Four Span Simply Supported Steel Plate Girder Input
As-Built Model Only

September, 2011
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1. Creating a New Bridge File

To create a new bridge right click on the folder where you want to save the bridge and choose New – New Bridge. New window will appear, fill the data as shown below:

Template: Template bridges serve as templates to help develop other bridges.
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**Bridge Completely Defined:** Check the box if the specified bridge is completely defined within the Virtis/Opis database. Do not check this box if some of the structures making up the bridge are not in the database.

**BridgeWare Association:** Opens the BridgeWare Association window allowing you to specify this current bridge as a Virtis, Opis or Virtis/Opis bridge and also to link this current bridge to a bridge in the Pontis database if Pontis is installed.

Virtis/Opis computes this value as the Truck PCT * ADT * Directional PCT

The data to input traffic values can be found on VDOT’s website at:

FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Virginia Department of Transportation
Traffic Engineering Division
2000
Annual Average Daily Traffic Volume Estimates By Section of Route
Bolestauf Maintenance Area

<table>
<thead>
<tr>
<th>Route</th>
<th>Length</th>
<th>AADT</th>
<th>QA</th>
<th>4Tire</th>
<th>Bus</th>
<th>Truck</th>
<th>QC</th>
<th>K Factor</th>
<th>Dir Factor</th>
<th>AADT</th>
<th>QW</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolestauf County</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prices Bluff Rd</td>
<td>2.10</td>
<td>185</td>
<td>R</td>
<td>NA</td>
<td>NA</td>
<td>H-307</td>
<td>4L</td>
<td>0.111</td>
<td></td>
<td></td>
<td></td>
<td>11/03/2004</td>
</tr>
<tr>
<td>Bridge St</td>
<td>0.27</td>
<td>370</td>
<td>G</td>
<td>95%</td>
<td>2%</td>
<td>1%</td>
<td>NA</td>
<td>C</td>
<td>F</td>
<td>0.674</td>
<td>390</td>
<td>G</td>
</tr>
<tr>
<td>Main St</td>
<td>0.28</td>
<td>370</td>
<td>N</td>
<td>95%</td>
<td>2%</td>
<td>1%</td>
<td>NA</td>
<td>N</td>
<td>N</td>
<td>0.674</td>
<td>390</td>
<td>N</td>
</tr>
<tr>
<td>Main St</td>
<td>0.04</td>
<td>38</td>
<td>R</td>
<td>NA</td>
<td>NA</td>
<td>H-718</td>
<td>N</td>
<td>0.111</td>
<td></td>
<td></td>
<td></td>
<td>05/09/2007</td>
</tr>
</tbody>
</table>

370 x (0.02 + 0.02 + 0.01) = 19

**OK button**: Saves the bridge description in this window and its tabs to memory and closes the window.

**Apply button**: Saves the bridge description in this window and its tabs to memory and keeps the window open.

**Cancel button**: Closes the window without saving the bridge description in this window and its tabs to memory.

**Note**: It is strongly recommended that the bridge data be saved at this point, and regularly to avoid lost data.
2. Material Properties Input

**Structural Steel**

Copy from Library button: Opens the Library – Materials – Structural Steel window, allowing you to copy a set of structural steel material properties from the library to this window.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Library</th>
<th>Units</th>
<th>Fy (ksi)</th>
<th>Fu (ksi)</th>
<th>alpha</th>
<th>Density/Lin (lbf/ft)</th>
<th>Modulus of Elasticity (ksi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1105 to 1306</td>
<td>Built 1105 to 1306 - steel unknown</td>
<td>Standard US Customary</td>
<td>36.000</td>
<td>60.000</td>
<td>0.00000065</td>
<td>0.4500</td>
<td>29000.00</td>
<td></td>
</tr>
<tr>
<td>1105 to 1306</td>
<td>Built 1105 to 1306 - steel unknown</td>
<td>Standard US Customary</td>
<td>33.000</td>
<td>55.000</td>
<td>0.00000065</td>
<td>0.4500</td>
<td>29000.00</td>
<td></td>
</tr>
<tr>
<td>AASHTO M 98(91)</td>
<td>AASHTO M 98(91) or AASHTO A 5 (1967)</td>
<td>Standard US Customary</td>
<td>23.000</td>
<td>40.000</td>
<td>0.00000065</td>
<td>0.4500</td>
<td>29000.00</td>
<td></td>
</tr>
<tr>
<td>AASHTO M 98(91)</td>
<td>AASHTO M 98(91) or AASHTO A 5 (1968)</td>
<td>Standard US Customary</td>
<td>46.000</td>
<td>70.000</td>
<td>0.00000065</td>
<td>0.4500</td>
<td>29000.00</td>
<td></td>
</tr>
<tr>
<td>AASHTO M 98(91)</td>
<td>AASHTO M 98(91) or AASHTO A 5 (1967)</td>
<td>Standard US Customary</td>
<td>55.000</td>
<td>80.000</td>
<td>0.00000065</td>
<td>0.4500</td>
<td>29000.00</td>
<td></td>
</tr>
<tr>
<td>AASHTO M 103</td>
<td>AASHTO M 103 or AASHTO A 646 – &gt;4” to &lt;=8” thick, inclusive</td>
<td>Standard US Customary</td>
<td>36.000</td>
<td>60.000</td>
<td>0.00000065</td>
<td>0.4500</td>
<td>29000.00</td>
<td></td>
</tr>
<tr>
<td>AASHTO M 103</td>
<td>Built steel 103 - steel unknown</td>
<td>Standard US Customary</td>
<td>36.000</td>
<td>60.000</td>
<td>0.00000065</td>
<td>0.4500</td>
<td>29000.00</td>
<td></td>
</tr>
<tr>
<td>ASTM A362 - &lt;= 3/4”</td>
<td>ASTM A 362 - &lt;= 3/4” thick and under</td>
<td>Standard US Customary</td>
<td>56.000</td>
<td>75.000</td>
<td>0.00000065</td>
<td>0.4500</td>
<td>29000.00</td>
<td></td>
</tr>
<tr>
<td>ASTM A362 - &gt; 1 1/2” to &lt;=4” thick, inclusive</td>
<td>ASTM A 362 - &gt; 1 1/2” to &lt;=4” thick, inclusive</td>
<td>Standard US Customary</td>
<td>42.000</td>
<td>57.000</td>
<td>0.00000065</td>
<td>0.4500</td>
<td>29000.00</td>
<td></td>
</tr>
<tr>
<td>ASTM A362 - &gt; 4” to &lt;=4” thick, inclusive</td>
<td>ASTM A 362 - &gt; 4” to &lt;=4” thick, inclusive</td>
<td>Standard US Customary</td>
<td>46.000</td>
<td>60.000</td>
<td>0.00000065</td>
<td>0.4500</td>
<td>29000.00</td>
<td></td>
</tr>
</tbody>
</table>

Material Properties

- Specified minimum yield strength (Fy) = 36.000 ksi
- Specified minimum tensile strength (Fu) = 55.000 ksi
- Coefficient of thermal expansion = 0.00000065
- Density = 0.4500 lbf/ft³
- Modulus of elasticity (E) = 29000.00 ksi

Click to accept and close
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Concrete

Double click to open

Click to use data from library

Copy from Library button: Opens the Library – Materials – Concrete window, allowing you to copy a set of concrete material properties from the library to this window.
### Four Span Simply Supported Steel Plate Girder Input

**As-Built Model Only**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Library</th>
<th>Units</th>
<th>Eo</th>
<th>Fy</th>
<th>Density</th>
<th>Modulus of Elasticity</th>
<th>Poisson's Ratio</th>
<th>Modulus of Plasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3 Traffic</td>
<td>Class A3 Traffic Concrete</td>
<td>Agency Defined</td>
<td>US Customary</td>
<td>3000</td>
<td>11,000</td>
<td>0.0000166666</td>
<td>0.165</td>
<td>0.145</td>
<td>0.325</td>
</tr>
<tr>
<td>Class A</td>
<td>Class A cement concrete</td>
<td>Standard</td>
<td>SI Metric</td>
<td>2000</td>
<td>11,000</td>
<td>0.0000166666</td>
<td>0.165</td>
<td>0.145</td>
<td>0.325</td>
</tr>
<tr>
<td>Class B</td>
<td>Class B cement concrete</td>
<td>Standard</td>
<td>SI Metric</td>
<td>1700</td>
<td>11,000</td>
<td>0.0000166666</td>
<td>0.165</td>
<td>0.145</td>
<td>0.325</td>
</tr>
<tr>
<td>Class C</td>
<td>Class C cement concrete</td>
<td>Standard</td>
<td>SI Metric</td>
<td>2600</td>
<td>11,000</td>
<td>0.0000166666</td>
<td>0.165</td>
<td>0.145</td>
<td>0.325</td>
</tr>
<tr>
<td>Class D</td>
<td>Class D cement concrete</td>
<td>Standard</td>
<td>SI Metric</td>
<td>3000</td>
<td>11,000</td>
<td>0.0000166666</td>
<td>0.165</td>
<td>0.145</td>
<td>0.325</td>
</tr>
<tr>
<td>Class E</td>
<td>Class E cement concrete</td>
<td>Standard</td>
<td>SI Metric</td>
<td>4000</td>
<td>11,000</td>
<td>0.0000166666</td>
<td>0.165</td>
<td>0.145</td>
<td>0.325</td>
</tr>
<tr>
<td>PS 6 (US)</td>
<td>PS 6.3 ksi (Fcc = 6.3 ksi)</td>
<td>Agency Defined</td>
<td>US Customary</td>
<td>6,500</td>
<td>5,500</td>
<td>0.0000166666</td>
<td>0.165</td>
<td>0.145</td>
<td>0.325</td>
</tr>
</tbody>
</table>

#### Class A4 (US)

- **Compressive strength at 28 days (ksi):** 4,000
- **Initial compressive strength (ksi):**
- **Coefficient of thermal expansion:** 0.0000000000 1/°F
- **Density (lb per cubic foot):** 119 lb/ft³
- **Density (lbs per cubic foot):** 119 lb/ft³
- **Modulus of elasticity (ksi):** 364,415
- **Initial modulus of elasticity:**
- **Poisson's ratio:** 0.000
- **Composition of concrete:** Normal
- **Modulus of rupture:** 0.800 ksi
- **Gross factor:** 1.000
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Reinforcing Steel

Double click to open

Click to use data from library

Copy from Library button: Opens the Library – Materials – Reinforcing Steel window, allowing you to copy a set of reinforcing steel material properties from the library to this window.
### FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

**AS-BUILT MODEL ONLY**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Liability</th>
<th>Units</th>
<th>Fy</th>
<th>Fu</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 300</td>
<td>300 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 500</td>
<td>500 kPa reinforcing steel (rail steel)</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 310</td>
<td>310 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 350</td>
<td>350 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 375</td>
<td>375 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 400</td>
<td>400 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 450</td>
<td>450 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 500</td>
<td>500 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 550</td>
<td>550 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 600</td>
<td>600 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 700</td>
<td>700 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 800</td>
<td>800 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 900</td>
<td>900 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
<tr>
<td>Grade 1000</td>
<td>1000 kPa reinforcing steel</td>
<td>Standard</td>
<td>S / Metric</td>
<td>330.00</td>
<td>500.00</td>
<td>115/48.90</td>
</tr>
</tbody>
</table>

**Material Properties**

- **Specified yield strength (Fy)**: 40,000 kPa
- **Modulus of elasticity (E)**: 290,000 kPa
- **Ultimate strength (Fu)**: 70,000 kPa

Select Type:
- [ ] Plain
- [ ] Exposed
- [ ] Bolted
- [ ] Other

Click to accept

Click to accept and close
3. Appurtenances Input

**Parapet**

Enter the parapet dimensions as shown on the As-Built drawings and the unit load.

Note: In this design example the parapet is not a solid concrete structure, but is an open parapet with posts and a rail on top. Therefore, the parapet load was computed manually and simply entered into the additional load text box.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Impact / Dynamic Load Allowance Input

- Materials
- Beam Shapes
- Appurtenances
  - Parapet
  - Median
  - Railing
  - Generic
- Impact / Dynamic Load Allowance
- Factors
- SUPERSTRUCTURE DEFINITIONS
- BRIDGE ALTERNATIVES

Double click to open

AASHTO LRFD default

Click to accept and close
4. Factors Input

Factors Input: Allows you to enter factors that are specific for this bridge only. These factors can be selected to override the System Defaults library factors on the Analysis tab of the Girder System Superstructure Definition window as discussed later in this example. However, factor overrides will remain when files are imported into future versions of Virtis. Unless factors specific to the bridge are required, overrides are not recommended as they can prevent updates to System Defaults in future versions (e.g., legal load SHV factors in the MBE).
5. Superstructure Definitions Input

- Materials
- Beam Shapes
- Appurtenances
- Impact / Dynamic Load Allowance
- Factors
- SUPERSTRUCTURE DEFINITIONS
- BRIDGE ALTERNATIVES

Double click to open

New Superstructure Definition

- Girder System Superstructure
- Girder Line Superstructure
- Floor System Superstructure
- Floor Line Superstructure
- Truss System Superstructure
- Truss Line Superstructure

Click to accept and close

OK Cancel

A girder system defines a set of girders within a cross section, including each girder’s relationship to the others.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

**Factor Override:** Allows you to use a set of factors that have been entered for this bridge only. These factors allow you to override the System Defaults library factors with factors specific to this bridge.

**Consider structural slab thickness for rating:** Check this box if the structural slab thickness should be used to compute section properties for rating. If this box is not checked, the rating will use section properties computed from the total deck thickness.

**Consider wearing surface for rating:** Check this box if the wearing surface loads should be included for rating.

**Load Case Description**

- Materials
- Beam Shapes
- Appurtenances
- Impact / Dynamic Load Allowance
- Factors
- SUPERSTRUCTURE DEFINITIONS
  - As Built Span 1 (Span A)
    - Impact / Dynamic Load Allowance
    - Framing Plan Detail
    - Structure Typical Section
    - Superstructure Loads
  - Connectors
  - Shear Connector Definitions
  - Stiffener Definitions
- MEMBERS
- BRIDGE ALTERNATIVES
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

<table>
<thead>
<tr>
<th>Load Case Name</th>
<th>Description</th>
<th>Stage</th>
<th>Type</th>
<th>Time (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC1</td>
<td>DC acting on non-composite section</td>
<td>Non-composite (Stage 1)</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>LC2</td>
<td>DC acting on long-term composite</td>
<td>Composite (Stage 2)</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>DW</td>
<td>DW acting on long-term composite</td>
<td>Composite (Stage 2)</td>
<td>DW</td>
<td></td>
</tr>
<tr>
<td>SP Frames</td>
<td>Weight due to stay-in-place forms</td>
<td>Non-composite (Stage 1)</td>
<td>DC</td>
<td></td>
</tr>
</tbody>
</table>

Click to use default loads

Click to accept and close

Add Default Load Case Descriptions button: Adds four default load cases to the load case description table as shown above. The default load cases include dead load (DC) acting on non-composite section, dead load (DC) acting on long term composite section, dead load (DW) acting on long term composite section and stay-in-place forms acting on non-composite section. These default load cases can be edited and modified as desired.

Framing Plan Detail

- Materials
- Beam Shapes
- Appurtenances
- Impact / Dynamic Load Allowance
- Factors
- SUPERSTRUCTURE DEFINITIONS
  - As Built Span 1 (Span A)
    - Impact / Dynamic Load Allowance
    - Load Case Description
    - Structure Typical Section
    - Superstructure Loads
    - Connectors
    - Shear Connector Definitions
    - Stiffener Definitions
    - MEMBERS

Double click to open
**FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT**

**AS-BUILT MODEL ONLY**

**Girder Spacing Orientation:** Specify the girder spacing orientation for the girder spacing table as either perpendicular to girder or along support. If the girder spacing varies along the length of the bridge (that is, if the girders are not parallel to one another), then you must specify the girder spacing orientation as along the support.

**Note:** In this example there is no skew, however, a clockwise rotation is positive.

Enter diaphragm spacing as depicted on the As-Built plans. The Duplicate button is used to copy an existing row in the diaphragms table, and the new button adds a new blank row.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

**Copy Bay To button:** Allows you to copy diaphragm information from this girder bay to another. After you have entered all diaphragm information in this tab for the selected girder bay, click this button and then select the number of the girder bay to which you want this diaphragm information to be copied.

Note: In this example the diaphragm spacing from Girder Bay 1 is copied to Bays 2 and 3.

**Diaphragm Wizard:** If you have uniform diaphragm spacing throughout the bridge, then you can use the diaphragm wizard to generate the diaphragm table.

To access the framing schematic view, right click on Framing Plan Detail, and select Schematic. Or highlight Framing Plan Detail in the Bridge Workspace tree and click the View Schematic icon on the toolbar.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Structure Typical Section

- Materials
- Beam Shapes
- Appurtenances
  - Impact / Dynamic Load Allowance
- Factors
- SUPERSTRUCTURE DEFINITIONS
  - As Built Span 1 (Span A)
    - Load Case Description
    - Framing Plan Detail
    - Structure Typical Section
    - Superstructure Loads
    - Connectors
    - Shear Connector Definitions
    - Stiffener Definitions
    - MEMBERS
- BRIDGE ALTERNATIVES

Double click to open
Enter the Deck dimensions as shown on the typical section from the As-Built Plans.
Under the Parapet Tab, enter the location of the previously defined parapets as shown.

Compute button: Opens the Compute Lane Positions window, which presents the computed values in the lane position table based on information that you have entered using the other tabs of the Structure Typical Section Window.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

The Apply button will populate the computed values for Lane Position.

To access the structure typical section schematic, right click on Structure Typical Section, and select Schematic. Or highlight Structure Typical Section in the Bridge Workspace tree and click the View Schematic icon on the toolbar.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

View Schematic

03393
03393 - As Built Span 1 (Span A)
08/18/11

Deck Thickness: 8"
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Stiffener Definitions

Select Trans. Plate Stiffener and click OK.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Repeat the steps above for the next connector plate type.
Select Plate Stiffener and click OK.
Enter the Bearing Stiffener dimensions from the As-Built Drawings.

Note: It is a good idea to save the project regularly by selecting Save in the file pull down menu.
6. Member Inputs

**Member Loads**

- Materials
- Beam Shapes
- Appurtenances
  - Impact / Dynamic Load Allowance
- Factors
- SUPERSTRUCTURE DEFINITIONS
  - As Built Span 1 (Span A)
    - Impact / Dynamic Load Allowance
    - Load Case Description
    - Framing Plan Detail
    - Structure Typical Section
    - Superstructure Loads
- Connectors
- Shear Connector Definitions
- Stiffener Definitions
- MEMBERS
  - G1
    - Member Loads
    - Supports
  - G2
  - G3
  - G4
- BRIDGE ALTERNATIVES
Note: For this particular bridge, a distributed member load in the DC1 stage has been input along the first 11’ of Span A to account for a variable overhang to allow for a turning radius.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Supports

Materials
Beam Shapes
Appurtenances
Impact / Dynamic Load Allowance
Factors

SUPERSTRUCTURE DEFINITIONS

As Built Span 1 (Span A)
Impact / Dynamic Load Allowance
Load Case Description
Framing Plan Detail
Structure Typical Section
Superstructure Loads
Connectors
Shear Connector Definitions
Stiffener Definitions

MEMBERS

G1
Member Loads
Supports
MEMBER ALTERNATIVES

G2
G3
G4

BRIDGE ALTERNATIVES
**Support Type:** Select the support type as either pinned, roller, fixed, free, or other. Check marks will automatically appear in the appropriate boxes for translation and rotation constraints to correspond with the selected support type.
Member Alternatives

Material Type: Select the material type. Virtis/Opis currently limits floorbeam and stringer definitions to steel beams.

Girder Type: Select the girder type. The girder types available are dependent upon the selected material type.
Default rating method: Select the default rating method to be used for the member alternative. The ASD rating method is displayed as read only if the member alternative is a non-detailed alternative since the LFD and LRFD rating methods require actual beam dimensions that are not available in a non-detailed section.

Girder property input method: Cross-section based input describes the member alternative in terms of a section cut through the member at a specific location. The selection of girder property input method affects which windows are provided for defining the member alternative.
**Factor Override**: Allows you to override the System Defaults library factors with a set of factors that have been entered for this bridge only. Factor overrides will remain when files are imported into future versions of Virtis. Unless factors specific to the bridge are required, overrides are not recommended as they can prevent updates to System Defaults in future versions (e.g., legal load SHV factors in the MBE).
## FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

### AS-BUILT MODEL ONLY

<table>
<thead>
<tr>
<th>Member/Alternative:</th>
<th>Exterior Girder</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Factors</th>
<th>Engine</th>
<th>Import</th>
<th>Control Options</th>
</tr>
</thead>
</table>

### LFID

- **Points of Interest**
  - Generate at tenth points
  - Generate at section change points
  - Generate at user defined points

- **Allow moment redistribution**
- **Use Appendix A8 for flexural resistance**
- **Allow plastic analysis**
- **Ignore long. reinf in negative moment capacity**

- **Distribution Factor Application Method**
  - By axle
  - By PCI

### LRFR

- **Points of Interest**
  - Generate at tenth points
  - Generate at section change points
  - Generate at user defined points

- **Allow moment redistribution**
- **Use Appendix A8 for flexural resistance**
- **Allow plastic analysis**
- **Evaluate remaining fatigue life**
- **Ignore long. reinf in negative moment capacity**

- **Distribution Factor Application Method**
  - By axle
  - By PCI

### LFD

- **Points of Interest**
  - Generate at tenth points
  - Generate at section change points
  - Generate at user defined points

- **Allow moment redistribution**
- **Include bearing stiffeners in rating**

- **Distribution Factor Application Method**
  - By axle
  - By PCI

### ASD

- **Points of Interest**
  - Generate at tenth points
  - Generate at section change points
  - Generate at user defined points

### Notes

- Click to accept and close.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Once the Member Alternative has been created, you can double click on the member, and the alternative be listed as shown below.

**Existing**: Check the box next to the name of the member alternative that represents the existing member. The existing member alternative is selected for analysis during a batch analysis process.

**Current**: Check the box next to the name of the member alternative that represents the current alternative being modified or reviewed.

**Span Length**: This input is disabled for a girder system since the span lengths are computed based on the data entered in the Structure Framing Plan Details and Structure Typical Section windows.

**Pedestrian load**: Enter the pedestrian live load acting on the member, in units of force per length of member.
**FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT**

**AS-BUILT MODEL ONLY**

<table>
<thead>
<tr>
<th>Type</th>
<th>Plate Girder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web</td>
<td>Top Range, Bottom Flange</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Begin Depth (in)</th>
<th>End Depth (in)</th>
<th>Thickness (in)</th>
<th>Support Number</th>
<th>Start Distance (ft)</th>
<th>Length (ft)</th>
<th>End Distance (ft)</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>50.0000</td>
<td>50.0000</td>
<td>0.4375</td>
<td>1</td>
<td>0.00</td>
<td>91.00</td>
<td>91.00</td>
<td>ASTM A35</td>
</tr>
</tbody>
</table>

Enter the dimensions of the web per the as-built drawings.

<table>
<thead>
<tr>
<th>Web</th>
<th>Top Range, Bottom Flange</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Begin Width (in)</th>
<th>End Width (in)</th>
<th>Thickness (in)</th>
<th>Support Number</th>
<th>Start Distance (ft)</th>
<th>Length (ft)</th>
<th>End Distance (ft)</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.7500</td>
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<td>0.00</td>
<td>81.00</td>
<td>81.00</td>
<td>ASTM A36</td>
</tr>
</tbody>
</table>

Enter the dimensions of the top flange per the as-built drawings.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Enter the dimensions of the bottom flange per the as-built drawings.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Deck Profile

- SUPERSTRUCTURE DEFINITIONS
  - As Built Span 1 (Span A)
    - Impact / Dynamic Load Allowance
    - Load Case Description
    - Framing Plan Detail
    - Structure Typical Section
    - Superstructure Loads
  - Connectors
  - Shear Connector Definitions
  - Stiffener Definitions
  - MEMBERS
    - G1
      - Member Loads
      - Supports
    - MEMBER ALTERNATIVES
      - Exterior Girder (E) (C)
        - Impact / Dynamic Load Allowance
        - Live Load Distribution
        - Hinge Locations
        - Splice Locations
        - Girder Profile
        - Haunch Profile
        - Lateral Support
        - Stiffener Ranges
        - Bearing Stiffener Locations
        - Points of Interest
        - Deterioration Profile
  - G2
  - G3
  - G4

BRIDGE ALTERNATIVES
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT
AS-BUILT MODEL ONLY

<table>
<thead>
<tr>
<th>Material</th>
<th>Support Number</th>
<th>Start Distance (ft)</th>
<th>Length (ft)</th>
<th>End Distance (ft)</th>
<th>Structural Thickness (in)</th>
<th>Start Effective Flange Width (Std) (in)</th>
<th>End Effective Flange Width (Std) (in)</th>
<th>Start Effective Flange Width (LRFD) (in)</th>
<th>End Effective Flange Width (LRFD) (in)</th>
</tr>
</thead>
</table>

Click to Compute

Compute from Typical Section...

---

Compute Deck Profile from Structure Typical Section

Total deck thickness entered on the Structure Typical Section window = 8.0000 in

Enter a structural thickness to use when computing the effective flange width: 7/8 in

Click to accept and close

OK  Cancel
Note: By selecting Composite under the Connector ID pull down the Stud Dimensions under the Shear Connector Definitions become irrelevant since the deck is treated as a composite structure.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Haunch Profile

Double click to open
Enter the dimensions of the haunch per the as-built drawings.

<table>
<thead>
<tr>
<th>Support Number</th>
<th>Start Distance (ft)</th>
<th>Length (ft)</th>
<th>End Distance (ft)</th>
<th>Z1 (in)</th>
<th>Z2 (in)</th>
<th>Z3 (in)</th>
<th>Z4 (in)</th>
<th>Y1 (in)</th>
<th>Y2 (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.00</td>
<td>91.00</td>
<td>91.00</td>
<td>0.0000</td>
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<td>3.0000</td>
<td>15.0000</td>
<td>1.0000</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Click to accept and close
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Lateral Support

File: F:\Program Files\VDOT\Bridge Inspection and Maintenance System\VDOT BINM System\As-Built Model Only\Lateral Support

- SUPERSTRUCTURE DEFINITIONS
  - As Built Span 1 (Span A)
    - Impact / Dynamic Load Allowance
    - Load Case Description
    - Framing Plan Detail
    - Structure Typical Section
    - Superstructure Loads
  - Connectors
  - Shear Connector Definitions
  - Stiffener Definitions
- MEMBERS
  - G1
    - Member Loads
    - Supports
  - MEMBER ALTERNATIVES
    - Exterior Girder (E) (C)
      - Default Materials
      - Impact / Dynamic Load Allowance
      - Live Load Distribution
      - Hinge Locations
      - Splice Locations
      - Girder Profile
      - Deck Profile
      - Haunch Profile
    - Lateral Support
      - Lateral Support
  - G2
  - G3
  - G4
- BRIDGE ALTERNATIVES

Double click to open
Regions where the slab is considered to provide lateral support for the top flange are defined using the lateral support window.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Stiffener Ranges

- SUPERSTRUCTURE DEFINITIONS
  - As Built Span 1 (Span A)
    - Impact / Dynamic Load Allowance
    - Load Case Description
    - Framing Plan Detail
    - Structure Typical Section
    - Superstructure Loads
  - Connectors
  - Shear Connector Definitions
  - Stiffener Definitions
  - MEMBERS
  - G1
    - Member Loads
    - Supports
  - MEMBER ALTERNATIVES
    - Exterior Girder (E) (C)
      - Default Materials
      - Impact / Dynamic Load Allowance
      - Live Load Distribution
      - Hinge Locations
      - Splice Locations
      - Girder Profile
      - Deck Profile
      - Haunch Profile
      - Lateral Profile
      - Lateral Support
      - Bearing Stiffener Locations
      - Points of Interest
      - Deterioration Profile

  - G2
  - G3
  - G4

- BRIDGE ALTERNATIVES

Double click to open
Apply at Diaphragms button: Stiffener ranges corresponding to diaphragm locations are added. A dialog will open prompting for the bearing stiffener and transverse stiffener definitions to be used. The Computed stiffener locations are added to the list of ranges.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

**Diaphragm Connection Plates**

Apply the following stiffener definitions to the diaphragm locations:

**End Diaphragms and Diaphragms At Piers**

**Bearing Stiffener:** Select a bearing stiffener definition to place at the end diaphragms and diaphragms located at piers. If no bearing stiffener definitions exist, “None defined” will appear in this list box.

**Interior Diaphragms**

**Transverse Stiffener:** Select a transverse stiffener definition to place at the interior diaphragm locations. If no transverse stiffener definitions exist, “None defined” will appear in this list box.

**Apply button:** Creates the stiffener locations and closes this window.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Enter the other stiffener locations as depicted on the as-built drawings.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Bearing Stiffener Locations

Double click to open
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Verify that the bearing stiffeners are placed at the supports as the stiffener ranges were set in the previous page.

Save: It is a good idea to save the project regularly by selecting Save in the file pull down menu.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT
AS-BUILT MODEL ONLY

Copying a Member

Follow the same steps to manually enter the information for G2 as previously shown for G1. You can also copy properties of one girder to another as shown below, but Member Loads and Supports need to be defined as previously shown for G1 with interior loads.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Right click on Girder 1 and choose Copy.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT
AS-BUILT MODEL ONLY

Right click on the Member Alternative for G2 and click paste. You will notice that a copy of Girder 1 is placed under G2 Member Alternatives.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

SUPERSTRUCTURE DEFINITIONS
  As Built Span 1 (Span A)
    Impact / Dynamic Load Allowance
    Load Case Description
    Framing Plan Detail
    Structure Typical Section
    Superstructure Loads
  Connectors
  Shear Connector Definitions
  Stiffener Definitions
  MEMBERS
    G1
    G2
    Member Loads
    Supports
  MEMBER ALTERNATIVES
    G3
    G4
  BRIDGE ALTERNATIVES

Double click to open
Rename the girder as an interior girder, and check the Factors tab and Control Options tab as done for G1 above. G2 has a couple differences from G1 since it is an interior girder.

First, in this example there is no additional Member Load on this girder to account for the variable overhang as there was on the exterior girder. Member Alternatives was copied from G1 which did not include Member Loads. Do not enter the variable overhand load for G2.
Secondly, the deck profile will need to be updated using the Compute from Typical Section button as was done for G1, because the effective flange width is different for the interior girder.
Thirdly, the Haunch Profile is automatically updated for an interior beam; however, the dimensions should be checked to make sure they are correct.
Finally, the Stiffener Ranges need to be updated to represent the fact that they are pair stiffeners for the interior girders instead of single for the exterior girders.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

<table>
<thead>
<tr>
<th>Name</th>
<th>Support Number</th>
<th>Start Distance (ft)</th>
<th>Number of Spaces</th>
<th>Spacing (ft)</th>
<th>Length (ft)</th>
<th>End Distance (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERMEDIATE STIFFENER PAIR</td>
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<td>1</td>
<td>21.0000</td>
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<tr>
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<td>1.75</td>
<td>1</td>
<td>20.0000</td>
<td>1.67</td>
<td>3.42</td>
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<tr>
<td>INTERMEDIATE STIFFENER PAIR</td>
<td>1</td>
<td>3.42</td>
<td>3</td>
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<td>11.08</td>
<td>14.49</td>
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<tr>
<td>INTERMEDIATE STIFFENER PAIR</td>
<td>1</td>
<td>18.19</td>
<td>1</td>
<td>0.0000</td>
<td>0.00</td>
<td>18.19</td>
</tr>
<tr>
<td>INTERMEDIATE STIFFENER PAIR</td>
<td>1</td>
<td>18.19</td>
<td>3</td>
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<td>13.66</td>
<td>31.84</td>
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<tr>
<td>INTERMEDIATE STIFFENER PAIR</td>
<td>1</td>
<td>18.19</td>
<td>3</td>
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<td>54.62</td>
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<tr>
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<td>87.55</td>
<td>1</td>
<td>20.0000</td>
<td>1.67</td>
<td>89.25</td>
</tr>
</tbody>
</table>

Click to accept and close
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Linking a Member

To complete the bridge typical you may link previously defined girders to similarly (symmetrically) placed girders elsewhere in the bridge typical. In this example, G3 can be linked to G2 and G4 can be linked to G1 since it is a symmetrical bridge section.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Link with: Select the member to which this member is to be linked. If two members are linked, they share the same definition and any revisions to one member affect the other member. If the applied loads acting on the two members are different (due to different tributary widths, different arrangements of parapets, medians, sidewalks, and railings, and different lane positions), then they should not be linked with one another. If you do not want to link this member with any other member, select “None”. This input field is available for a girder system only.

Repeat the same steps to link G4 to G1.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Once all the girders are defined and linked, verify that the entered data is correct by viewing the bridge schematics. Right-click on the Structure Typical Section from the Bridge Workspace and select Schematic from the popup menu.

03393
03393 - As Built Span 1 (Span A)
06/19/11

To view the girder elevation right-click on the Exterior Girder from the Bridge Workspace and select Schematic from the popup menu.
Live Load Distribution

Once all the data for the girders and the schematics have been checked for accuracy, the live load distributions can be computed for each girder.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

**Compute from Typical Section button**: Computes the live load distribution factors per wheel based on the values that you entered in the Structure Typical Section window and the Structure Framing Plan Details window. The computed distribution factors are then displayed on this tab.

![Diagram](image)

**Compute from Typical Section button**: Computes the live load distribution factors per wheel based on the values that you entered in the Structure Typical Section window and the Structure Framing Plan Details window. The computed distribution factors are then displayed on this tab.

Repeat the same steps for G2.

7. **Creating Additional Spans**

Once the first span is created, it can be copied for the other spans. Simply right click on As Built Span 1 and select copy and then right click on superstructure definitions and hit paste as shown below.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

- Materials
- Beam Shapes
- Appurtenances
  - Impact / Dynamic Load Allowance
- Factors
- SUPERSTRUCTURE DEFINITIONS
  - As Built Span 1 (Span A)
  - Copy of As Built Span 1 (Span A)
- BRIDGE ALTERNATIVES

Double click to open
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Rename the span and change the length if necessary. In this example the lengths are slightly longer for the two middle spans.

The change in length also causes the diaphragms to be spaced slightly more as shown below.
In this example there is no member load for the exterior girders for any span other than span 1, so it will need to be removed as shown below also.

![Diagram of bridge model with Superstructure Definitions and Member Loads highlighted](image)
The end bearing location is 9 inches at the abutments and only 7 inches at the piers, so this will need to be updated in the girder window.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Click to accept and close
In addition, for Span 2 the girder profile, deck profile, haunch profile, lateral support, and stiffener ranges will need to be updated under the member alternatives for G1 and G2 to reflect the change in length.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Type: Plate Girder

Web

Top Flange

Bottom Flange

<table>
<thead>
<tr>
<th>Type</th>
<th>Plate Girder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web</td>
<td></td>
</tr>
<tr>
<td>Top Flange</td>
<td></td>
</tr>
<tr>
<td>Bottom Flange</td>
<td></td>
</tr>
</tbody>
</table>

New | Duplicate | Delete

OK | Apply | Cancel

VDOT VERSION 6.2

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FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Superstructure Definitions
- As Built Span 1 (Span A)
- As Built Span 2 (Span B)
  - Impact / Dynamic Load Allowance
  - Load Case Description
  - Framing Plan Detail
  - Structure Typical Section
  - Superstructure Loads
  - Connectors
  - Shear Connector Definitions
  - Stiffener Definitions
- Members
  - G1
    - Member Loads
    - Supports
    - Member Alternatives
      - Exterior Girder (E) (C)
        - Default Materials
        - Impact / Dynamic Load Allowance
        - Live Load Distribution
        - Hinge Locations
        - Splice Locations
        - Girder Profile
          - Deck Profile
        - Haunch Profile
        - Lateral Support
        - Stiffener Ranges
        - Bearing Stiffener Locations
        - Points of Interest
        - Deterioration Profile
  - G2
  - G3 (G2)
  - G4 (G1)
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Click to accept and close
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

- SUPERSTRUCTURE DEFINITIONS
  - As Built Span 1 (Span A)
  - As Built Span 2 (Span B)
    - Impact / Dynamic Load Allowance
    - Load Case Description
    - Framing Plan Detail
    - Structure Typical Section
    - Superstructure Loads
  - Connectors
  - Shear Connector Definitions
  - Stiffener Definitions
  - MEMBERS
    - G1
      - Member Loads
      - Supports
    - MEMBER ALTERNATIVES
      - Exterior Girder (E) (C)
        - Default Materials
        - Impact / Dynamic Load Allowance
        - Load Case Description
        - Live Load Distribution
        - Hinge Locations
        - Splice Locations
        - Girder Profile
        - Deck Profile
        - Haunch Profile
          Double click to open
        - Lateral Support
        - Stiffener Ranges
        - Bearing Stiffener Locations
        - Points of Interest
        - Deterioration Profile
    - G2
    - G3 (G2)
    - G4 (G1)
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Click to accept and close
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

SUPERSTRUCTURE DEFINITIONS
- As Built Span 1 (Span A)
- As Built Span 2 (Span B)
  - Impact / Dynamic Load Allowance
  - Load Case Description
  - Framing Plan Detail
  - Structure Typical Section
  - Superstructure Loads
- Connectors
- Shear Connector Definitions
- Stiffener Definitions
- MEMBERS
  - G1
    - Member Loads
    - Supports
- MEMBER ALTERNATIVES
  - Exterior Girder (E) (C)
    - Default Materials
    - Impact / Dynamic Load Allowance
    - Live Load Distribution
    - Hinge Locations
    - Splice Locations
    - Girder Profile
    - Deck Profile
    - Haunch Profile
    - Lateral Support
    - Stiffener Ranges
    - Bearing Stiffener Locations
    - Points of Interest
    - Deterioration Profile
  - G2
  - G3 (G2)
  - G4 (G1)

Double click to open
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT
AS-BUILT MODEL ONLY

<table>
<thead>
<tr>
<th>Support Number</th>
<th>Start Distance (ft)</th>
<th>Length (ft)</th>
<th>End Distance (ft)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>0.00</td>
<td>91.17</td>
<td>91.17</td>
</tr>
</tbody>
</table>

Click to accept and close
Update the transverse stiffener ranges to match the values shown below.

Once all the differences in Span 2 have been accounted for, it can be copied as previously shown and the copy can be renamed Span 3. Span 3 is identical to Span 2, and therefore will not need to be updated. Finally, Span 1 can be copied again and renamed Span 4. Modify the end bearing locations for Span 4, which are 7 inches at the pier and 9 inches at the abutment. Also, delete the Member Load for Span 4 as previously shown for Span 2.

Save: It is a good idea to save the project regularly by selecting Save in the file pull down menu.
8. Bridge Alternatives

A bridge can have several unique bridge alternatives. Each bridge alternative must include the entire bridge but can consist of a different layout of superstructures. The number of spans, the span lengths, and the pier locations are defined within the bridge alternative (and its accompanying windows). Entering different bridge alternatives can be useful when comparing various alternatives for a preliminary study.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

The Description tab of the Bridge Alternative window allows you to describe the orientation of the bridge alternative reference line with respect to the bridge global reference point. Enter the required information and click another tab or the OK button. This data is more for informational purposes than for calculations.

Superstructures
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Superstructure Alternatives

- Materials
- Beam Shapes
- Appurtenances
- Impact / Dynamic Load Allowance
- Factors
- SUPERSTRUCTURE DEFINITIONS
  - As Built Span 1 (Span A)
  - As Built Span 2 (Span B)
  - As Built Span 3 (Span C)
  - As Built Span 4 (Span D)
- BRIDGE ALTERNATIVES
  - As built (E) (C)

Superstructure definition: Select the superstructure definition assigned to the superstructure alternative. A definition named “None” is available to allow you to create a superstructure alternative as a placeholder for a superstructure definition that is not defined within Virtis/Opis. The name of the superstructure definition assigned to the alternative displays in the Bridge Workspace tree following the alternative name.
After the Superstructure Definition is defined, the span length will appear. Repeat the above process to create a bridge alternative for each of the other three as-built spans. Start each time by double clicking on the Superstructures folder and selecting the appropriate span from the Superstructure Definition dropdown under Superstructure Alternatives.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Once each bridge alternative has been created, double click on the bridge to open the bridge information window.

Under the Alternatives tab, the Existing and Current boxes should be checked to run the As-Built model. For this particular bridge the inspection report did not indicate any deterioration so the As-Built bridge alternative is the only one necessary. If the inspection report for a bridge indicates deterioration, then another model can be created and the member specific deterioration can be input. By selecting the existing and current check boxes, the user can control which bridge alternative Virtis will model.
Before continuing, save your work and check the input.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Bridge Validation

Total Number of Messages: 107
Number of Information Messages: 83
Number of Warning Messages: 24
Number of Error Messages: 0

Bridge: 03393
Existing bridge alternative: As Built
Current bridge alternative: As Built
As Built (Bridge Alternative)
   As Built Span 1 (Superstructure)
      Existing superstructure alternative: As Built Span 1
      Current superstructure alternative: As Built Span 1
      As Built Span 1 (Span A) (Superstructure Alternative)
      As Built Span 1 (Span A) (Superstructure Definition)
      No errors or warnings.
   As Built Span 2 (Superstructure)
      Existing superstructure alternative: As Built Span 2
      Current superstructure alternative: As Built Span 2
      As Built Span 2 (Superstructure Alternative)
      As Built Span 2 (Span B) (Superstructure Definition)
      No errors or warnings.
   As Built Span 3 (Superstructure)
      Existing superstructure alternative: As Built Span 3
      Current superstructure alternative: As Built Span 3
      As Built Span 3 (Superstructure Alternative)
      As Built Span 3 (Span C) (Superstructure Definition)
      No errors or warnings.
   As Built Span 4 (Superstructure)
      Existing superstructure alternative: As Built Span 4
      Current superstructure alternative: As Built Span 4
      As Built Span 4 (Superstructure Alternative)
      As Built Span 4 (Span D) (Superstructure Definition)
      No errors or warnings.

As Built Span 1 (Span A) (Girder System Superstructure Definition)
Girder Members
   G1 (Girder Member)
      Existing member alternative: Exterior Girder
      Current member alternative: Exterior Girder
      Exterior Girder (Member Alternative)
      Warning: LRFD live load distribution factors not defined.
      Warning: Deck reinforcement ranges not defined.
      Warning: No points of interest defined.
   G2 (Girder Member)
      Existing member alternative: Interior Girder
      Current member alternative: Interior Girder
      Interior Girder (Member Alternative)
      Warning: LRFD live load distribution factors not defined.

Click to Save

Review Errors and Warnings

Continue saving  Cancel Save operation
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

9. Rating the Structure

To run the analysis from the Bridge Explorer, exit to back to main page with the list of bridges. Right click on the bridge you want to rate and select rate.
Select the vehicles to be rated and click the Add to Rating button to include them. A template of vehicles to be rated can be saved and reused as well.

Once all vehicles for the LRFR Simple Span template have been entered, left click the Advanced button above the right column.
For the two Blanket Permit vehicles, change the Frequency to Unlimited Crossings.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Once you click OK the analysis will start automatically.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT
AS-BUILT MODEL ONLY

Once you close the Analysis Progress window the Bridge Rating Results window will automatically open as shown below. To find the controlling member, highlight the vehicle which creates the lowest rating (HL-93 in this case), and click on View Structure Rating Results button. This will display the ratings by span. Spans 2 and 3 both have the lowest rating of 1.184. Therefore, highlight either of these spans and click the View Member Rating Results button. This will display the ratings of each member in that span and the controlling location. As shown, member G2 has the 1.184 rating factor, and therefore it is the controlling member.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

### Bridge Rating Results

<table>
<thead>
<tr>
<th>Bridge ID</th>
<th>Vehicle</th>
<th>Inventory Rating Factor</th>
<th>Operating Rating Factor</th>
<th>Legal Rating Factor</th>
<th>Permit Rating Factor</th>
<th>Inventory Rating Method</th>
<th>Operating Rating Method</th>
<th>Legal Rating Method</th>
<th>Permit Rating Method</th>
<th>Inventory Capacity (Ton)</th>
<th>Operating Capacity (Ton)</th>
<th>Legal Capacity (Ton)</th>
<th>Permit Capacity (Ton)</th>
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</thead>
<tbody>
<tr>
<td>03202</td>
<td>HS-20-44</td>
<td>1.029</td>
<td>2.069</td>
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<td>LFR</td>
<td>LFR</td>
<td>LFR</td>
<td>LFR</td>
<td>LFR</td>
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<td>75.56</td>
<td>75.56</td>
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<td>Blanket Permit 115</td>
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<td>LFR</td>
<td>LFR</td>
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<td>SUL</td>
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### Structure Rating Results

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<thead>
<tr>
<th>Bridge ID</th>
<th>Structure</th>
<th>Vehicle</th>
<th>Inventory Rating Factor</th>
<th>Operating Rating Factor</th>
<th>Legal Rating Factor</th>
<th>Permit Rating Factor</th>
<th>Inventory Rating Method</th>
<th>Operating Rating Method</th>
<th>Legal Rating Method</th>
<th>Permit Rating Method</th>
<th>Inventory Capacity (Ton)</th>
<th>Operating Capacity (Ton)</th>
<th>Legal Capacity (Ton)</th>
<th>Permit Capacity (Ton)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>As Built Span 1</td>
<td>H-L-80 (US)</td>
<td>1.190</td>
<td>1.542</td>
<td>LFR</td>
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<td>LFR</td>
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<td>42.84</td>
<td>55.27</td>
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<td>03393</td>
<td>As Built Span 4</td>
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<td>1.542</td>
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<td>42.82</td>
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### Member Rating Results

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<th>Member</th>
<th>Vehicle</th>
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<th>Operating Rating Factor</th>
<th>Legal Rating Factor</th>
<th>Permit Rating Factor</th>
<th>Inventory Location (ft)</th>
<th>Operating Location (ft)</th>
<th>Legal Location (ft)</th>
<th>Permit Location (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>03393</td>
<td>As Built Span 2</td>
<td>G1</td>
<td>H-L-80 (US)</td>
<td>1.190</td>
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<td>As Built Span 2</td>
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<td>H-L-80 (US)</td>
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<td>45.39</td>
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<td></td>
</tr>
</tbody>
</table>

**Click to close**
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Once the controlling member has been identified, an analysis can be run on the individual girder. As shown below, this can be done by highlighting the girder and clicking the analyze icon, or by right clicking and selecting analyze. After the analysis is run, you can click the view analysis report icon shown below to view the results.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Click the View Analysis Report Icon to see the report.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

<table>
<thead>
<tr>
<th>Live Load Type</th>
<th>Lane</th>
<th>Load Rating</th>
<th>Rating Level</th>
<th>Rating Factor</th>
<th>Location (ft)</th>
<th>Location Span (%)</th>
<th>Limit State</th>
<th>Impact</th>
<th>Lane</th>
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<tbody>
<tr>
<td>HS-20-44</td>
<td>Lane</td>
<td>LRPR</td>
<td>Operating</td>
<td>2.22</td>
<td>48.50</td>
<td>1 - 50.0</td>
<td>STRENGTHI</td>
<td>As Requested</td>
<td>As Requested</td>
</tr>
<tr>
<td>HS-20-44</td>
<td>Lane</td>
<td>LRPR</td>
<td>Operating</td>
<td>2.00</td>
<td>46.56</td>
<td>1 - 50.0</td>
<td>STRENGTHI</td>
<td>As Requested</td>
<td>As Requested</td>
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<tr>
<td>HS-20-44</td>
<td>Lane</td>
<td>LRPR</td>
<td>Operating</td>
<td>2.00</td>
<td>46.56</td>
<td>1 - 50.0</td>
<td>STRENGTHI</td>
<td>As Requested</td>
<td>As Requested</td>
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<tr>
<td>HS-20-44</td>
<td>Lane</td>
<td>LRPR</td>
<td>Operating</td>
<td>2.00</td>
<td>46.56</td>
<td>1 - 50.0</td>
<td>STRENGTHI</td>
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<tr>
<td>HS-20-44</td>
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<td>LRPR</td>
<td>Operating</td>
<td>2.00</td>
<td>46.56</td>
<td>1 - 50.0</td>
<td>STRENGTHI</td>
<td>As Requested</td>
<td>As Requested</td>
</tr>
</tbody>
</table>

Click to close
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Click the View Analysis Output Icon to see additional output options.

Double Clicking on the Spec Check Results will open a window with the Specification Check Summary shown below and results of the code analysis.
FOUR SPAN SIMPLY SUPPORTED STEEL PLATE GIRDER INPUT

AS-BUILT MODEL ONLY

Note: Spec Check Results are provided in an .xml document. Virtis requires .xml documents to be opened with Internet Explorer, so this must be set as the default program to open these types of files.

Bridge ID: 388
NBI Structure ID: 03393
Bridge: 03393
Superstructure Def: As Built Span 2 (Span B)
Member: G2
Member Alt: Interior Girder


Specification Check Summary

<table>
<thead>
<tr>
<th>Article</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>Flexure (6.10.7.1.1, 6.10.7.2.1)</td>
<td>Pass</td>
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<tr>
<td>Shear (6.10.9)</td>
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<tr>
<td>Serviceability (6.10.4.2.2)</td>
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<tr>
<td>Transverse Stiffeners (6.10.11.1.2, 6.10.11.1.3)</td>
<td>Pass</td>
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<tr>
<td>Longitudinal Stiffeners (6.10.11.3.1, 6.10.11.3.2, 6.10.11.3.3)</td>
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<tr>
<td>Bearing Stiffeners (6.10.11.2.2, 6.10.11.2.3, 6.10.11.2.4)</td>
<td>Pass</td>
</tr>
<tr>
<td>Shear Connector (6.10.10.1, 6.10.10.4)</td>
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</tbody>
</table>

Once the structure has been rated, and the results have been checked for accuracy a summary form is usually generated to display the pertinent results along with any assumptions or comments which would be relevant to someone reviewing rating. A sample summary form has been provided in Appendix D.
Intermediate Diaphragm

<table>
<thead>
<tr>
<th>w, lb/ft</th>
<th>L, ft</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>62.88</td>
<td>7.7</td>
<td>8.1667</td>
</tr>
<tr>
<td>62.88</td>
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<td>8.1667</td>
</tr>
<tr>
<td>124.08</td>
<td>6.6</td>
<td>9.40</td>
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</tbody>
</table>

249.85 lb
249.85
287.32 (15% Misc.)
USE 287.00 lb

End Diaphragm

<table>
<thead>
<tr>
<th>w, lb/ft</th>
<th>L, ft</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.45</td>
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</tr>
<tr>
<td>169.05</td>
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</tr>
<tr>
<td>146.88</td>
<td>13.6</td>
<td>5.40</td>
</tr>
</tbody>
</table>

416.38 lb
416.38
478.84 (15% Misc.)
USE 478.00 lb
CONCRETE RAILING LOAD CALCULATION

Railing Information:
- \( N_1 = 2 \) # of Posts/Underhang Attachments
- \( N_2 = 1 \) # of Rails
- \( L_2 = 9.04 \) Out to Out Slab Length (ft)

* All dimensions are found in the transverse section of concrete railing

Post Weight:
- \( W = 18 \) Width (in) along span
- \( H = 15 \) Height (in) 3'-3"
- \( L = 9.5 \) Length (in) perpendicular to span
- \( W_1 = 0 \) Width of Sloped Back (in)

\[ P_p = N_1 \times \left[ \left( W \times H \times L \right) + \left( 0.5 \times W_1 \times H \times L \right) \right] / 12 \times (\text{in/ft}) \times 0.15(\text{kips/cf}) / L_2 \]

\[ 0.049 \text{ kips/ft} \]

Underhang Attachment Weight:
- \( W = 0 \) Width (in)
- \( H_1 = 0 \) Rectangle Height (in)
- \( H_2 = 0 \) Triangle Height (in)
- \( L = 0 \) Length (in)

\[ P_u = N_1 \times \left[ \left( W \times H_1 \times L \right) + \left( 0.5 \times W \times H_2 \times L \right) \right] / 12 \times (\text{in/ft}) \times 0.15(\text{kips/cf}) / L_2 \]

\[ 0.000 \text{ kips/ft} \]

Curb Load:
- Included in cross section

- \( W = 9.25 \) Width (in)
- \( H = 29 \) Height (in)
- \( W = 7 \) Width (in)
- \( H = 11 \) Height (in)

\[ P_c = (W \times H) / 12 \times (\text{in/ft}) \times 0.15 \text{(kips/ft)} \]

\[ 0.360 \text{ kips/ft} \]

Rail Load:
- \( W = 11 \) Width (in)
- \( H = 10 \) Height (in)

\[ P_r = (W \times H \times N_2) / 12 \times (\text{in/ft}) \times 0.15 \text{(kips/ft)} \]

\[ 0.115 \text{ kips/ft} \]

**TOTAL CONCRETE RAILING MEMBER LOAD:**

\[ P = P_p + P_u + P_c + P_r \]

\[ 0.523 \text{ kips/ft} \]

**0.520 kips/ft**
# APPENDIX D: SAMPLE LOAD RATING SUMMARY FORM FOR BRIDGES

Route: 622 (Bridge Street)  
Over: James River  
VA Str. No.: 6418  
FED. ID: 03393  
County: Botetourt  
District: Salem  
Rated By:  
Checked By:  
VDOT Reviewer:  

Calculation Tools/Method Used: Virtis 6.2  
Basis for Rating: Conversion to LRFR  
Sign: ____________________  
Date:  

<table>
<thead>
<tr>
<th>GVW (TONS)</th>
<th>RATING</th>
<th>CONTROLLING MEMBERS</th>
<th>CONTROLLING LOCATION</th>
<th>CONTROLLING FORCE</th>
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<td><strong>DESIGN LOAD</strong></td>
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<td>HL-93 (INV)</td>
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<td>1.184</td>
<td>Spans 2 &amp; 3 (Interior Girder G2)</td>
<td>0.5 L</td>
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<td>HL-93 (OPR)</td>
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<td>*LANE</td>
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* Not applicable for simple span less than 200 feet.
INSPECTION REPORT USED FOR THIS RATING:


ASSUMPTIONS/COMMENTS BY LOAD RATING ENGINEER:

Comments:

1. The controlling Design Load (Inventory & Operating) and Legal Load Limit States are Strength I.
2. The controlling Permit Load Limit States are Strength II.

Assumptions:

Bridge No: 03393 – 4 Spans Composite Steel Plate Girder Multi-Girder Bridge.

1. Material properties not noted in the plans are based on the year of construction. Materials used for the analysis are Structural Steel, ASTM A36, Grade 36, Fy=36 Ksi; Reinforcing steel, Grade 40, Fy=40 Ksi, Cast-in-Place Concrete class A4, f’c=4 Ksi.
2. The slab thickness was reduced by 0.5” per VDOT, IIM-S&B-80 for composite properties.
3. The LRFD effective slab width used for composite properties was the full tributary width as outlined in Section 4.6.2.6 of the AASHTO LRFD Bridge Design Specifications (2008 Interims).
4. Superimposed dead load was distributed uniformly to all girders.
5. A 1” deep haunch has been input for composite beam properties and dead load.
6. LRFD Live load distribution factors were computed by Virtis.
7. The variable overhang in Span 1 (Span A), is a short portion of the span (11’ vs. 91’) and has been input as a Member Load in the DC1 stage.
8. IR noted a thin overlay on the deck without exact thickness. Photo #2 of the Inspection Report shows the overlay which is estimated at ¼” of epoxy sand and has NOT been input into an Inspection Report model.
9. Per IR, Condition factor for the bridge was used corresponding to Satisfactory (Superstructure Rating= 6); φc=1.0.
## Rating Results:

### Bridge Rating Results

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<tr>
<th>Bridge ID</th>
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<th>Inventory Rating Factor</th>
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<th>Legal Rating Factor</th>
<th>Permit Rating Factor</th>
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<th>Legal Rating Method</th>
<th>Permit Rating Method</th>
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