The FHWA Bridge and Tunnel Programs

A presentation to the ARTBA Bridge Policy and Promotion Council

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Federal Highway Administration
Topics?

- EDC2 Alternative Contracting Methods Update
- Buy America update
- Indefinite Delivery / Indefinite Quantity contracts
- New Mexico Performance-based Contractor Prequalification and Procurement System
- USDOT Local Hiring Preference Program Pilot
- USDOT / FHWA transition to 2 CFR 200 – what does it mean?
Contractors Division Roundtable with Federal Highway Administration

Right after this presentation....1pm until 4pm.

FHWA represented by:
Gerald (Jerry) Yakowenko
Team Leader, Office of Program Administration
Contents

• Changing the Language of the Federal-Aid Bridge Program
• I-5 Skagit River Bridge Collapse
• National Tunnel Inspection Standards
• National Bridge Inspection Standards
• Transportation Performance Management – Bridge Performance Measures
• Q and A
Goal...Eliminate Federally instituted but (to the uninformed) sometimes confusing, unclear, alarming or misleading terms from the language of bridge engineers!

This is language that has served us well and we have “owned” but recognize it does not translate well in a transparent world.
Changing the Language of the Federal-Aid Bridge Program

View of the I-5 Skagit River Bridge looking west...May 24, 2013.
Accident Information

– Thursday, May 23, 2013, about 1005pm EDT, an oversized load struck the I-5 bridge over the Skagit River near Mount Vernon, WA.
– At approximately midnight, NTSB requested FHWA assistance.
– Wheels up at 0600!
Original 1955 configuration.

Southbound lane.  
Northbound lane.
Reconfiguration in 1956 to accommodate I-5 widening to 2 lanes in each direction.
History* of High Load Hits

• Received numerous high load hits dating back to 2003

• High load hit on 11/29/2012
  • Portal brace, Span 5
  • Northbound direction
  • 16-inch section
  • 3-inch tear in steel
Accident Information

Did the bridge hit the truck or did the truck hit the bridge?
I-5 Wreckage

Looking north from end of remaining truss structure.

Looking south from atop north abutment.
Access to wreckage.
As with any collapse, the challenge is always to sort out:

- Damage caused by initial event
- Damage caused during the fall
- Damage caused by the structure hitting the river/riverbed
- Damage from recovery
Survey of wreckage from water.
Documentation of buckling and fractures (local behaviors).
Analysis and documentation of global behavior.
Change of perspective.
Witness marks.
Recovery of wreckage.
Observations: Portal Frame v. Sway Brace

Warren Truss with verticals.

NTSB
Strong v. Weak Node

NTSB
Strong v. Weak Node
Strong v. Weak Node

Survey of damage to remaining truss structure.
Lucky?

- No less than 4 separate security video surveillance cameras captured the collapse.
- Video confirmed our analysis that impact from the over-height load caused the collapse.
Security Camera Footage
Truck

Pick-up and Camper
With all of that as context...what do you think was the first question I had to answer for the Chairman of the NTSB?
The Sufficiency Rating (SR) for the Skagit River Bridge is 53.8. Is that unsafe?
• 4 Components (Appendix B)
  – Structural Adequacy and Safety (55%)
    • Items 59, 60, 62 and 66
  – Serviceability and Functional Obsolescence (30%)
    • Items 28, 29, 32, 43, 51, 53, 58, 67, 68, 69, 71, 72 and 100
  – Essentiality for Public Use (15%)
    • Items 19, 29 and 100
  – Special Reductions (up to -13%)
    • Items 19, 36 and 43

• So….is 58.9 unsafe?
Sufficiency Rating

- Legacy Term (MAP-21)
- Used as a means to apportion Highway Bridge Program Funding to States
- An early attempt at bridge management
- Still in many of our programs, guidance, etc. (SI&A) but the Federal-Aid program no longer uses it
What was the second question?
The Skagit River Bridge is Functionally Obsolete (FO). Is that unsafe?
An appraisal rating of 3 or less for
- Item 68, Deck Geometry; or
- Item 69, Underclearances; or
- Item 72, Approach Roadway Alignment

OR

An appraisal rating of 3 for
- Item 67, Structural Evaluation
- Item 71, Waterway Adequacy

Is a FO bridge unsafe?
Functionally Obsolete

- 1960’s 3Br, 1Ba single family home
- Legacy Term (MAP-21)
- Used to incorporate some of the functional parameters of a bridge into the allocation and decisions on funding
- Still in many of our programs, guidance, etc. (SI&A) but the Federal-Aid program no longer uses it
Next Question?
The Skagit River Bridge is Fracture Critical (FC).

Is that unsafe?
• 23 CFR 650 (C)
• A steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse.

• Is a FC bridge unsafe?
Fracture Critical

- Rooted in two bridge failures
- Reliability v. robustness
  - Material standards
  - Fabrication standards
  - Hands-on inspection
- (Why only tension members?)
- System Redundant Member
- No FC members on I-5 failed
Improvements to the I-5 Bridge

I-5 Bridge – Before Accident

I-5 Bridge – After Accident

NTSB
Changing the Language of the Federal-Aid Bridge Program

- Sufficiency Rating
- Functionally Obsolete
- Fracture Critical => System Redundant Member, others

- What other bridge program terminology needs to be addressed to achieve my goal?
The I-35W Bridge was Structurally Deficient (SD). Was that unsafe?
• A condition rating of 4 or less for
  – Item 58, Deck; or
  – Item 59, Superstructures; or
  – Item 60, Substructures; or
  – Item 62, Culvert and Retaining Walls
OR
• An appraisal rating of 2 or less for
  – Item 67, Structural Evaluation
  – Item 71, Waterway Adequacy

• Is a SD bridge unsafe?
Structurally Deficient

- Condition and physical adequacy parameter for SR
- No longer needed for funding apportionment, but still in MAP-21 (bridge penalty provision)
- Performance Measures Rule-Making...Good/Fair/Poor
- Poor
  - A condition rating of 4 or less for
    - Item 58, Deck; or
    - Item 59, Superstructures; or
    - Item 60, Substructures; or
    - Item 62, Culvert and Retaining Walls
  OR
  - An appraisal rating of 2 or less for
    - Item 67, Structural Evaluation
    - Item 71, Waterway Adequacy
- Easy “sell”...Poor/SD = 0.998
Changing the Language of the Federal-Aid Bridge Program

- Sufficiency Rating
- Functionally Obsolete
- Fracture Critical => need to retain in some form
- Structurally Deficient => Poor?
- A decade of effort?
- What bridges are unsafe?
Open bridges are safe, unsafe bridges are closed.

Safe.

Unsafe!
MAP-21 Initiatives

- Establish the National Tunnel Inspection Standards (NTIS)
- Update the National Bridge Inspection Standards (NBIS)

Both of these efforts require rule-making to produce the regulations that will implement the law.
- ANPRM – 2008
- NPRM – 2010
- Draft Final Rule – 2012
- MAP-21
- SNPRM – 2013
- Final Rule – 2015(?)
NTIS Final Rule

• 23 CFR 650 (E)
  – Applicability.
  – Definitions.
  – Tunnel Inspection Organization Responsibilities.
  – Qualifications of personnel.
  – Inspection interval.
  – Inspection procedures.
  – Inventory.
National Tunnel Inspection Program

- NTIS
- National Tunnel Inventory (NTI) Database
- Specifications for the NTI (Coding Guide)
- NHI Tunnel Inspector Training
- Tunnel assessment process...19(?) Metrics
• **Definitions**
  – Nationally certified bridge inspector

• **Bridge Inspection Organization Responsibilities**
  – Critical finding activities and a central registry of bridge inspectors

• **Inspection Interval**
  – Risk-based inspection interval

• **Inspection Procedures**
  – Minimum situations that define a critical finding, when they need to be reported to FHWA and what must be included in the report.
• FHWA will **likely** address more than just the MAP-21 required elements once the rule-making process “opens up” the NBIS regulation

• Please comment on what you like in addition to what you don’t like...also, offer us solutions
Pavement and Bridge Condition Performance Measures
Notice of Proposed Rulemaking
## NHS Bridge Condition Performance Measures (490.407)

<table>
<thead>
<tr>
<th>Bridge Condition Performance Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of NHS Bridges Classified</td>
</tr>
<tr>
<td>as in “Good” Condition</td>
</tr>
<tr>
<td>Percentage of NHS Bridges Classified</td>
</tr>
<tr>
<td>as in “Poor” Condition</td>
</tr>
</tbody>
</table>
Data Sources and Components of a Bridge

<table>
<thead>
<tr>
<th>Bridge NBI Items</th>
<th>Culvert NBI Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 58- Deck</td>
<td>Item 62- Culverts</td>
</tr>
<tr>
<td>Item 59- Superstructure</td>
<td></td>
</tr>
<tr>
<td>Item 60- Substructure</td>
<td></td>
</tr>
</tbody>
</table>

Subpart D (490.400s)
# NBI Bridge Condition Rating Thresholds for NHS Bridges

<table>
<thead>
<tr>
<th>NBI Rating Scale (from 0 – 9)</th>
<th>9</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good</td>
<td>Fair</td>
<td>Poor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Bridge

<table>
<thead>
<tr>
<th>Component</th>
<th>Rating</th>
<th>Minimum Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck</td>
<td>≥7</td>
<td>5 or 6</td>
</tr>
<tr>
<td>Superstructure</td>
<td>≥7</td>
<td>5 or 6</td>
</tr>
<tr>
<td>Substructure</td>
<td>≥7</td>
<td>5 or 6</td>
</tr>
<tr>
<td>Culvert</td>
<td>≥7</td>
<td>5 or 6</td>
</tr>
</tbody>
</table>
**Bridge Classification Example**

Example for bridge

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**Item 58**
- Deck = 8
  - G: >=7; F: 5 or 6; P: <=4
  - Good
    - Fair
    - Poor

**Item 59**
- Superstructure = 8
  - G: >=7; F: 5 or 6; P: <=4
  - Good
    - Fair
    - Poor

**Item 60**
- Substructure = 4
  - G: >=7; F: 5 or 6; P: <=4
  - Good
    - Fair
    - Poor

Lowest Rating is Poor

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Overall Condition Classification = Poor
## Calculating NHS Bridge Condition Performance Measures (490.409)

<table>
<thead>
<tr>
<th>Overall Bridge Condition Rating</th>
<th>Structure Type</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>Bridges</td>
<td>All metrics rated “Good”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metric rated “Good”</td>
</tr>
<tr>
<td>Poor</td>
<td></td>
<td>Any metric rated “Poor”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metric rated “Poor”</td>
</tr>
<tr>
<td>Fair</td>
<td></td>
<td>Minimum rated metric “Fair”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metric rated “Fair”</td>
</tr>
</tbody>
</table>

- **Bridges**:
  - 3 metric classification (58-Deck, 59-Superstructure, 60-Substructure)

- **Culverts**:
  - 1 metric classification (62-Culverts)

- Measures:
  - Percentage of deck area classified as in “Good” condition
  - Percentage of deck area classified as in “Poor” condition

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*Transportation Performance Management*
**Minimum Condition and Penalty for Structurally Deficient Bridges (490.411 and 490.413)**

- **Minimum condition level:** \( \leq 10\% \) of total deck area of NHS bridges classified as Structurally Deficient

- **Penalty:** If for 3 consecutive years the minimum condition level is not met, State must set aside and obligate NHPP funds for eligible projects on bridges on the NHS

**Calculation:**

\[
100.0 \times \frac{\text{Total Deck Area of NHS Bridges Classified as Structurally Deficient}}{\text{Total Deck Area of NHS Bridges in a State}}
\]
Performance Measure Comments

- Docket closes May 8, 2015

- www.federalregister.gov and search “bridge performance measures”
What does the future look like?

- SR, FO, SD
- FC
- Good, Fair, Poor
- More...what else do we need to tell our story?
- Risk based, data driven
- Risk...severity of consequence v. likelihood of occurrence.
Thank you!

Q and A

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