FHWA Update

A PRESENTATION AT THE PCI COMMITTEE DAYS AND TECHNICAL CONFERENCE

BRIAN KOZY, PHD, P.E.
STRUCTURAL ENGINEERING TEAM LEADER
HQ OFFICE OF BRIDGES AND STRUCTURES

SEPTEMBER 27, 2019 • ROSEMONT, IL

U.S. Department of Transportation
Federal Highway Administration
Office of Infrastructure

All images used in this presentation are in the public domain.

Contents

- Bridge Program Language
- Recent Appropriated Bridge Programs
  - FY18 Competitive Highway Bridge Program
  - FY19 Bridge Rehabilitation and Replacement Program
  - FY20 Discretionary(?) Bridge Program
- NBIS
  - Risk Based Inspection
  - Critical Findings Database
- Emergency Vehicles Load Rating
- NTSB Investigation of FIU Pedestrian Bridge Collapse Status
  - Hearing Docket/Date
  - OSHA Report

Acronyms

- CF: Critical Finding
- CFR: Code of Federal Regulations
- D/D: Data-driven
- FC: Fracture critical
- FIU: Florida International University
- IR: Inventory rating
- LRFD: Little Rock Fire Department
- MAP-21: Moving Ahead for Progress in the 21st Century Act
- MBE: Manual for Bridge Evaluation
- NTSB: National Transportation Safety Board
- NCHRP: National Cooperative Highway Research Program
- NBIS: National Bridge Inspection Standards
- OSHA: Occupational Safety and Health Administration
- PCA: Plan of Corrective Action
- R/B: Risk-based
- USC: United States Code

Bridge Program Language

Transition to Good, Fair and Poor

Illustrative Language

U.S. Department of Transportation
Federal Highway Administration
Office of Infrastructure

Bridge Program Language

- ~~Sufficiency Rating~~
- ~~Functionally Obsolete~~
- ~~Structurally Deficient~~ → Poor
- ~~Fracture Critical~~ → National Bridge Inspection Standards (NBIS) Update?
- Good/Fair/Poor
- Eliminates the Federally instituted but sometimes confusing, unclear, misleading or alarming terms from the language of bridge engineers!

Bridge Program Language

- To avoid some of the same misuse or misinterpretation, illustrative language was needed.
- Published earlier this year.
- The language combines the regulatory definition with a plain language description of possible conditions and some possible associated actions or activities.
- Consistent with past practice and current programs.

Good

- A bridge classified as in Good condition has all primary bridge components rated in good condition or better. Good condition would indicate the structural elements of the bridge have no deterioration or some minor deterioration. A bridge in good condition may need preservation or cyclic maintenance activities.

Component Condition Rating	Performance Measure
9 Excellent Condition	Good
8 Very Good Condition	Good
7 Good Condition	Good

Fair

- A bridge classified as in Fair condition has one or more primary bridge components rated in satisfactory or fair condition, and no components rated worse than fair condition. Fair condition would indicate that some structural elements of the bridge have minor deterioration that could include section loss, cracking, spalling, scour, or other defects of similar significance. Typical needs of a bridge in fair condition would include preservation, cyclic maintenance activities, or condition-based maintenance activities.

Component Condition Rating	Performance Measure
6 Satisfactory Condition	Fair
5 Fair Condition	Fair

Poor

- A bridge classified as in Poor condition has one or more primary bridge components rated in poor or worse condition. Poor condition would indicate that some structural elements of the bridge have advanced deterioration. Typical needs of a bridge in poor condition would include condition-based maintenance activities, rehabilitation, or replacement.

Component Condition Rating	Performance Measure
4 Poor Condition	Poor
3 Serious Condition	Poor
2 Critical Condition	Poor
1 Imminent Failure Condition	Poor
0 Failed Condition	Poor

Recent Appropriated Bridge Programs

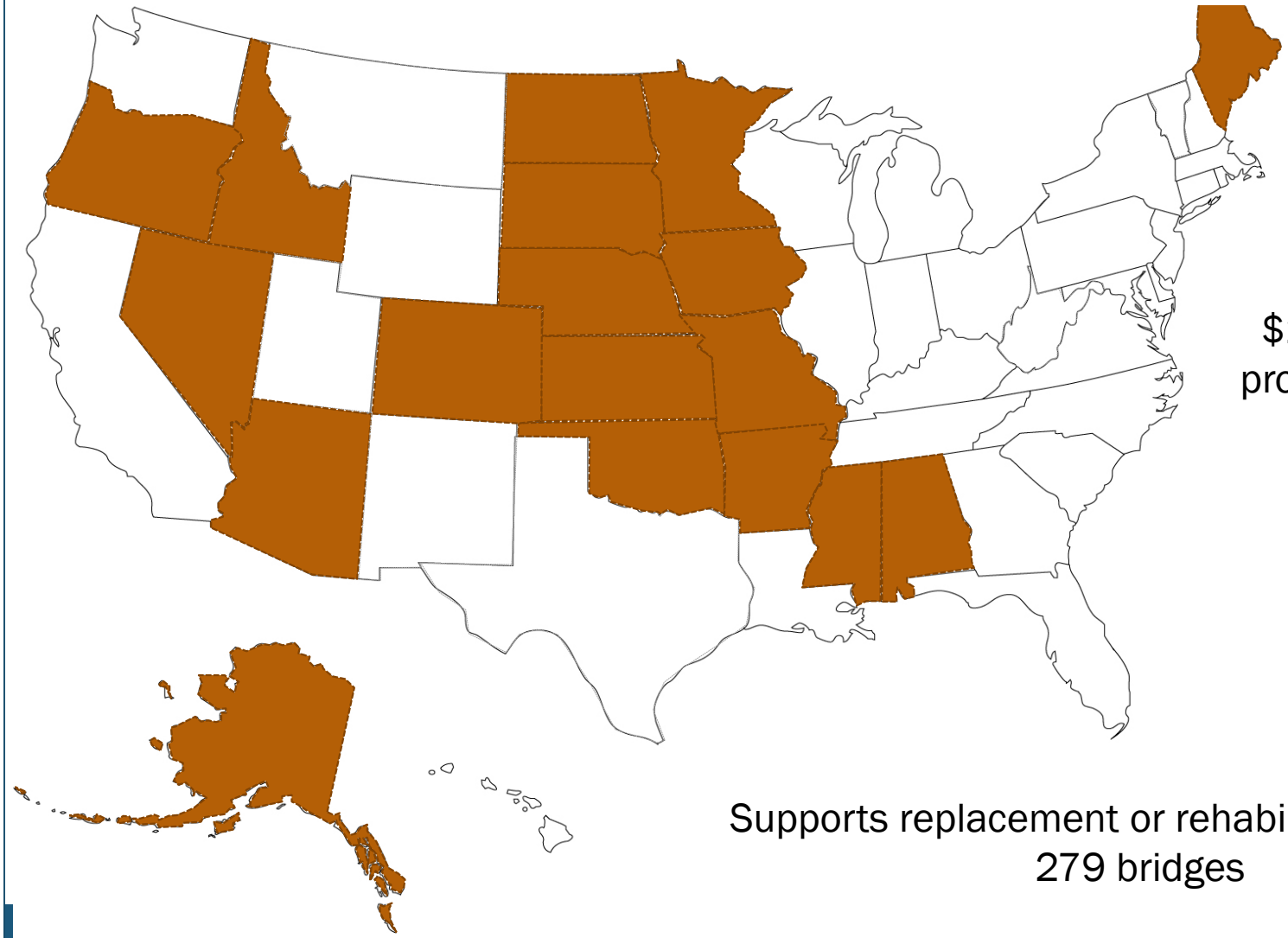
FY18 Competitive Highway Bridge Program
FY19 Bridge Rehabilitation and Replacement Program
FY20 Discretionary(?) Bridge Program

FY18 Appropriations
Competitive Highway Bridge Program

- $225M in grants for States that have a population density of less than 100 individuals per square mile (AL, AK, AZ, AR, CO, ID, IA, KS, ME, MN, MS, MO, MT, NE, NV, NM, ND, OK, OR, SD, TX, UT, VT, WV, WY).
- Funding for highway bridge replacement or rehabilitation projects that demonstrate cost savings through bundling more than one project into a single contract.
- Funds must be obligated in FY20 & expended by FY26.
- 56 individual applications requesting $654M

CHBP Awards

https://www.fhwa.dot.gov/bridge/chbp/2019grantawards/



$225M for 20 projects from 18 states

Supports replacement or rehabilitation of up to 279 bridges

FY19 Appropriations
Bridge Replacement and Rehabilitation Program

- Replaces the FY18 Competitive Highway Bridge Program.
- $475M distributed via formula to States that have at least 7.5 percent of total deck area of bridges classified as in poor condition (AK, CT, IA, IL, LA, MA, ME, MI, MO, MT, NC, NH, NJ, NY, PA, RI, SD, WV, WY).
- Funding for highway bridge replacement or rehabilitation projects in areas of a State that have a population of 200,000 or fewer people.
- Funding can be used in any area if a State does not have needs in areas with a population of 200,000 of fewer.

FY20 Appropriations(?)

- *Reboot…Competitive Highway Bridge Program?*
- *$300M*
- *Discretionary grants to States*
- *Replacement or rehabilitation highway bridge projects on public roads*
- *Highway bridges classified as rural in the 2018 National Bridge Inventory*
- *Projects must demonstrate cost savings by bundling multiple highway bridge projects into a single contract*

National Bridge Inspection Standards Update

Rule Making Status

Risk-Based Inspection Memo

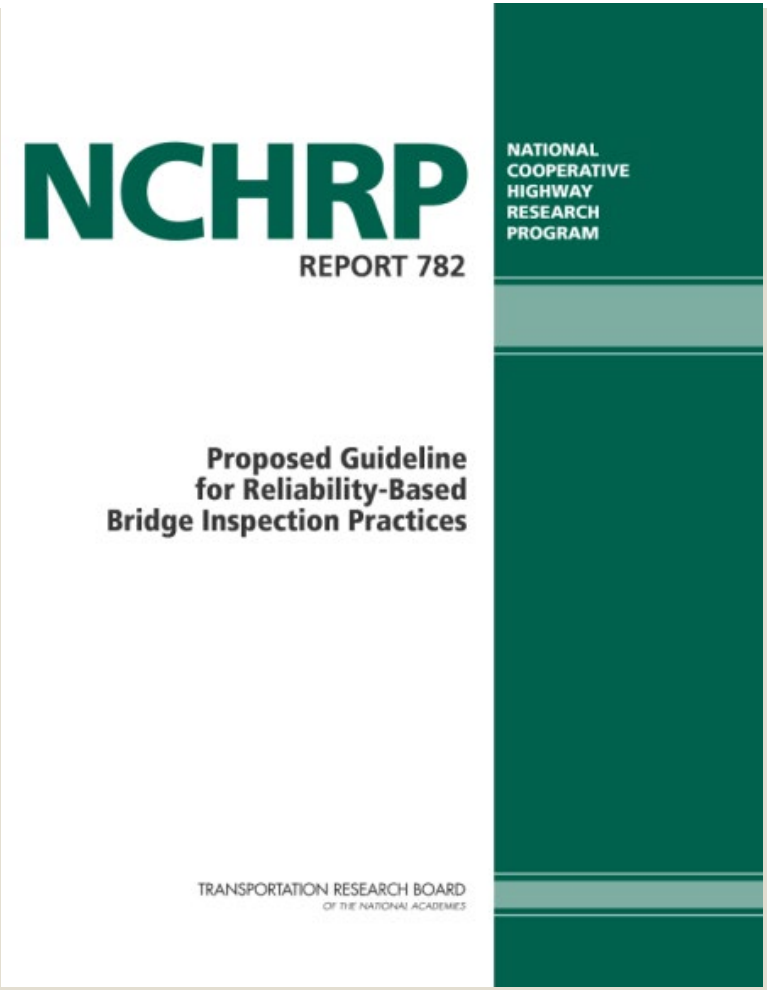
Critical Findings Database

MAP-21 Required NBIS Update

- 23 U.S.C. 144(a)(2)(B) Establish risk-based, data-driven frequency of inspections
- 23 USC 144(h)(3)(B) Establish procedures for reporting critical findings and monitoring corrective actions
- ✓ 23 USC 144(h)(4)(A) Requirement to conduct annual compliance reviews
- ✓ 23 USC 144(i)(1) Maintain a bridge inspection training program
- 23 USC 144(h)(2) Nationally Certified Bridge Inspectors
- 23 USC 144(h)(1)(B) Make the NBIS and NTIS uniform

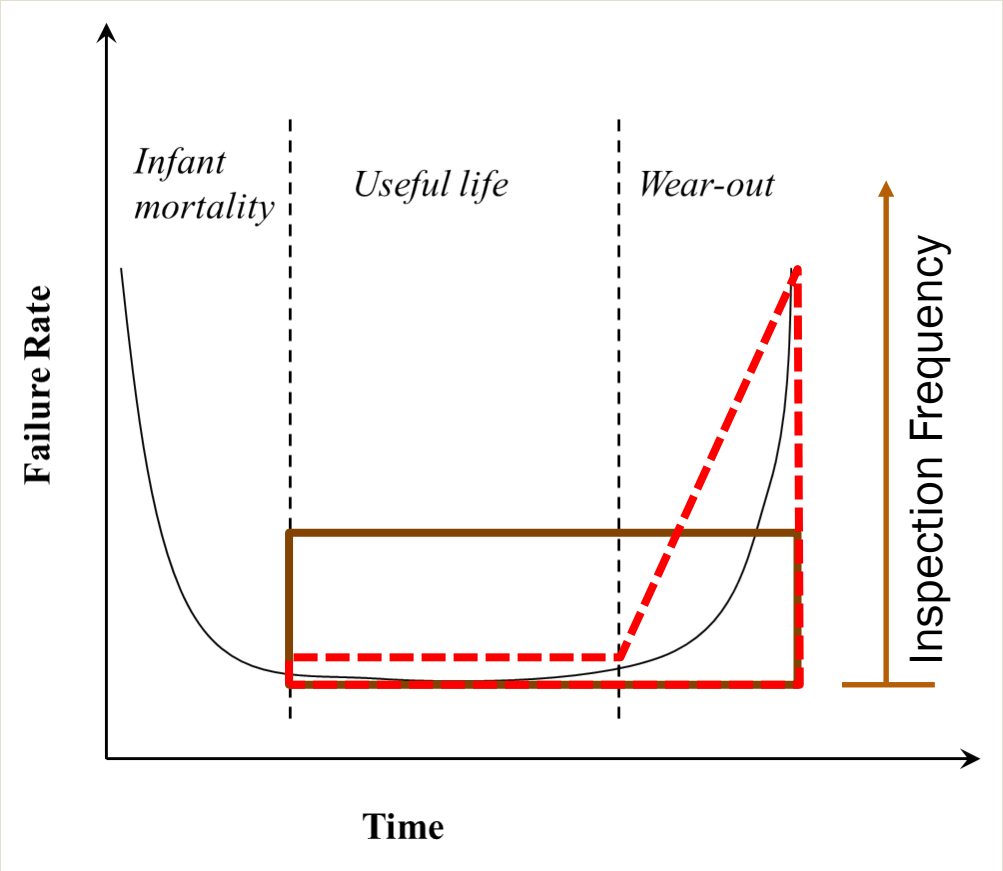
Establish R/B, D/D frequency of inspections

- NCHRP Report 782
  - Washer, Nasrollahi, Connor, others
  - Available online
- Inspection intervals that consider the reliability of bridge elements and the consequences of damage



NCHRP 782 Motivation

Typical Lifetime Performance Curve



NCHRP 782 Risk Matrix

- Plot values of likelihood (occurrence) and impact (consequence)
- Components in the top right corner are “high risk”
- High likelihood may not mean high risk, if impact is low
- High impact may not be high risk, if the likelihood is low

Occurrence Factor				
High	48	24	24	12
Moderate	48	48	24	24
Low	72	72	48	24
Remote	96	72	48	48
	Low	Moderate	High	Severe

Consequence Factor

Risk-Based, Data-Driven Inspection Intervals

- Deploys methodology of NCHRP Report 782
- Limited to Routine Inspection and the current Extended Inspection Interval limit of 48 months
- Not applicable for FC bridges

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **INFORMATION:** Risk-Based Interval Determination for Routine Bridge Inspections

Date: June 8, 2018

From: /Original signed by/
Joseph L. Hartmann, PhD, P.E.
Director, Office of Bridges and Structures

In Reply Refer To: HIBS-30

To: Division Administrators
Federal Lands Highway Division Directors

The Moving Ahead for Progress in the 21st Century Act (MAP-21) (P.L. 112-141), was signed into law on July 6, 2012. As part of this enactment, Section 1111 amended Section 144 of Title 23 United States Code (U.S.C.) and directed the Federal Highway Administration to, "consider a risk-based approach to determining the frequency of bridge inspections."

Section 650.311(a)(3) of the National Bridge Inspection Standards (NBIS) (23 CFR 650 subpart C) states, "Certain bridges may be inspected at greater than twenty-four month intervals, not to exceed forty-eight months, with written FHWA approval." This extended routine inspection interval has historically been accomplished by following Technical Advisory 5140.21 dated September 16, 1988 (http://www.fhwa.dot.gov/bridge/nbis/t514021.cfm). To meet Section 1111 of MAP-21, the FHWA has developed risk-based, routine inspection interval guidance in the attachment that State transportation departments, Federal agencies, and tribal governments can use as an alternate approach to the current technical advisory.

Additionally, 23 CFR 650.311(a)(2) states, "Certain bridges require inspection at less than twenty-four intervals." The attached risk-based, routine inspection interval guidance may also be used to satisfy this provision.

When State transportation departments, Federal agencies, and tribal governments consider using this option, the Division offices should review the submission then coordinate with the Office of Bridges and Structures for final approval.

Please direct questions to John Thiel at (202) 366-8795 or e-mail at John.Thiel@dot.gov or to Shay Burrows at (202) 366-4675 or e-mail at Shay.Burrows@dot.gov .

cc:
Directors of Field Services

HIBS-30
Brian Kozy, HIBS-10
Joe Krolak, HIBS-20

Extended Routine Inspection Intervals

Technical Advisory 5140.21	Risk-Based…Memorandum

• Condition Rating > 6
• IR > State's Legal Load
• Spans ≤ 100-ft
• Clearances ≥ 14-ft
• Typical bridge types
	• Risk Assessment Panel
	• Risk Levels and Categories
	  ○ Occurrence Levels
	  ○ Consequence Levels
	• Develop supplemental inspection procedures

Potential Benefits of Risk-Based Inspection

- Better, more effective and purposeful inspections
  - Inspection plan (scope and interval) supported by engineering assessment by risk assessment panel (RAP)
    - Vs. Calendar-based inspection strategy
  - Rational inspection strategies
    - Flexible intervals based on need and engineering analysis
- Allocate resources more effectively and efficiently
  - Focus inspection resources where most needed
- Improved bridge safety and reliability

Critical Findings Database

- "Establish procedures for reporting critical findings and monitoring corrective actions" (MAP-21)
  - Procedures and definitions
  - Reporting = collecting…database
  - Database = data-driven programs

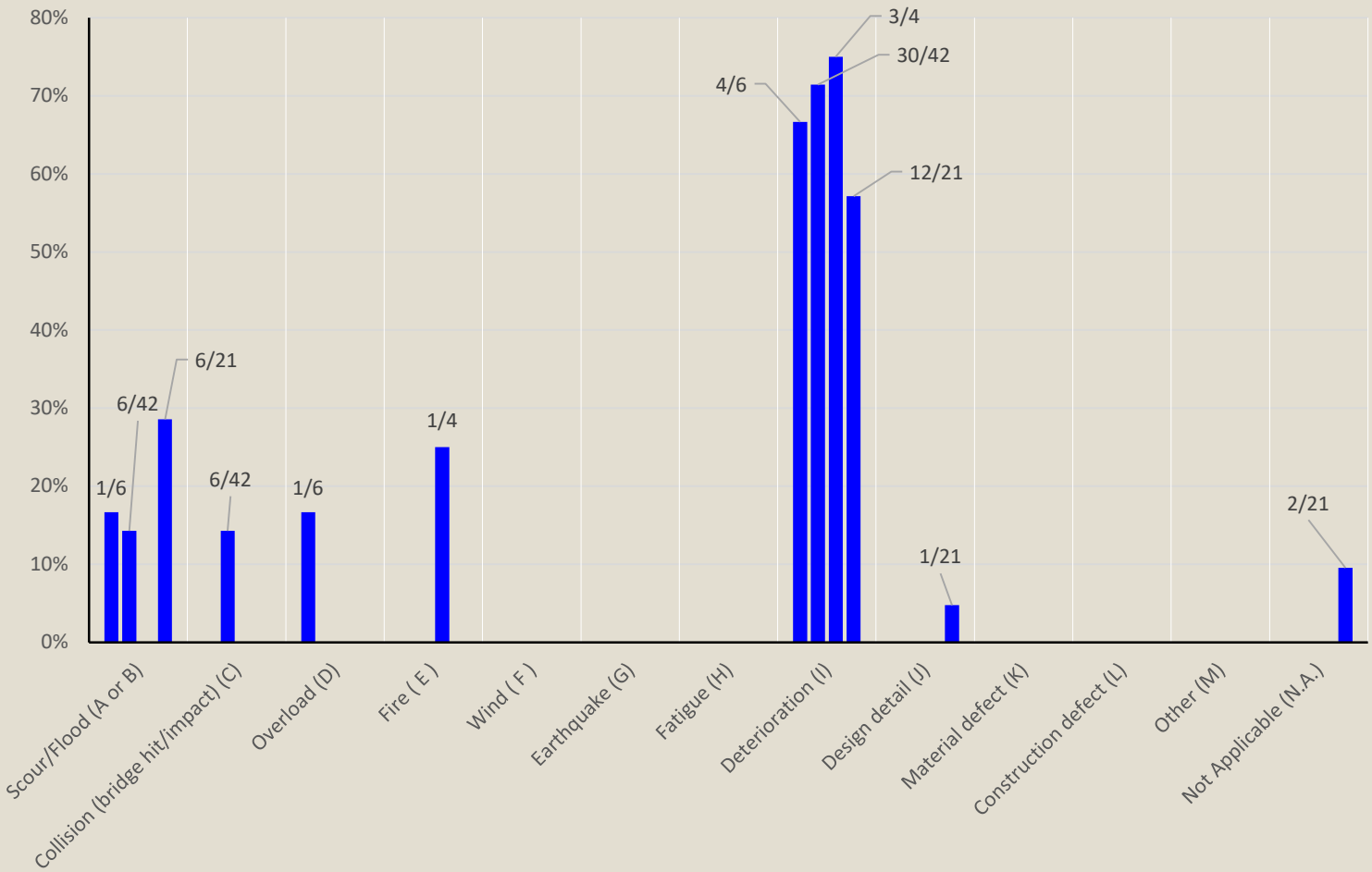
Scope and Purpose

- #1 cause of bridge closure?
- How many scour related CFs last year?
- What is the trend for deterioration CFs?
- Damage CFs?
- Defect CFs?
- Drive research efforts and program development using CF database.

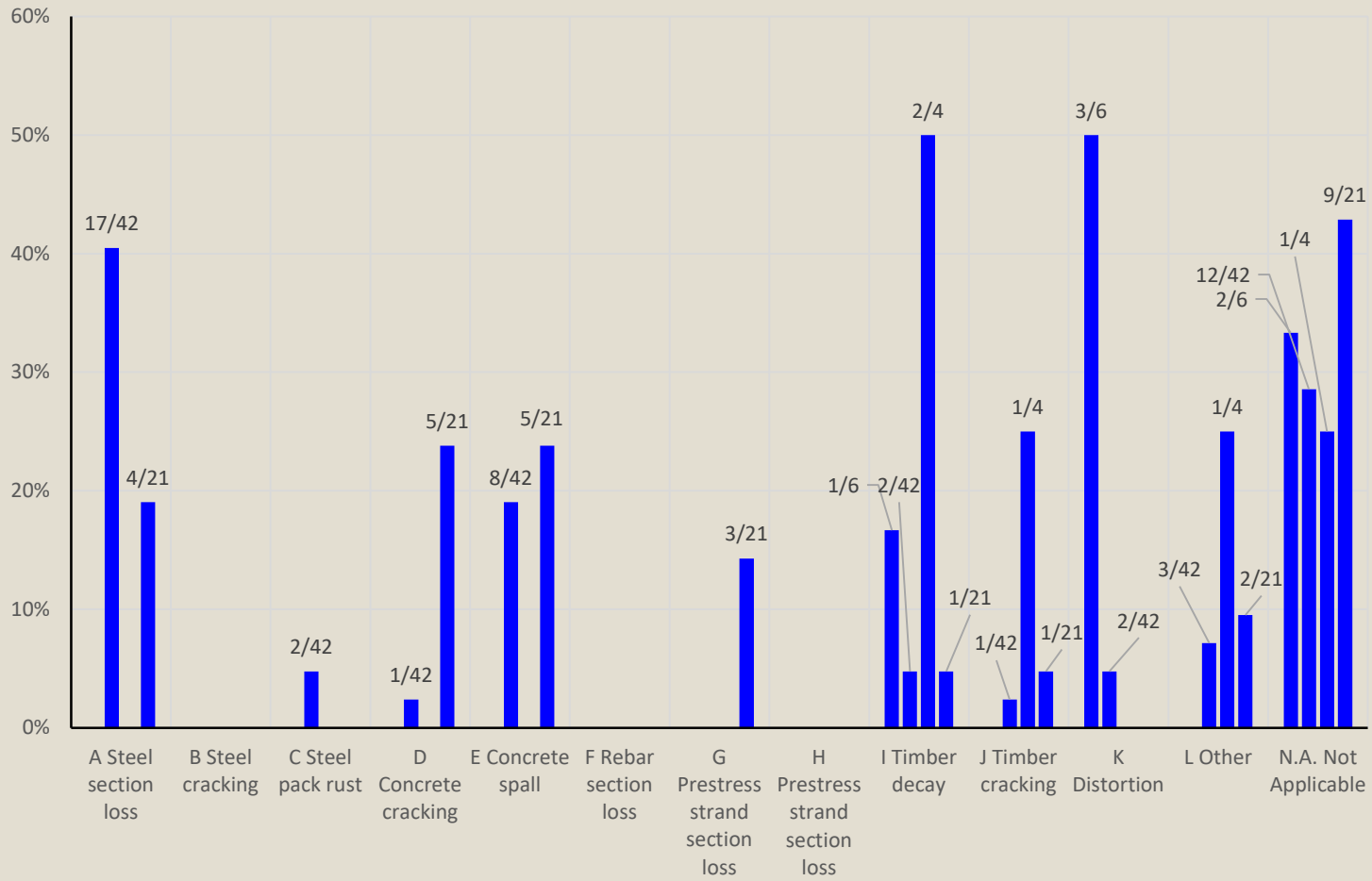
Current Status

- Created procedures and definitions necessary for the reporting and collection of critical findings.
- Internal SharePoint site was created as a data collection mechanism.
- Implemented a pilot program with four participants states.
  - CF data from last two quarters has been collected and analyzed
- Intend to launched a second pilot involving more states before national level implementation.

Distribution of Critical Findings



Deterioration Driven Critical Findings



Pilot Program Findings

- The pilot was a success.
- The database provides a good balance of capturing relevant data without being a heavy burden
- Definitions and criteria vary among States which will require coordination
- FHWA expects the database to be effective at identifying national trends with CFs and appropriately focusing the bridge program going forward

FAST Act Emergency Vehicles

Statutory Basis

Load Rating Memo

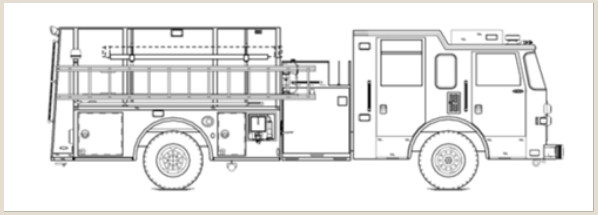
Compliance Review

FAST Act Emergency Vehicles (EV)

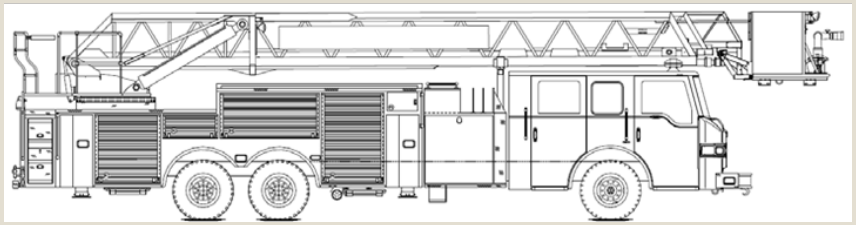
- 23 U.S.C. 127
  - A State shall not enforce against an EV using the Interstate System (and w/i reasonable access)
- 23 U.S.C. 144
  - Establish procedures to conduct evaluation or load rating of highway bridges
- 23 CFR 650
  - Load rate for all legal and unrestricted loads using the AASHTO MBE

FAST Act 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)



Load Rating for Emergency Vehicles

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **ACTION:** Load Rating for the FAST Act's Emergency Vehicles

Date: November 3, 2016

From: /Original signed by/
Joseph L. Hartmann, Ph.D., P.E.
Director, Office of Bridges and Structures

In Reply Refer To: HIBS-1

To: Division Administrators
Federal Lands Highway Division Directors

On December 4, 2015, the President signed into law the *Fixing America's Surface Transportation Act* (FAST Act) (Pub. L.114-94). Section 1410 of the FAST Act amended 23 U.S.C. 127, *Vehicle weight limitations—Interstate System*, by revising the weight limits for certain vehicles on the Interstate System. The purpose of this memorandum is to provide guidance on maintaining compliance with the load rating and posting requirements of 23 CFR Part 650—specifically for the amended weight limits in 23 U.S.C. 127(r), *Emergency Vehicles*, for bridges on the Interstate System and within reasonable access to the Interstate System. Reasonable access is defined in a September 30, 1992 Non-Regulatory Supplement to 23 CFR Part 658 as at least one-road-mile from access to and from the National Network of highways, which includes the Interstate System, or further if the limits of a State's reasonable access policy for food, fuel, repairs, and rest extend to facilities beyond one-road-mile.

An emergency vehicle as defined in the FAST Act is designed to be used under emergency conditions to transport personnel and equipment to support the suppression of fires and mitigation of other hazardous situations (23 U.S.C. 127(r)(2)). The gross vehicle weight limit for emergency vehicles is 86,000 pounds under section 127(r). The statute imposes the following additional limits, depending upon vehicle configuration:

- 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

Emergency vehicles are typically operated by fire departments and are primarily equipped for firefighting, but are also used to respond to and mitigate other hazardous situations in

U.S. Department of Transportation
Federal Highway Administration

QUESTIONS AND ANSWERS

Load Rating
for the FAST Act's Emergency Vehicles

Office of Bridges and Structures
Federal Highway Administration
1200 New Jersey Avenue, SE
Washington, DC 20590
March 2017

Load Rating for Emergency Vehicles

- Analysis (Options from the MBE)
  - Multiple Presence: one lane of the traffic stream
  - Load Factor: 1.3 for unrestricted permit loads
- Group 1 Bridges: re-rate when warranted
- Group 2 Bridges: re-rate by Dec. 2019
- Compliance Determination: Dec. 2020
- PCA (if needed): NLT Mar. 2021

FIU Pedestrian Bridge Collapse NTSB Investigation Update

2nd Investigative Update

Current Status

OSHA Report

NTSB 2nd Investigative Update
FIU Pedestrian Bridge Collapse

- All concrete samples obtained met the released-for-construction plans and FDOT requirements
- The post-tensioning rods collected from the collapsed structure and additional unused rods all met the specified minimum yield strength, tensile strength, and percent elongation at fracture requirements
- The mild steel reinforcing bars collected from the collapsed structure all met the minimum yield strength, tensile strength, and percent elongation at fracture requirements

NTSB 2nd Investigative Update
FIU Pedestrian Bridge Collapse

- The FHWA design assessment has determined that errors were made in the design of the bridge
- These design errors resulted in an overestimation of the capacity (resistance) and an apparent underestimation of the demand (load) at the critical section that failed causing the collapse
- The FHWA's evaluation has determined that the cracking observed in the node prior to the collapse is consistent with the errors identified

NTSB Investigation
FIU Pedestrian Bridge Collapse

- NTSB is in the analysis portion of their investigation
- Board hearing is tentatively scheduled for October 22, 2019
- Hearing will determine probable cause of the collapse
- OSHA Report
  - Relies on a subset of information
  - NTSB report will be the authoritative document

Source: FHWA

Thank you for your time and attention.

BRIAN.KOZY@DOT.GOV

https://www.fhwa.dot.gov/bridge/