visible). In the Panel Actions Menu the user is able to switch the results to a tabular format or from here the user can export all of the data for the assets highlighted to CSV or XLSX file for use in a spreadsheet program.

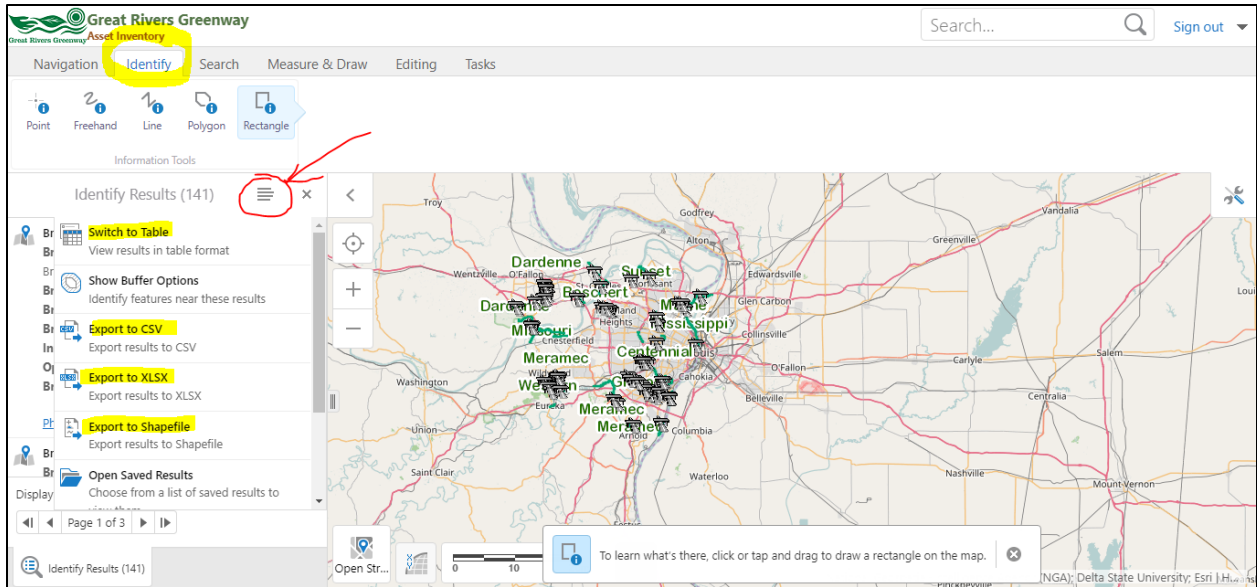


Figure 13: Panel Actions Menu for results generated using the *Identify* function

Section II: Bridge Data Fields Definitions

The bridge layer data fields are detailed below. Fields are listed in alphabetical order.

Key to Field Types:



Text: Can input text, numbers, symbols, etc.



Dropdown: Choose from a predetermined list of values



Date: Select a calendar date, month, year and time



Numerical: Input a decimal number only

Bridge Average Daily Traffic

This field gives information about the estimated daily use of the bridge based on documented trail counts. This field is a rough estimate and should not be heavily relied upon given current data (July 2017).

Bridge Comment

This field gives any additional information that is not detailed in another field. General notes can also be taken here.

Bridge Condition

This field gives a general idea of the condition of the bridge. The *Bridge Condition* is determined by a basic visual inspection—not an engineering inspection. For the summer 2017 GIS Bridge Inventory project, an engineer intern (disclaimer: NOT a licensed or professional engineer) rated the conditions of the bridges using the follow criteria:

A bridge has a condition of **Good** if it was constructed recently, has no notable damages, no major maintenance concerns, or any obvious visual blemishes.

A bridge has a condition of **Fair** if one or more of the following are true:

- the bridge appears to be an outdated structure or is over 50 years old and not renovated
- the bridge has some structural concerns identified by a licensed engineer (as in the case of the Old Chain of Rocks Bridge on the Mississippi Greenway and the Duckett Creek Boardwalk on the Busch Greenway)
- the bridge has obvious visual blemishes (e.g., graffiti, chipping paint, etc.)
- the bridge appears to be not well maintained

A bridge has a condition of **Poor** if it is over 70 years and not renovated or if there is any major deterioration.

Bridge Deck Camber

This field gives the camber of the bridge deck. This field may be important in checking ADA requirements. This data for this field is not 100% accurate and should be double-checked if any important decisions are being made with this data. This field is not applicable for box-culverts and tunnels.

- Dead Load only
- 0-1%
- 1-2%
- 2-5%
- 5-8%
- Other
- N/A

Bridge Deck Clear Width (feet)

This field gives the clear width of the bridge deck in feet. This is defined as the minimum horizontal clearance on the bridge (i.e., the maximum width that a rectangular object could have and still pass the bridge). This field is not applicable for structural culverts. For tunnels this specifies the clear width *through* the tunnel.

Bridge Deck Material

This field gives the material of the bridge decking surface. Many bridges may be a combination of multiple materials. If this is the case, the *Bridge Deck Material* will be listed as the material that makes up the useable surface (e.g., if a bridge deck consists of concrete cast-in-place onto a corrugated steel pan, then the *Bridge Deck Material* would be listed as *Concrete*).

- Concrete
- Wood or Timber
- Composite Timber
- Steel
- Aluminum
- Asphalt
- Fiber Reinforced Polymer
- Composite
- Other
- N/A

Bridge Design

This field gives additional design details about the bridge that may be important, but are not specified in another field. For example, a bridge may be a different style truss than is available in the *Bridge Type* field. If "*Other truss – Half through*" is chosen for the *Bridge Type*, then the user may specify whatever truss style they want in the *Bridge Design* field.

Bridge Designated Inspection Frequency

This field may be used to specify how often or under what conditions an asset will be inspected.

Bridge Editor

This field specifies the last GRG user who edited the asset.

Bridge Finish

This field specifies the type of finish on a bridge. This is mainly used for metal bridges, as they are the most likely to be easily effected by exposure to the elements.

- Weathered
- Painted
- Galvanized
- Metalized
- None
- Other
- N/A

Bridge Greenway

This identifies the greenway where the asset is located.

Bridge Height (feet)

For bridges, this field gives a general idea of the elevation of the bridge deck above grade. For box culverts and tunnels, this field gives the height of the opening of the asset. Some heights are estimated, and even measured heights are not precise or accurate. The general rule that was followed when taking measurements for bridges is that the asset's *Bridge Height* is the greatest distance between the top of the bridge deck to the lowest point under the bridge. This convention was not strictly followed as sometimes this height could not be measured using the means available to the data collector in the field.

Bridge ID

This is an arbitrary numerical value assigned to the asset to help keep track of the bridge in the GIS.

Bridge Inspection Date

This field gives the date of the last inspection of the asset.

Bridge Install Date

This field gives the approximate date of the installation of the asset. For most assets, the year is accurate, but the month and day are often uncertain or unknown.

Bridge Last Update

This field gives the date and time of the most recent update to the asset's information in the asset inventory.

Bridge Maintained By

This field specifies which entity is responsible for the maintenance of the asset per O&M agreements.

Bridge Maintenance Date

This field gives the approximate date of the most recent maintenance, repair, or rehabilitation of an asset. For most assets, the year is accurate, but the month and day are often uncertain or unknown.

Bridge Manufacture Date

This field gives the approximate date of the manufacture of a bridge. This only applies to prefabricated assets or assets with many prefabricated components. For most assets, the year is accurate, but the month and day are often uncertain or unknown.

Bridge Manufacturer

This field gives the manufacturer of a prefabricated asset or an asset with many prefabricated components.

Bridge Manufacturer Style

This field specifies the style of bridge by the manufacturer. The styles for three pedestrian bridge manufacturers that GRG commonly uses are given.

- Contech - Keystone
- Contech - Capstone
- Contech - Archway
- Contech - Gateway
- Contech - Link
- Contech - Expressway
- Contech - Pony
- Contech - Cable-Stayed
- Contech - Tied Arch
- Contech - Connector
- Wheeler - Timber Stringer
- Wheeler - Timber Panel-Lam
- Wheeler - Timber Trussed Arch
- Wheeler - Timber Pratt Truss
- Wheeler - Steel Warren Truss
- Wheeler - Steel Pratt Truss
- Wheeler - Steel Bowstring Truss
- Wheeler - Steel Modified Bow Truss
- Big R - Underhung Floor Beam
- Big R - H-Section Floor Beam
- Big R - Bowstring
- Big R - Modified Bowstring
- Big R - Box
- Other
- N/A
- Contech – CON/SPAN® Bridge Systems

Bridge Material

This field specifies the primary material used in the superstructure. Some bridges are made with a combination of materials. For these bridges, the dominant material or *Other* was specified as the *Bridge Material*.

- Aluminum/Wrought Iron/Cast Iron
- Concrete
- Masonry
- Steel
- Wood or Timber
- Composite Timber
- Fiber Reinforced Polymer
- Other

Bridge Minimum Vertical Clearance On (feet)

This field gives the minimum vertical clearance for users on a bridge or through a tunnel. This is given as the minimum distance from the deck surface to the lowest permanent obstruction overhead. This field is left blank for bridges with no overhead obstructions and for box culverts. This field mainly applies to through-truss bridges.

Bridge Minimum Vertical Clearance Under (feet)

This field gives a general idea of the minimum vertical clearance for persons and objects below the bridge. This is generally given as the minimum distance from a low point on the bridge to the grade below. This distance could not always be measured accurately using the means available to the data collector in the field, therefore this field should not be heavily relied upon. Most of the data in this field is therefore taken from shop drawings and project plans. This field is left blank for box culverts and bridges with no traffic below.

Bridge Name

This field gives the name that is commonly used to identify the asset. Nearly all of the bridges in GRG's asset inventory are technically unnamed, but many were identified by a given name during construction or in regular correspondence. The names and identifiers found in old documents (including project plans and specs) are usually the names specified as the Bridge Name in the asset inventory.

Bridge Posted Load Limit (tons)

This field gives the load limit that is physically posted on the bridges. These limits are given in tons.

Bridge Railing Height (inches)

This field gives the height of the railing on the asset. For box culverts this is given as the railing height that is on the path above the culvert.

Bridge Safety Railing

This field specifies the type of safety railing on the asset.

- Vertical Picket
- Horizontal
- Mesh
- Chain-link fence
- Parapet wall
- Parapet with rail
- Other
- None

Bridge Serial Number

This field indicates the serial number assigned to a bridge. This number is assigned by the manufacturer. Not all bridges have a serial number.

Bridge Span Lengths

This field gives the length of each span in a multi-span bridge. The format used in specifying the span lengths of a bridge with “ n ” spans is as follows: n spans @ (first span length')(second span length')(third span length')...(n^{th} span length'). For example, the *Bridge Span Lengths* of a bridge with four spans at distances of 14 feet, 13 feet, 12 feet, and 20 feet will be “4 spans @ (14')(13')(12')(20)’”.

Bridge Span Type

This field gives the type of bridge span.

- Simple
- Continuous
- Cantilever
- Cantilever (with suspended span)
- Simple and Continuous
- Other combination

Bridge Span Width (feet)

This field gives a general idea of the width of the asset. For bridges this is usually taken as the lateral out-to-out distance of the superstructure or the width to the centerlines of truss chords. For box culverts and tunnels this is taken as the width of the opening.

Bridge Total Length (feet)

This field gives the total length of the asset. For bridges, this is usually taken as the length from abutment-to-abutment. For tunnels and culverts, this is taken as the length from opening-to-opening.

Bridge Traffic On

This field specifies the type of traffic on the asset. For box culverts and tunnels this is given as what traffic passes above the location of the structure.

- Pedestrian
- Pedestrian-bicycle
- Bicycle
- Equestrian
- Vehicle
- Pedestrian-bicycle-equestrian
- Other

Bridge Traffic Under

This field specifies the type of traffic underneath the asset. For box culverts and tunnels this is given as what passes through the asset.

- Highway
- Road
- Railway
- Pedestrian/bicycle
- Creek or Stream
- River
- Overbank/Floodplain
- Highway-railroad
- Combination
- Other

Bridge Type

This field specifies the type of bridge or structure. Many options are given for bridge types, with the most common pedestrian bridge types being broken down into more specific categories such as half-through, through, and deck varieties of various truss types. There is also an option to identify an asset as a culvert, tunnel, or boardwalk.

- Pratt truss – Half through
- Pratt truss – Through
- Pratt truss – Deck
- Bowstring truss – Half through
- Bowstring Truss – Through
- Modified bowstring truss – Half through
- Modified bowstring truss – Through
- Warren truss – Half through
- Warren truss – Through
- Warren truss – Deck
- Vierendeel truss – Half through
- Vierendeel truss – Box

- Other Truss – Half-through
- Other Truss – Through
- Other Truss – Deck
- Other Truss – Box
- Slab
- Stringer/Multi-beam or girder
- Girder and floor beam system
- Tee beam
- Box beam or box girder
- Suspension/Tied arch
- Cable-stayed
- Boardwalk
- Tunnel
- Box Culvert
- Double box culvert
- Triple box culvert
- Quad+ box culvert
- Other culvert
- Mixed types
- Other

Bridge Vegetation Condition

This field gives the general condition of the bridge with respect to surrounding vegetation (i.e., how much vegetation is growing over the asset, how likely it is for a large tree to fall over the asset, etc.). For the summer 2017 GIS Bridge Inventory project, an engineer intern rated the *Vegetation Condition* of the bridges using the follow criteria:

A bridge's *Vegetation Condition* is **None** if there is no vegetation near the bridge members or if the surrounding vegetation is negligible.

A bridge's *Vegetation Condition* is **Light** for bridges with just low brush or vegetation, or with vegetation in the proximity but that is not yet a considerable issue.

A bridge's *Vegetation Condition* is **Moderate** if vegetation only grows heavily at the abutments, there are some trees nearby that overgrow the bridge from time-to-time, or if any trees are nearby that could grow in a way as to stress the bridge structure.

A bridge's *Vegetation Condition* is **Heavy** for bridges which are easily and often overgrown all-around, or when trees permanently grow over the bridge deck, or if the bridge is particularly vulnerable to damage from surrounding vegetation (e.g., old wooden bridges, dated steel structures, etc.).

Inventory Load Rating

Inventory rating, as defined by the 2011 AASHTO Manual for Bridge Evaluation, is the load that can safely utilize the bridge for an indefinite period of time. It is equivalent to the design level of stress. A bridge that is not subjected to more than this stress level can be expected to safely function for the intended life of the bridge. This is left blank for nearly all of the bridges in the GRG asset inventory, as a detailed engineering analysis is needed to determine the load rating.

Miscellaneous Design Loads

This field gives any design loads specified in the plans, specifications, or drawings for an asset that are not detailed in any other fields for the Bridge layer.

Operating Load Rating

Operating rating, as defined by the 2011 AASHTO Manual for Bridge Evaluation, is the maximum permissible live load stress level to which a structure may be subjected. Using a bridge at its operating load may shorten the life of the bridge. This field is left blank for nearly all of the bridges in the GRG asset inventory, as a detailed engineering analysis is needed to determine the load rating.

Pedestrian Design Load

This field gives the design pedestrian live load or the general live load for the structure. This is often given in pounds per square foot (psf).

Vehicle Design Load

This field gives the vehicle used to design the asset. This is often an AASHTO truck, though sometimes GRG's assets may only have been designed for a railway load, pedestrian load, etc.

- H-5
- H-10
- H-15
- H 15-44
- HS-15
- H-20
- H 20-44
- HS-20
- HS 20-44
- HS-20+Mod
- HS-25
- HL-93
- Pedestrian
- Railroad
- HS-10
- HS-15-44
- H-25
- Personal vehicle of specified weight
- Other
- Unknown