August 31, 2011

Douglas Bramlette, P.E. L.S.
County Engineer
Douglas County Transportation and Land Services
140 19th Street NW, Suite “A”
East Wenatchee, WA 98802

RE:   Chief Joseph Dam Bridge (Bridge No. 26.5ENE) - Revised Load Rating

Dear Mr. Bramlette:

Nicholls Engineering performed a Routine and Fracture Critical Bridge Inspection of the Chief Joseph Dam Bridge on March 14, 2011. As a result of this inspection, Nicholls Engineering revisited the load rating that we performed in 2009. This letter summarizes our overall findings during the fracture critical inspection, explains our revisions made to the bridge load rating and provides our recommendations to the County.

Additionally, as part of our scope of work, we addressed the concerns regarding the load rating by David Evans and Associates (as specified in an October 7, 2010 e-mail).

Bridge Summary

The Chief Joseph Dam Bridge crossing Foster Creek is located in northern Douglas County on Pearl Hill Road. It is a 308 foot long bridge with a 126 foot historic timber truss main span with timber approach spans on each side. The historic truss was originally built in 1958 and was designed for H15-S12 live load and a 26'-4" wide timber deck. The bridge was rehabilitated in 2003 by replacing both approach spans and replacing the entire deck with a fiber reinforced polymer (FRP) deck system. The new deck was widened to 32'-0" wide and new curbs and railing were added.

Overall Inspection Observations

Overall the bridge members (FRP deck, Glulam Timber Girders, Timber Stringers, Timber Floor Beams, Abutments and Piers) are in fair to good condition. The majority of the defects that we observed and noted in our inspection report occur in the bridge connection details. In our opinion, many of these defects appear to be related to construction or alignment issues.

We left the superstructure coded a “4” (Poor Condition) due to the truss portion. The superstructure was coded down to a “4” as a result of cracks discovered in the gusset plates at L0 (North side). Fish plates were bolted to the gussets as a repair on 8/27/2008. We observed no problems with this repair, but we feel that this fix should be considered temporary until the overall capacity of the repair plates can be determined.

Please refer to the most recent Bridge Inspection Report for a summary of all other notes and repair recommendations.
Load Rating Remarks

The following revisions and updates were made to our load rating report dated February 2009:

1. In the rating for the tension rod members, we removed the calculation for checking “bending” in the truss pins. This was the controlling factor in our previous load rating. In our original load rating, we checked the bending in the pins as a result of a comment we read in the 2002 inspection report (by others). The comment stated, “The bolt at U2 South is slightly bent”. During our inspection, we paid close attention to this and are now satisfied that the pin is not actually bent. We did observe several locations where the fish plates on each side of the pins were misaligned. In other words, they were not in tight contact with the pin, which may have caused the pin to appear bent in previous photographs.

2. In the rating for the tension rod members, we updated the capacity of the weld material to 60 ksi.

3. We revised the distribution factor (for a one lane bridge) to be 1.22. The distribution factor is the proportion of one line of truck wheels that is distributed to each side of the truss. Upon further consideration, we feel that even though this bridge is currently restricted to one lane down the center of the bridge, we should account for the chance that the trucks may be slightly off center driving down the bridge.

4. In the rating calculation for the diagonal compression tension (timber Glulam members), we updated the modulus of elasticity of the timber glulam to 1,700,000 psi per AASHTO Table 13.5.3B. Additionally, we added a load duration factor of 1.15 per AASHTO Table 13.5.5A.

In the rating calculation for the diagonal compression glulam members, we feel that a wet service factor \( C_m = 0.73 \) is applicable. This factor is used in applications where the moisture content of the timber glulam exceeds 16%. Since we do not know the exact moisture content without testing and the truss elements could be considered exposed to the elements (snow and rain) without full protection, it is conservative to apply this wet service factor.

As additional support, according the 1991 NDS Commentary for timber design, it states that, “Applications in which the structural members are regularly exposed directly to rain and other sources of moisture are typically considered wet conditions of service.” and “The designer has final responsibility for determining the appropriate moisture content basis for the design.”

As a result of our inspection and re-visiting the load rating, we have determined that the bridge would not require posting if configured for one lane down the center of the bridge. We have also evaluated the bridge for the two lane scenario and have included that rating for your information. Two loaded lanes would still require the bridge to be posted. The controlling rating factors for the bridge are 1) the axial strength of the vertical tension rod in the truss and then 2) the compressive strength of the timber glulam members. The following two tables provide a summary of our findings:
Summary for One Lane Configuration in the Center of the Bridge

<table>
<thead>
<tr>
<th>Truck Type</th>
<th>Rating Factor</th>
<th>Allowable Loads (tons)</th>
<th>Controlling Point</th>
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<tbody>
<tr>
<td>AASHTO Type 3</td>
<td>1.73</td>
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<tr>
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<td>51.1</td>
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<td>Compression in U4-U5</td>
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<td>HS-20 Operating</td>
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<td>70.9</td>
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</table>

Summary for Two Lane Configuration on the Bridge

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<th>Controlling Point</th>
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<td>HS-20 Operating</td>
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<td>31.1</td>
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</tbody>
</table>

Summary and Recommendations

Even though this bridge was rehabilitated in 2003, we feel that the historic truss portion does not have the capacity to fully carry legal trucks that are on the road today. Much of the load carrying capacity of the truss is taken up by the additional dead loads of the rehabilitated deck. We calculated that the rehabilitated dead loads to the truss are approximately 70% more than the original dead loads. Additionally, the live load has increased over time as well. The original truss was only designed for an H15-S12 live load or a 15-ton two-axle truck.

In order for this bridge to carry two lanes of unrestricted traffic, we believe further and extensive evaluation of the truss would be required. Issues that would need to be addressed would be the strength and size of the vertical tension rods, the actual strength and size of the glulam timbers, existing alignment issues in many connections and the option of reducing the dead load weight on the truss.

Additionally, we most recently spoke with Grant Griffin from Highways and Local Programs. He asked us about the possible option to move the historic truss to a different location in Douglas County and build a new main span at the bridge site. This is an option that the County may choose to explore and it would also preserve the rehabilitated approaches that were constructed within the past 10 years.
We appreciate this opportunity to provide our professional services to you. Should you have any questions or comments regarding these issues, please do not hesitate to contact our office.

Sincerely,
NICHOLLS ENGINEERING

Jerome J. Nicholls, PE/SE
Principal Engineer

Susan M. Kovich, P.E.
Project Engineer

Enclosures