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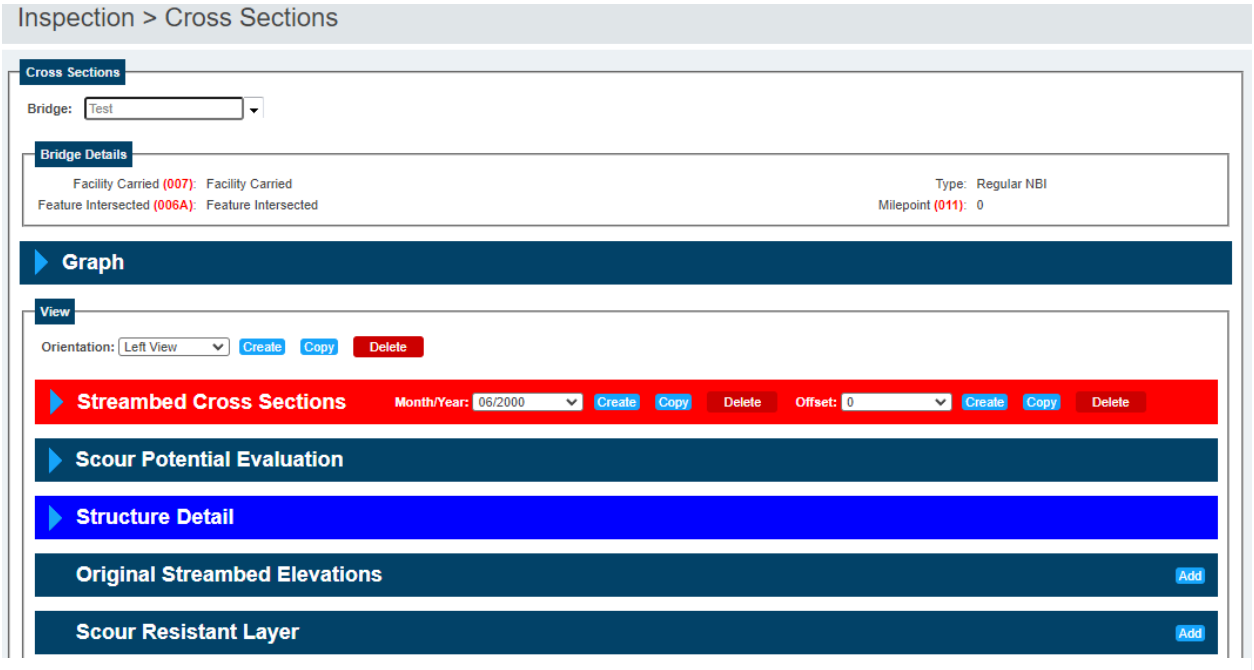
Memorandum

From:	Tim Welter, E.I.T., Bridge Maintenance Engineer
Approved By:	Henry Henning, P.E., Bridge Inspection Engineer
Date:	May 3rd, 2022
Subject:	BrM Cross Section Module Guidance

The intent of this guidance is to provide familiarity with the cross-section module within our Structure Management system powered by AASHTOWare BrM. Cross sections are required for structures that meet the requirements outlined in underwater section of the bridge inspection manual. In addition to this guidance more information about the BrM Cross Section is available within the application using the question mark in the top right-hand corner of the screen or here.

Navigation

The cross-section module is in the Inspection Tab under the Cross Section Task (Inspection>Cross Sections). This task consists of six different panes Graph, Streambed Cross Sections, Scour Potential Evaluation, Structure Detail, Original Streambed Elevations, and Scour Resistant Layer. Figure 1 shows an overview of the module.



View Selection

Before any cross section can be entered stationing and views must be defined. The views (Right and Left are to be defined in conjunction with MDT 145 Bridge Inventory Direction. Figure 2 shows an example of view selection in conjunction with inventory direction.

Left view - data is for the left side of the bridge (when looking ahead on-line)

Right view - data is for the right side of the bridge (when looking ahead on-line)

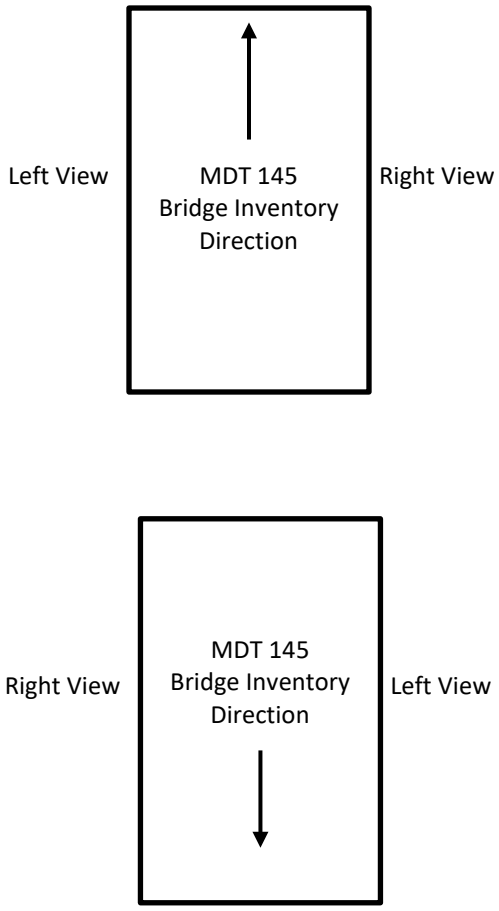


Figure 2: View Selection Diagram

Structure Detail

The Structure Detail pane is used to enter the Structure detail information (Substructure and Superstructure information). This is used so an elevation view of the structure can be included in the cross section. Each view (right or left) has its own structure detail if a bridge is symmetrical the views can be copied to both views. Structure details are required for every bridge with the only exception being culverts, culverts only need a 0 point. Once initially created structure details can be viewed, added, changed, or deleted from this pane. Figure 3 shows an overview of the structure detail pane.

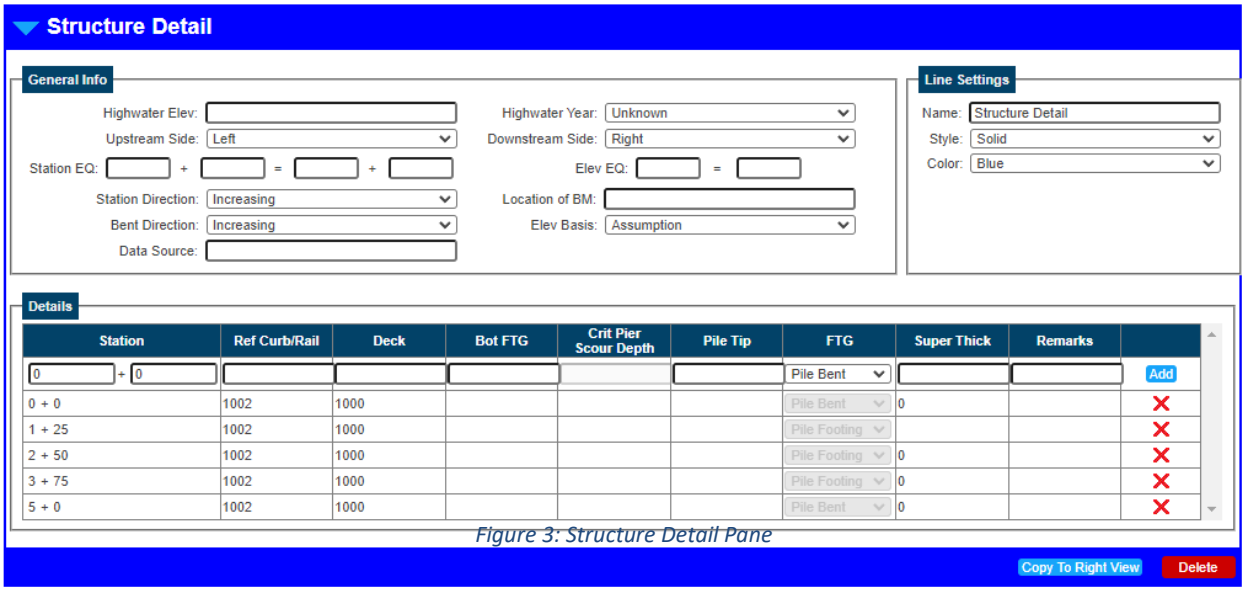


Figure 3: Structure Detail Pane

General Info

The General Info pane contains bridge hydrology information including highwater elevation and corresponding year, specify the upstream and downstream sides of the bridge, and define location of benchmark and other information related to the structure. If information is unknown the value should be left blank.

Highwater Elevation/Year

Highwater elevation and year are used to track highwater elevation and the year of highwater. This information should only be populated by inspectors if the information is known.

Upstream and Downstream

The Upstream and Downstream sides (right or left) of the bridge are determined when looking ahead on-line in conjunction with MDT 145 Bridge Inventory Direction.

Station and Elevation Equation

Station EQ and Elevation EQ can be used to modify the bridge in the event of a change in elevation or station and does not need to reflect plans for the bridge. The station and elevation equation are used to move the graph on the X and/or Y axis.

Station and Bent Direction

Station and Bent Direction are used to determine the direction of stationing and bent numbering and should always be increasing.

Location of Benchmark

Location of benchmark is used to capture the location of the benchmark used for the structure detail. All structure information should be entered relative to abutment 1.

Elevation Basis

This field captures the type of platform the elevations for the structure details are based on. The field contains the parameters below:

Code:	Description:
Assumption	Elevations are based on assumption
US Geodetic Survey	Elevations are based on a USGS benchmark.
Plans	Elevations are based on Plans

It is recommended to use an assumed elevation of 100 when entering in Structure Details and use the Elevation EQ to set the actual elevation if desired.

Data Source

This field captures where the structure details came from (ex. Plans, Measurements, Survey, etc.…).

Line Settings

Line settings are used to change the name, style, and color of the structure detail line. This can be used to make the line easier to see on the graph.

Details

The details section is used to define the structure details such as pier locations, deck elevations, footing types and elevations, as well as superstructure thickness.

Station

Station details are used to define where each structure detail point is located. This information is entered in as stations and can be taken from plans, measurements, or a survey. Multiple stations for the same pier may be needed to better define the structure detail if there is a change in superstructure depth.

Ref Curb/Rail

Reference Curb/Rail is used to define the distance between the top of the deck and where soundings are typically measured from (top of bridge rai/ top of curb). This value will be changed where the cross section is graphed to make everything relative to the deck. Note that if soundings are typically taken from the top of the bridge deck this value should be entered as the same elevation as the deck.

Deck

The Deck value is used to define the Y-coordinate measurement for the structure detail. All values for graphing and measurements are relative to the deck. It is acceptable to have the deck elevation be set to an assumed elevation of 100. However, if it is easier to enter deck elevations from plans that can be done. If there is a slope to the bridge the slope should be accounted for in the deck. See Figure 4 for the example data entry and Figure 5 for the corresponding graph.

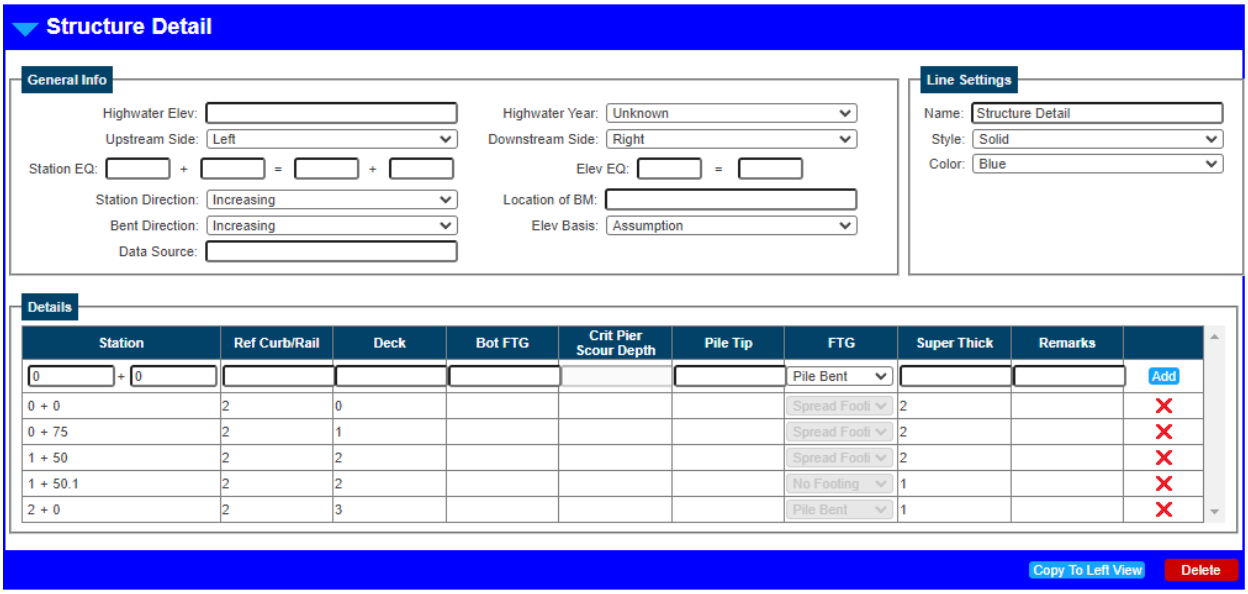


Figure 4: Sloped Deck Entry Example

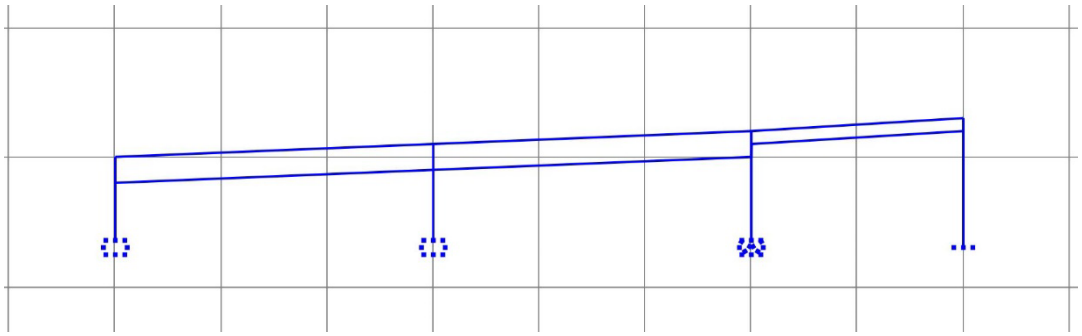


Figure 5: Sloped Deck Example Graph

Bot FTG

The Bot FTG column stands for Bottom of Footing and is the elevation of the bottom of the footing relative to the deck. Footing lines are drawn down from the Deck line and do not connect horizontally from one measure to the next. If this value is unknown leave this value blank and do not enter 0.

Crit Pile Scour Depth

The Crit Pier Scour Depth column is a place to track the Critical Pier Scour Depth, or depth at which the pier will become unstable if exposed. This value graphs itself as a small x-mark on the pier to indicate the location. This value is determined when a scour analysis is performed on the bridge and is not the responsibility of the bridge inspectors.

Pile Tip

The Pile Tip column indicates the estimated pile tip depth of the pier as an elevation. If this value is unknown leave this value blank and do not enter 0.

FTG

The FTG column allows the ability to specify the type of footing for each bent. The different types of footings have different symbols on the graph. Please note that every pier that is created and has a defined FTG will be given a pier numbering. If multiple stations are required for the same pier due to change in superstructure depth, ensure that only one station has a footing defined and the others are defined has no footing.

Super Thick

The Super Thick measurement subtracts from the Deck line and connect horizontally from one measure to the next. It is used to draw the bottom chord of the structure, or superstructure thickness. If the superstructure thickness changes at a bent a second structure detail should be added with no footing defined for FTG and have a slightly larger or smaller station. This line can be used to draw the openings of culverts and buried structures. It is not required to generate a graph but will significantly increase the ease of interpretation of the graph for. It is not expected of bridge inspectors to graph curved opening of culverts and buried structures.

Remarks

Remarks are used as a comments field and are to be used to define what Abutment/Pier each station is. For example, the Pier 2 detail should have a remark saying Pier 2.

Special Structure Detail Cases

Culverts

Tops or bottoms of culverts can be drawn into the structure detail if desired. It is not required of MDT Bridge inspectors to draw curved openings for culverts.

Arched Superstructures

It is possible to draw arched superstructures with the structure detail window. While it is not required to draw the curve of arched superstructures (unless desired) the superstructure thickness should be entered as the distance from the bottom of the deck to the lowest point of the arch in most cases.

Streambed Cross Sections

The Streambed Cross Section Pane is used for recording channel measurements and will be what is used most often. Figure 8: Streambed Cross Sections Overview Shows an overview of the streambed cross sections pane.

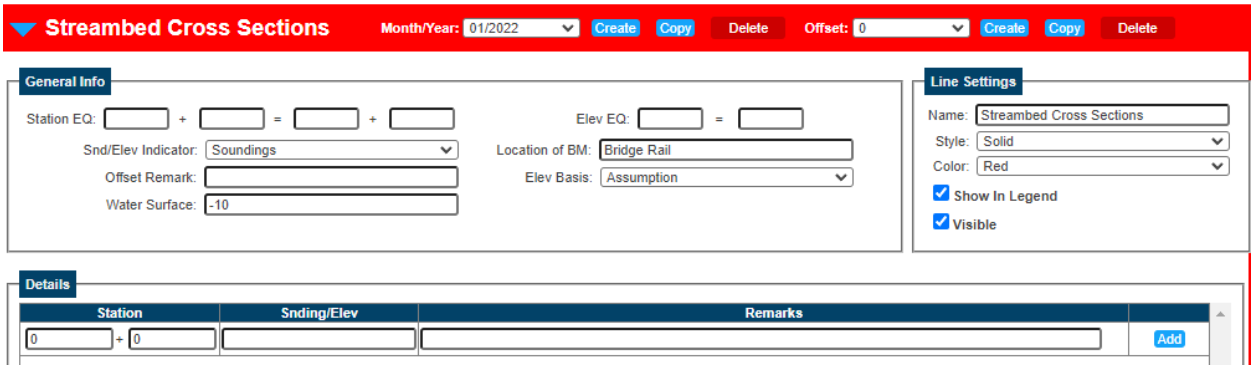


Figure 6: Streambed Cross Sections Overview

Offsets

Offsets are used to define how far away from the bridge you are for each view (right or left). Offsets must be created before a cross section can be entered. Offsets are defined starting from the upstream side of the bridge. For example, if the right side of the bridge is the upstream side the upstream cross section would be created for the right view and have a 0 offset and the downstream side would be created for the left view and have an offset equal to the width of the bridge. Offsets should be measured to the nearest foot. Figure 9: Cross Section Offsets shows an example of defining offsets based on the upstream side of the bridge.

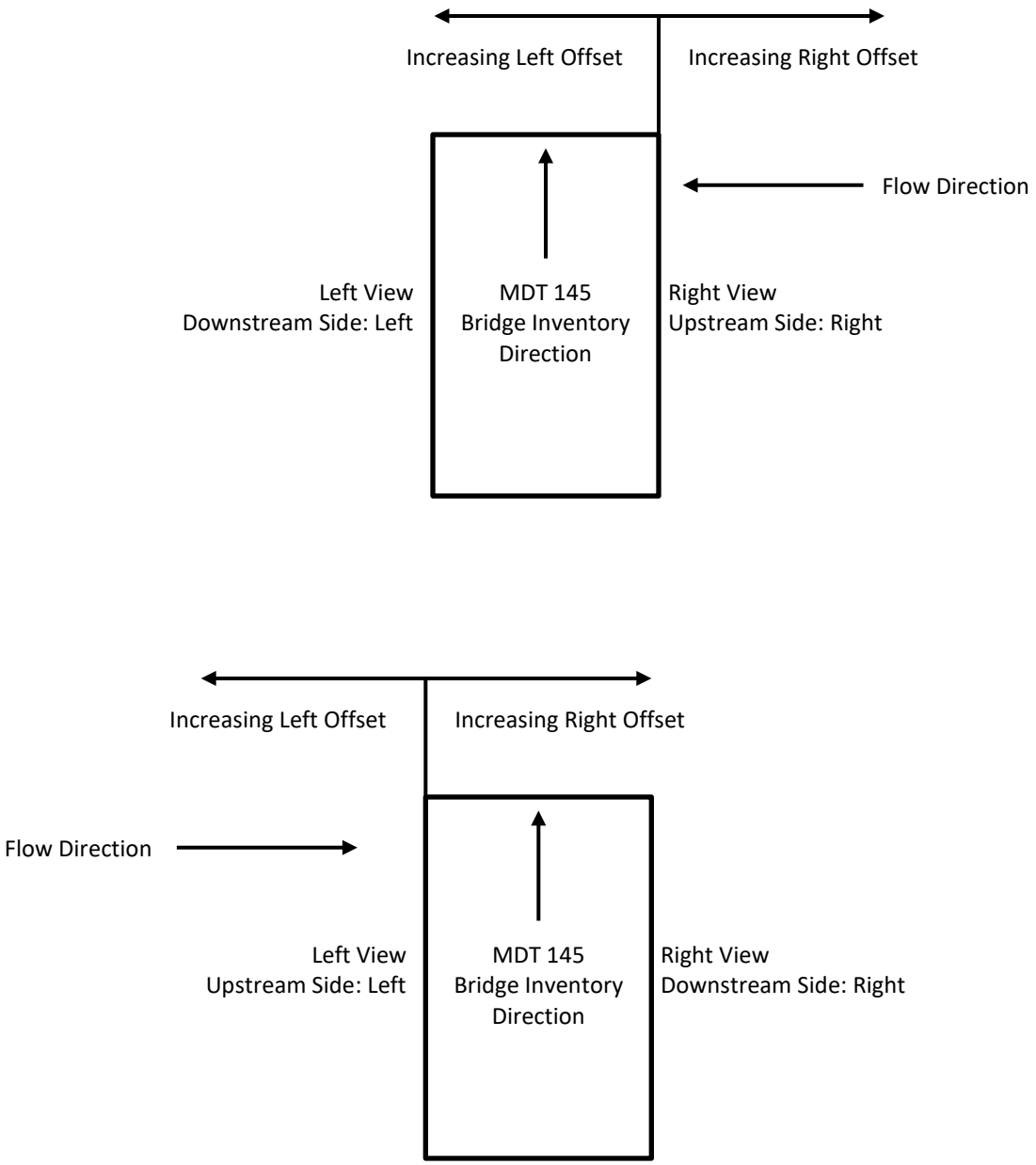


Figure 7: Cross Section Offsets

Month and Year

Month and year are used to define when the cross section is taken. Offsets must be defined before a month and year can be entered for a cross section.

General Info

The general info section is used to define general information about the cross section and can be used to shift the cross section to better align with structure details and previous cross sections.

Station and Elevation Equation

Station and Elevation Equation are used to move the cross section to help align it with the structure detail and/or previous cross sections as needed. The station equation will move the cross section left or right. The Elevation equation will adjust cross sections up or down. For example, if measurements are normally taken measuring stationing from the beginning of the approach slab, but on this occasion are measured from the beginning of deck 25' further in the direction of stationing, then the inspector can enter in the Station Equation that 0+00 = 0+25 to adjust the stationing of the cross section to match the previous cross sections. The same process can be used for the Elevation Equation to adjust if soundings were taken from a different reference point.

Soundings/Elevations Indicator

Sounds/Elevations Indicator dropdown indicated if the vertical measurements given in the Details section are given as soundings (a distance to be subtracted from the bridge deck) or as elevations (a distance to be graphed from sea-level). It is most common for cross sections to be taken as soundings.

Location of BM

Location of Benchmark is used to define where the Soundings/Elevations were taken from. For example, if the soundings were taken from the top or the bridge rail then top of bridge rail should be entered into this field.

Offset Remark

This field is used to help better define where the cross section was taken. Examples of this can include, Upstream side of the bridge, 25’ upstream, downstream side of the bridge, etc.…

Elevation Basis

This field captures the type of platform the elevations for the cross section are based on. The field contains the parameters below:

Code:	Description:
Assumption	Elevations are based on assumption
US Geodetic Survey	Elevations are based on a USGS benchmark.
Plans	Elevations are based on Plans

Water Surface

Water surface is used to define the water surface when the cross section was taken. If the measurement is taken as soundings the water surface measurement should be entered in as a negative value measured from the top of the bridge deck.

Inspection

Inspection is a drop down to link the cross section to a specific inspection.

Line Settings

Line settings are used to change the name, style, and color of the structure detail line.

Details

The details section is used to define the cross section and is where soundings are entered. Station is used to define where along the bridge the measurement is taken(x-coordinate). Sounding/Elevation is used to define y coordinate of the cross section. Remarks is used to define any comments about the cross section. It is MDT policy to add remarks for the edge of water measurement, each pier, and any others that help interpret the cross-section information.

Original Streambed Elevations

Original Streambed Elevations are a cross section that marks out the original stream bed. The data entry for these follows the same guidelines as Streambed Cross Sections. The first cross section of newly constructed structures being inventoried should be entered as an original streambed elevation. This information should not be pulled from plans and should always be measured.

Graph

The graph section will allow you to view multiple different cross sections and overlay them on top of each other. The graph automatically refreshes when changes to the cross section or structure detail are made however this can be toggled off by unselecting refresh automatically.

To change what is displayed on the graph you need to open the Parameters menu in the top left side of the graph window. You can change the orientation, Plot Background, and last Cross Section Color. The scale of the graph is automatically set by BrM but can be adjusted in the bottom of the Parameter menu. The graph can be printed or downloaded using the button on the top right side of the graph.

Scour Potential Evaluation and Scour Resistant Layer

Scour Potential Evaluation and Scour Resistant Layer information should only be entered in if it is available. It is not expected of bridge inspectors to enter this information. The Scour Potential Evaluation section is for recording of a hydraulic analysis report, particularly the scour potential data. If no scour potential reports are recorded, this section will appear BrM blue with an Add button. It is possible to have multiple Scour Potential Evaluations at a time, either for updated data or perhaps for different Q-values.