FHWA Bridge Program Initiatives - Bridge Design and Analysis

2018 RADBUG
Boise, ID

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Presentation Outline

- Training and Resources for Bridge Design Engineers
- FHWA Load Rating Program Initiatives
- Transforming the Bridge (and Tunnel) Program

FHWA/NHI Bridge Design Courses (www.nhi.fhwa.dot.gov) and Reference Manuals

- 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)**
- NHI Course 132082: LRFD for Bridge Substructures (4 day)

'New' FHWA/NHI Bridge Design Courses (www.nhi.fhwa.dot.gov) and Reference Manuals

- NHI Course 130102: Engineering for Structural Stability in Bridge Construction (2.5-3.5 days)**
- NHI Course 130122: Design and Evaluation of Bridges for Fatigue and Fracture (2 day)**
- NHI Course 130126: Strut and Tie Modeling for Concrete Structures (1.5 day)**
- Bridge Security Design Manual **
- Steel Bridge Design Handbook (updated)**
- Post-tensioned Box Girder Design Manual**

** Manuals can be found searching www.fhwa.dot.gov/bridges

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FHWA/NHI Bridge Design and Analysis Courses (www.nhi.fhwa.dot.gov)

- Many web-based training opportunities that are free of charge
- 3 PDHs or 0.3 CEUs offered
- Topics include:
  - LRFD Design of Bridge Decks and Bearings
  - LRFD Steel I-Girder Details Design
  - Prestressed Concrete Girder Topics
  - Introduction to LFRD for Foundation Design

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
- Mid-Atlantic States +
  - AR, DE, DC, KS, MD, PR, WV, VA
  - September 19-21, 2017, Sterling, VA

Load Rating Program Peer Exchanges

- Northwest States
  - CO, ID, MT, ND, SD, UT, WA, and WY
  - July 18-19, 2018, Denver, CO
- Southwest States
  - AK, AZ, CA, HI, NV, NM, TX, OK, and OR
  - Summer, 2019, TBD

Load Rating Program Peer Exchanges – Top Topics of Interest

- 2014
  - Accommodating deterioration in load rating
  - Rating of Gusset Plates
  - Re-rating triggers and follow-up
- 2015
  - Staffing Needs
  - Accommodating deterioration in load rating
  - Rating of concrete box culverts
- 2016
  - Responsibilities for load rating/posting locally owned bridges
  - Accommodating deterioration in load rating
  - QC/QA Procedures for load rating

Load Rating Program Peer Exchanges – Top Topics of Interest

- 2017
  - Accommodating deterioration in load rating
  - Rating of FAST Act EVs
  - Load Posting procedures/signs
- 2018
  - Rating of FAST Act EVs
  - Metrics 13 and 14
  - Staffing needs

Bridge Load Rating/Analysis Studies

- Development of Synthesis Report on Concrete Bridge Shear Load Rating
- Tunnel Load Rating Reference Guide Development
- Truck Platooning Impacts on Bridges – coming soon

Synthesis Report on Concrete Bridge Shear Load Rating

- To determine when and why existing shear analysis methods provide adequate results and recommend improvements
  - Assess past design specification requirements
  - Assess application of current and past analysis methods
  - Survey 9 States with past problems
  - Assess software implementation of shear analysis methods
- Started August 30, 2017 (approx. 20 month study)
- Thanks to States of CA, ID and 9 States for assistance with survey

Tunnel Load Rating Reference Guide Development

- Projected initiated Sept. 5, 2017
- Completion expected July 28, 2020
- Tunnel element load rating examples will be included
- Methods provided will be demonstrated on existing tunnel components
- Workshops (2) and training slides to be provided
- Thanks to States of CA, MA, PN, and WA for serving on TWG!

FHWA Bridge Load Rating Webinar Series

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/

Transformation of Bridge Program: TPM, TAMP, NBIS and NTIS

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Performance Management (https://www.fhwa.dot.gov/tpm/)

- Rulemaking published 1/18/17, effective 2/17/17
- Provide the **most efficient investment** of Federal transportation funds
- Refocus on **national transportation goals**
- Increase **accountability and transparency**
- **Improve decision-making** through performance-based planning and programming

§ 490.407 National Performance Management Measures for Assessing Bridge Condition

Bridge Condition Measures - All NHS Bridges

- Percentage of NHS bridges classified as in **Good** condition
- Percentage of NHS bridges classified as in **Poor** condition

OVERVIEW: TAMP PURPOSE

23 USC 119 National Highway Performance Program:

- Ensure investments of Federal-Aid support progress toward achievement of performance targets established in a TAMP (purpose #3).
- TAMP must include strategies leading to a program of projects that make progress toward achievement of State targets for asset condition and performance in accordance with section 150(d) and support progress toward achievement of national goals identified in section 150(b).

TAMP PROCESSES (23 CFR 515.7)

- Performance gap analysis
- Life-cycle planning
- Developing a risk management plan
- Developing a financial plan
- Developing investment strategies
- Obtaining data from NHS owners
- Using best available data and using management systems

TAMP MILESTONE DATES

04/30/18: Initial TAMP submitted to FHWA for development process certification

- FHWA will provide feedback on content beyond processes but not make a consistency determination
- Can exclude analyses for life-cycle planning, risk management planning, and financial planning
- Can exclude targets for FHWA measures

06/30/19: Complete TAMP submitted to FHWA for consistency determination

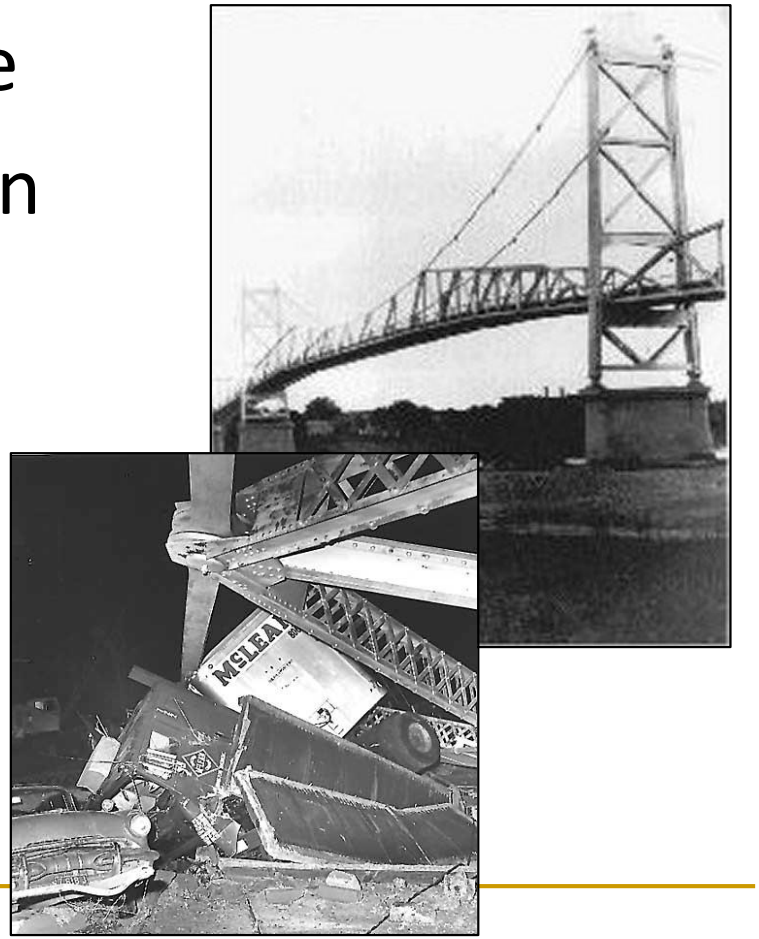
- Includes documentation demonstrating implementation
- Annual consistency review – FHWA completes by 08/31/19 (and 07/31 in subsequent years)
- New process certification required every 4 years or when updates made (23 CFR 515.15(c))

1971 NBIS

- All States required to perform or cause to be performed periodic inspection of bridges more than 20 feet located on Federal-aid highway systems
- Data collection and transmittal requirements established
- Qualifications for key personnel defined
- Training programs developed

The Silver Bridge Collapse

- Eye-bar suspension bridge
- US 35: Ohio River between WV & OH
- Collapsed Dec. 15, 1967
- Cause: instantaneous fracture
- 46 fatalities



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3 Significant Updates in 47 Years

- 1979:
  - NBIS extended to all bridges on public roads
  - National Bridge Inventory established
- 1988:
  - Fracture Critical Inspections
  - Underwater Inspections
- 2004:
  - Revised the qualifications requirements for bridge inspection team leaders and program managers

Fracture Critical: Mianus River Bridge

- I-95 in Greenwich, CT
- Collapsed June 28, 1983
- 3 Fatalities
- Corrosion and fatigue
- Fracture Critical Members were identified as needing more rigorous inspections

Underwater Inspection: Chickasawbogue Creek Bridge

- Built in 1958 in Mobile, AL
- Collapsed in 1985
- Steel piles corroded away below waterline
- Some States were conducting underwater Inspection
- A need for national underwater inspection requirements

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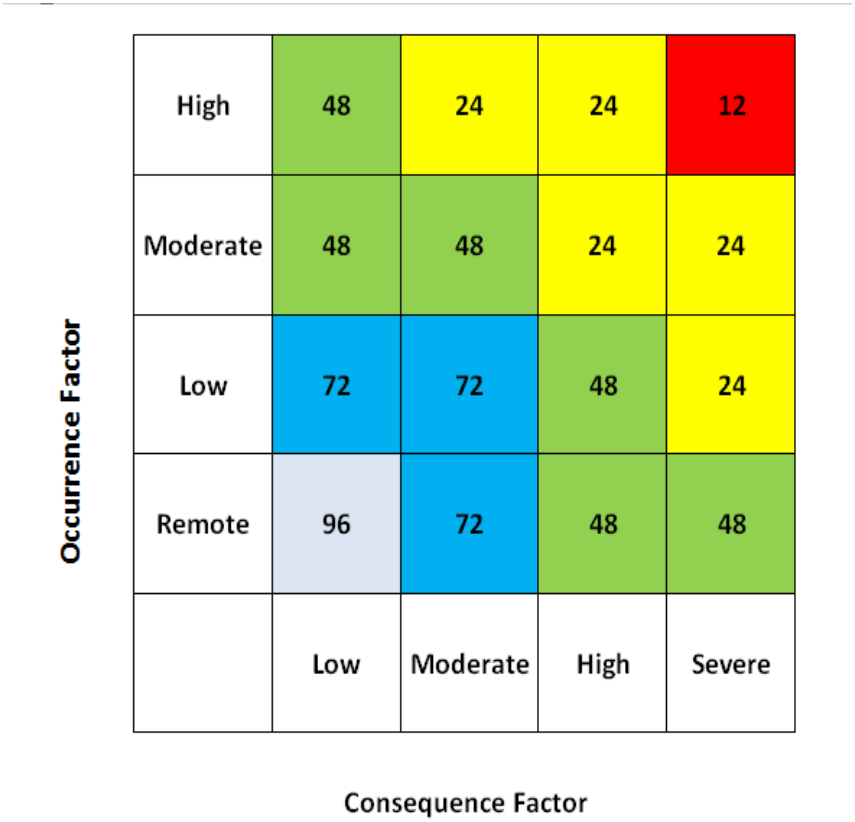
Underwater Inspection: Schoharie Creek

- Near Fort Hunter, NY
- Collapsed April 5, 1987
- 10 fatalities
- Not corrosion…Scour!
- Approx. 70% of bridges in the NBI are over water

Pending 4th Significant NBIS Update (MAP-21)

- Requirement to conduct annual compliance reviews
- Maintain a bridge inspection training program
- Nationally Certified Bridge Inspectors
- Risked-based approach to bridge inspection frequency – NCHRP Report 782
  - Inspection intervals that consider the reliability of bridge elements and the consequences of damage

NCHRP Report 782



- Inspections that consider
  - The reliability of bridge elements
    - Likelihood of deterioration and damage
      - Condition, design, materials and loading
  - The consequences of that damage
    - Minor serviceability issues, safety issue?
- Inspection interval and scope
  - Match inspection requirements with inspection needs for a bridge

Changing the Language of the Federal-Aid Bridge Program

- ~~Sufficiency Rating~~
- ~~Functionally Obsolete~~
- ~~Structurally Deficient~~ → Poor
- Fracture Critical → NBIS Update

National Tunnel Inspection Standards

- Initial Inspections Due, 08.13.2017
- Inspection Data Due, 03.15.2018
- Specifications for the National Tunnel Inventory
- NTIS Assessment Metrics – EOY 2019
  - Implemented in 2018
  - Eight States piloting this summer
  - Seek review/comment from SCOBS
  - Publish in Federal Register

CRITICAL FINDINGS

- Establish procedures for reporting critical findings and monitoring corrective actions."
  - Procedures and definitions
  - Reporting = collecting…database
  - Database = data-driven programs

Proposed CF Program

- States/Agencies/Tribes will be required to have written procedures addressing CFs for highway bridges
  - Procedures could be part of Bridge Inspection Manual or a stand-alone document
- Critical Findings Definition:
  - **"A critical finding is a structural or safety related deficiency that requires immediate follow-up inspection or action".**
- Notification time frames to FHWA
  - Within 24 hours of discovering the CF

Proposed FHWA Critical Findings Database

- Updated quarterly by Division for reported CFs
- The database is designed in SharePoint
- There are 23 pieces of data collected for each CF
  - NBI cross-walk identifiers
  - Written description of CF

What does 2020 look like?

- A Transformed (data driven) Bridge Safety and Stewardship Program!
- NTIS – Tunnel Inventory and Inspection Data
- NBIS – Risk-based, data driven intervals
- TAMP – Data driven investments
- TPM – Good, Fair, Poor
- Critical Findings Database
  - Scour?
  - Deterioration?
  - Overload?
  - Extreme Events?

QUESTIONS?

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