FHWA Bridge Program Initiatives - Bridge Design and Analysis

2016 RADBUG

Thomas Saad, P.E.
FHWA, Resource Center
(708) 283.3521
Thomas.saad@dot.gov
Outline

- Reauthorization
  - MAP-21
  - FAST Act
- Steel Bridge Initiatives
- Concrete Bridge Initiatives
- Load Rating Initiatives
MAP-21

- National Bridge Inspection Standards
- NHS Bridge Condition Penalty
- Bridge Performance Measures
- Risk-Based Prioritization
NBIS Update

- Establish and maintain risk-based, data-driven inspection standards
- Establish risk-based, data-driven frequency of inspections
- Establish procedures for reporting critical findings and monitoring corrective actions
- Requirement to conduct annual compliance reviews
- Maintain a bridge inspection training program
- Nationally Certified Bridge Inspectors
NHS Bridge Condition Penalty

- If deck area on structurally deficient NHS bridges exceeds 10 percent for 3 consecutive years,
- Then 50 percent of the State's Highway Bridge Program (HBP) apportionment in 2009 will be set aside from NHPP.
- First penalties will be “imposed” on October 1, 2016 (beginning of FY17)
Bridge Performance Measures

- The final rule is expected to be published by the end of the calendar year.

Risk-Based Prioritization

- Classify bridges according to serviceability, safety and essentiality.
- Based on that classification, assign each a risk-based priority for preventative maintenance, replacement or rehabilitation.
Fixing America’s Surface Transportation (FAST) Act

- Signed by President Obama on December 4, 2015 …retroactive to October 1, 2015
- First long-term authorization act in a decade
- Provides 5 years of funding certainty for infrastructure planning and investment
- Authorizes $305B (all modes) over FY 2016-2020
- $70B in transfers to keep the Highway Trust Fund solvent; fully “paid for” (offset) by unrelated savings
FAST Act Key Highway Facts

- $226.3B for highways over five years (FY 2016-2020)
- Builds on the program structure and reforms of MAP-21
- Continued focus on accelerating project delivery
- Adds a new freight formula and expands freight network
- Adds a new discretionary program for nationally significant freight and highway projects
Some FAST Act Bridge Related Provisions

- Sec. 1105 Nationally Significant Freight and Highway Projects
- Sec. 1106 National Highway Performance Program
- Sec. 1111 Bundling of Bridge Projects
- Sec. 1116 National Highway Freight Program
- Sec. 1303 Treatment of Certain Bridges Under Preservation Requirements
- Sec. 1409 Milk Products
- Sec. 1410 Interstate Weight Limits
- Sec. 1422 Study on Performance of Bridges
- Sec. 1439 Elimination of Barriers to Improve At-Risk Bridges
Sec. 1105 Nationally Significant Freight and Highway Projects

- New program: FASTLANE Grants
  - $900 M/year (average) for competitive grants or TIFIA loans for projects >$100 M (reduced for States w/ small programs)

- Eligible activities:
  - Highway freight projects on National Highway Freight Network
  - NHS highway/bridge projects that increase capacity or are in National Scenic Areas
  - Freight rail/intermodal/port projects (≤$500 M over 5-year period)
  - Rail-highway grade crossing or grade separation projects

- States, large MPOs, Tribes, localities, and FLMAs may apply
- OST selects projects; Congress has 60 days to disapprove
A vehicle carrying “fluid milk” products shall be considered a non-divisible load.
Sec. 1410 Interstate Weight Limits

- Covered Heavy-Duty Tow and Recovery Vehicles
- Vehicles on Certain Highways in TX
- Logging Vehicles in WI
- Vehicles on Certain Highways in AR
- Logging Vehicles in MN
- Emergency Vehicles
- Natural Gas Vehicles
Natural Gas Vehicles

- If operated by natural gas, may exceed any vehicle weight limit (up to a maximum gross vehicle weight of 82,000 pounds) by the difference between the natural gas tank and fueling system and the weight of a comparable diesel tank and fueling system.
Sec. 1410 Interstate Weight Limits

- Emergency Vehicles
  - Shall not enforce against an emergency vehicle up to a maximum of 86,000 pounds a limit less than –
    - 24,000 pounds on a single steering axle
    - 33,500 pounds on a single drive axle
    - 62,000 pounds on a tandem axle
    - 52,000 pounds on a tandem rear drive/steer axle
Sec. 1410 Interstate Weight Limits – Emergency Vehicles

- Single Rear Axle Emergency Vehicle
  - Front Single Axle: 24,000 pounds
  - Rear Single Axle: 33,500 pounds
  - Wheelbase: 15 ft.

- Tandem Rear Axle Emergency Vehicle
  - Front Single Axle: 24,000 pounds
  - Rear Tandem Axle: 62,000 pounds (two 31,000 pound axles spaced at 4 ft.)
  - Wheelbase: 17 ft. (distance from front axle to the centerline of rear tandem axle)
### Sec. 1410 Interstate Weight Limits – Emergency Vehicles

<table>
<thead>
<tr>
<th>System</th>
<th>NBI</th>
<th>CA</th>
<th>NY (State-Owned)</th>
<th>OR (State-Owned)</th>
<th>TN (biased)</th>
<th>VA (State-Owned)</th>
<th>WI (State-Owned)</th>
<th>WY</th>
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<tbody>
<tr>
<td>Interstate</td>
<td>10%</td>
<td>&lt;14% (State)</td>
<td>3%</td>
<td>15%</td>
<td>14%</td>
<td>2%</td>
<td>&lt;12%</td>
<td>4%</td>
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<td>Non-Interstate</td>
<td>35%</td>
<td>&lt;42% (Local)</td>
<td>17%</td>
<td>25%</td>
<td></td>
<td>&lt;12%</td>
<td>8% (Non-IS NHS)</td>
<td></td>
</tr>
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</table>

Concerns…
- Ubiquitous signs
- Freight
Sec. 1410 Interstate Weight Limits

- Covered Heavy-Duty Tow and Recovery Vehicles
  - Interstate vehicle weight limits to not apply
  - A vehicle that is transporting a disabled vehicle from the place where it became disabled to the nearest appropriate repair facility, and
  - Has a gross vehicle weight that is equal to or exceeds the gross vehicle weight of the disabled vehicle being transported
Covered Heavy-Duty Tow and Recovery Vehicles
## Sec. 1410 Interstate Weight Limits

- Covered Heavy-Duty Tow and Recovery Vehicles
  - Assuming both the tow vehicle and the disabled vehicle individually meet the Bridge Formula

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<th>VA (State-Owned)</th>
<th>WI (State-Owned)</th>
<th>WY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate</td>
<td>20%</td>
<td>14% (State)</td>
<td>6%</td>
<td>&gt;15%</td>
<td>39% (biased)</td>
<td>4%</td>
<td>12%</td>
<td>16%</td>
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<tr>
<td>Non-Interstate</td>
<td>42%</td>
<td>42% (Local)</td>
<td>11%</td>
<td>&gt;25%</td>
<td></td>
<td></td>
<td>12%</td>
<td>18% (Non-IS NHS)</td>
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</table>

18% (Non-IS NHS) 35% (Non-NHS)
National Tunnel Inspection Standards

- 07.14.2015, Enacted
- 08.13.2015, Effective
- 12.11.2015, Pre. Inventory Data Due
- 08.13.2017, Qualified PM Identified
- 08.13.2017, Initial Inspections Due
- 04.01.2018, Inspection Data Due

Much like NBIS, we are developing a metric based oversight process that will be implemented in 2018.
Highway Tunnel fun facts

- Number of highway tunnels = 473
- CA = 64
- WA = 56
- MA = 39
- NPS = 64
Longest highway Tunnel

- Anton Anderson Tunnel (AK)
- 13,000 ft.
Shortest highway Tunnel

- Apishapa Arch (CO) = 11 ft.
- Also the oldest tunnel...built in 1882!
Changing the Language of the Federal-Aid Bridge Program

- Goal…Eliminate Federally instituted but (to the uninformed) sometimes confusing, unclear, misleading or alarming 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.
  - Functionally Obsolete
  - Sufficiency Rating
  - Structurally Deficient
  - Fracture Critical
Functionally Obsolete

- Legacy Term (MAP-21)
- Relies on 5 items from the NBI
- Used to incorporate some of the functional parameters of a bridge into the allocation and decisions on funding
- Still in some of our programs, guidance, etc. (SI&A) but the Federal-Aid program no longer uses it
Sufficiency Rating

- Legacy Term (MAP-21)
- Relies on 19 items from the NBI
- Used as a means to apportion Highway Bridge Program Funding to States
- An early attempt at bridge management
- Still in some of our programs, guidance, etc. (SI&A) but the Federal-Aid program no longer uses it
Structurally Deficient

- Condition and physical adequacy parameter for SR
- No longer needed for funding apportionment, but still in law (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
Fracture Critical

- 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.
- Rooted in two bridge failures
- FHWA, AASHTO, AWS
- System Redundant Member
Changing the Language of the Federal-Aid Bridge Program

- Sufficiency Rating
- Functionally Obsolete
- Structurally Deficient => Poor?
- Fracture Critical => need to retain in some form
## Bridge Conditions

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2006</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Bridges</strong></td>
<td>614,288</td>
<td>597,561</td>
<td>563,500</td>
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<tr>
<td><strong>Structurally Deficient Poor</strong></td>
<td>56,017</td>
<td>75,422</td>
<td>88,900</td>
</tr>
<tr>
<td>Percent of total</td>
<td>9.1%</td>
<td>12.6%</td>
<td>15.8%</td>
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<tr>
<td><strong>Deck Area (million square meters)</strong></td>
<td>334.0</td>
<td>371.2</td>
<td></td>
</tr>
<tr>
<td>Percent of total</td>
<td>6.3%</td>
<td>9.6%</td>
<td></td>
</tr>
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</table>
2016 NBIS Compliance

% Satisfactory in PY 2016

- CY 2011
- Change From CY2011 to PY2016
2016 NBIS Compliance

# Metrics Conditionally Compliant by Year

- CY 2011: 350
- PY 2013: 250
- PY 2014: 200
- PY 2015: 150
- PY 2016: 100
Steel Bridge Technical Activities

- NHI Engineering for Stability in Bridge Construction (3½ day course now available)
- LRFD Superstructure Design Course update (complete)
- Bridge Information Modeling (BrIM) Standards (ongoing)
- Cooperative Agreement with Lehigh (ongoing)
  - Manual for Refined Analysis of Bridges
  - Tubular Member Design for Bridges
  - Reliability in Special Bridge Systems
- Strengthening of Bridge Members
- Orthotropic deck testing
Steel Bridge Technical Activities

- Steel Bridge Design Handbook update (12/15)
- NHI Fatigue and Fracture Course (late 2016)
- Design Specs for Non-composite Box Sections (late 2017)
Concrete Bridge Technical Activities

- Post-Tensioning Guidance & Training
  - PT Installation and Grouting Manual (E-doc on HIBS)
  - PT Installation and Grouting WBT (Available through NHI)
  - PT Box Girder Design Manual (Final Draft under Review)
  - Advanced PT Design Guidance (electrically isolated PT, replaceable grouted external PT)
  - Designing PT Systems to Accommodate NDE
    - Literature search complete & electrically isolated PT testing just starting
Concrete Bridge Technical Activities

- Advanced Precast Element Design Guidance & Training
  - Awarded to AASHTO w/ subcontract to PCI as primary developer (August 2014)
- PCC Girder Design WBT (8 hrs)
- Full-Depth Precast Deck Panel WBT (4 hrs)
- PCC Girder Stability WBT (4 hrs)
- Curved U-Beam Design Guidance & Criteria
FHWA/NHI Bridge Design and Analysis Courses (www.nhi.fhwa.dot.gov)

- **NHI Course 130081**: LRFD for Bridge Superstructures (4 day)
- **NHI Course 130092**: LRFR for Highway Bridges (4 day)
- **NHI Course 130093**: LRFD Seismic Analysis and Design of Bridges (4 ½ day)
- **NHI Course 130094**: LRFD Seismic Analysis and Design of Tunnels, Walls and other Geotechnical Features (4 day)
- **NHI Course 130095**: LRFD Design and Analysis of Skewed and Horizontally Curved Steel Bridges (2 ½ or 4 ½ days)
Safety and Security

- **AT Planner for Bridge**
  - A DHS developed assessment and design tool for bridges now available at US Army Corps of Engineers Protective Design Center software portal.

- **Bridge Security Design Manual**
  - Draft final manual is under review. Publication expected in early 2017 (probably in electronic format).
  - Will incorporate state of the art security mitigation to show engineers how to plan and design.
  - Design examples utilize the AT Planner for Bridge Tool
Bridge Load Rating Initiatives

- Develop policies and guidance in bridge load rating that improve the safety of our nation’s bridges
  - FAST Act’s Vehicles
  - SHVs, Concrete Box Culverts
- Provide stewardship to advance the state of practice in bridge load rating, posting and overweight permitting
  - Bridge Load Rating Peer Exchange
To further support State’s efforts in meeting the NBIS’s requirements in load rating and FHWA's initiative of implementing the LRFR method, a series of webinars have been planned to provide continued awareness for local, regional, and State transportation agencies.

No. 16: Bridge Load Rating for Overweight Load Permitting – State’s Practice (3) (5/19/2015)

No. 17: Federal Bridge Formula Weights and State-Specific Legal Loads (10/21/2015)

No. 18: Load Rating and Posting for State-Specific Legal Loads (1) (2/24/2016)

Recordings are available at https://www.fhwa.dot.gov/bridge/loadrating/
Load Rating Program Peer Exchanges

- Northeast States
  - CT, MA, ME, NH, NJ, NY, PN, RI and VT
  - Aug. 4-6, 2014, Manchester, NH

- Southeast States
  - AL, FL, GA, KY, LA, MS, NC, SC and TN
  - Sept. 1-3, 2015, Atlanta, GA

- Midwest States
  - IA, IL, IN, MI, MN, MO, OH and WI
  - August 30 - September 1, 2016
QUESTIONS
FHWA Load Rating Policy


- Load Rating for Specialized Hauling Vehicles (SHVs)
- Oversight of Bridge Load Ratings and Postings
- Assigned Load Ratings
- Etc…