John G. Lewis Memorial Bridge
Route 673 (Featherbed Lane)
Bridge over Catoctin Creek in Loudoun County

National Register Listing “Catoctin Creek Bridge”
Presentation January 29, 2015
What we know.

• The Bridge is on the National Register of Historic Places.

• Section 106 of the National Historic Preservation Act of 1966 requires that Federal agencies allow the Advisory Council on Historic Preservation an opportunity to comment on all projects affecting historic properties either listed in or determined eligible for listing in the National Register.

• Qualification for Federal grants for historic preservation, when funds are available.
Historical Significance
(extrapolated from the National Register Listing)

• January 25, 1974 – Entry Date
• “Modern guardrails are located along the sides but the wooden plank roadbed is intact.”
• “The ends are set on fieldstone abutments.”
• “On the Eastern End is a damaged circular plaque reading: “The Variety Iron Works Cleveland O. Bridge Builder.”
• The condition blocks are checked as Good and Unaltered
Statement of Significance

“The Catoctin Creek Bridge is an excellent example of the metal truss bridges once prevalent on the secondary roads throughout the state. Like the covered bridges they superseded, the metal truss bridges are a fast disappearing piece of Americana. This particular example is virtually the only bridge of its size and type left in northern Virginia, and it is given added distinction by its unusually picturesque setting in the beautiful farming region near the Quaker community of Waterford. The shaded unpaved county road served by the bridge, and wooden plank roadbed on the bridge itself add nostalgia to the scene.

The bridge was produced by the Variety Iron Works of Cleveland, Ohio, around 1900. It originally was located on Route 7 across Goose Creek east of Leesburg. It was dismantled and moved to its present location around 1932.”
Alterations / Changes over the Years

- Per the Baker inspection report, and as noted in the National Register, the bridge was originally built in 1889 on the Leesburg & Alexandria Turnpike (Route 7) over Goose Creek. In 1932 it was dismantled and moved to its present location.

- In 1967 the stringers were replaced.
- Truss joints were retrofit and several truss bracings were replaced.
- Guardrail was added continuously across the bridge.
- The bridge was metalized thus changing its appearance from original. (2003)
- After damage by a fallen tree 2 eye-bar members were replaced. (2003)
- Numerous other retrofit details were applied during rehabilitations. (2003)
- Stone masonry abutments have been capped and pointed. (2003)
- Roller type bearings have been replaced. (2003)
“John G. Lewis Memorial Bridge”

Tree Impact on Metalized Truss (Reconstruction in 2003)
Current Structural Issues

• Chemical composition of the material (steel or wrought iron?) is unknown, thus the susceptibility to brittle fracture is unknown. What is known is that it was manufactured in 1889.
### Early Unit Stresses Used in Tables of Allowable Loads as Published in Catalogs of the Following Mills

#### For Wrought Iron

<table>
<thead>
<tr>
<th>Year</th>
<th>Rolling Mill</th>
<th>Unit Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>1873</td>
<td>Carnegie Kloman &amp; Co. (&quot;Factor of Safety 3&quot;)</td>
<td>14000 psi</td>
</tr>
<tr>
<td>1874</td>
<td>New Jersey Steel &amp; Iron Co.</td>
<td>12000 psi</td>
</tr>
<tr>
<td>1881-1884</td>
<td>Carnegie Brothers &amp; Co., Ltd.</td>
<td>[12000 psi, 10000 psi]</td>
</tr>
<tr>
<td>1884</td>
<td>The Passaic Rolling Mill Co.</td>
<td>[12000 psi, 10000 psi]</td>
</tr>
<tr>
<td>1885</td>
<td>The Phoenix Iron Company</td>
<td>12000 psi</td>
</tr>
<tr>
<td>1886-1887</td>
<td>Pottsville Iron &amp; Steel Co.</td>
<td>12000 psi</td>
</tr>
<tr>
<td>1889</td>
<td>Carnegie Phipps &amp; Co., Ltd.</td>
<td>[12000 psi, 10000 psi]</td>
</tr>
</tbody>
</table>

#### For Steel

<table>
<thead>
<tr>
<th>Year</th>
<th>Rolling Mill</th>
<th>Unit Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>1887</td>
<td>Pottsville Iron &amp; Steel Co.</td>
<td>15600 psi</td>
</tr>
<tr>
<td>1889-1893</td>
<td>Carnegie Phipps &amp; Co., Ltd. (Bldgs.)</td>
<td>16000 psi</td>
</tr>
<tr>
<td>1893-1908</td>
<td>(Bridges)</td>
<td>12500 psi</td>
</tr>
<tr>
<td>1893-1908</td>
<td>Jones &amp; Laughlin Steel Co.</td>
<td>[16000 psi, 12500 psi]</td>
</tr>
<tr>
<td>1896</td>
<td>Carnegie Steel Co., Ltd. (Bldgs.)</td>
<td>16000 psi</td>
</tr>
<tr>
<td>1897-1903</td>
<td>(Bridges)</td>
<td>12500 psi</td>
</tr>
<tr>
<td>1898-1919</td>
<td>The Passaic Rolling Mills Co.</td>
<td>[16000 psi, 12500 psi]</td>
</tr>
<tr>
<td>1900-1903</td>
<td>Cambria Steel Co.</td>
<td>[16000 psi, 12500 psi]</td>
</tr>
<tr>
<td>1900-1903</td>
<td>Bethlehem Steel Co. (Bldgs.)</td>
<td>16000 psi</td>
</tr>
<tr>
<td>1907-1911</td>
<td>(Bridges)</td>
<td>12500 psi</td>
</tr>
<tr>
<td>1915</td>
<td>Lackawanna Steel Co.</td>
<td>[16000 psi, 12500 psi]</td>
</tr>
</tbody>
</table>

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Wrought Iron or Steel? Built in 1889?
Current Structural Issues

• The bridge is a fracture critical structure with 2 – eye bar chains for the lower chord. Should one eye-bar fail, doubling the load on the 2\textsuperscript{nd} eye bar, it too would be expected to fail.

• Eye-bars of this vintage typically would have high carbon content and fewer alloys thus making them more brittle and susceptible to brittle fracture.
Cracked Eyebolts
Current Structural Issues (cont.)

- Metalizing may have altered the surface metal properties.
- Inspection of the pin connections, is difficult for inspectors and requires additional inspections.
- The structure has noticeable loss of section (pitting)
- The structure has a mixture of rivets, machine bolts (unacceptable structurally) and H.S. Bolts. Some bolts have improper thread lengths.
- The abutments are/were stone masonry.
Cracking has been prevalent on the structure and can now be observed at:

1. Joint U2N truss member,
2. Joint U3N several locations,
3. Joint U7N,
4. Near U4N,
5. Near U2S,
6. Upper Chord outer web near U5 downstream
7. Floorbeam support plate at L2 Downstream
8. Floorbeam support plate L4 Downstream,
9. In the bracing plate at U4 Downstream,
10. U2 angle bracket upstream,
11. Lateral bracing connection at L4 upstream.

“John G. Lewis Memorial Bridge”
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PHOTO 12 – CRACK IN UPPER CHORD OUTER WEB NEAR U5, DOWNSTREAM
“John G. Lewis Memorial Bridge”
Fatigue, Fracture and Crack Propagation

“John G. Lewis Memorial Bridge”
### Posting Limits

<table>
<thead>
<tr>
<th>Year</th>
<th>Posted Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003 Rehab</td>
<td>15 Tons</td>
</tr>
<tr>
<td>2008</td>
<td>8 Tons</td>
</tr>
<tr>
<td>2014</td>
<td>3 Tons</td>
</tr>
</tbody>
</table>

"John G. Lewis Memorial Bridge"
POSTING LIMITS...
What posting limits? I never saw that sign!

“John G. Lewis Memorial Bridge”
Geometric Issues

• The existing roadway width is only 11’ – 2”
  Thus making the structure…
  Functionally Obsolete.
Design Live Load ???

100 Lbs./SF

“John G. Lewis Memorial Bridge”
What to Do?
Guiding Principles

Mission Statement
Our mission is to plan, deliver, operate and maintain a transportation system that is safe, enables easy movement of people and goods, enhances the economy and improves our quality of life.
What to Do? Guiding Principles

1. Safe – both structurally and functionally
   • Provides for the movement of People and Goods
   • Provides a 75 year service life
   • Recognizes the Historical Significance of the Existing Bridge
   • Is serviceable
   • Makes the best use of limited resources
   • Enhances the community
   • Others

“John G. Lewis Memorial Bridge”
Detour Route
Is 11.5 miles long and, per Bing, is approximately a 25 minute drive.

“John G. Lewis Memorial Bridge”
Options for Discussion

• Do Nothing. This could mean closing the bridge.
• Repair the existing bridge, modified with a redundant load path. (i.e. supplemental support structure)
• Replace the bridge with a new structure in the same location.
• Build a parallel structure.
• Preservation of the bridge in some form/location.
• Others?

“John G. Lewis Memorial Bridge”