FHWA Update

Michigan Bridge Week

U.S. Department of Transportation

Federal Highway Administration

Muskegon, MI

March 12, 2024

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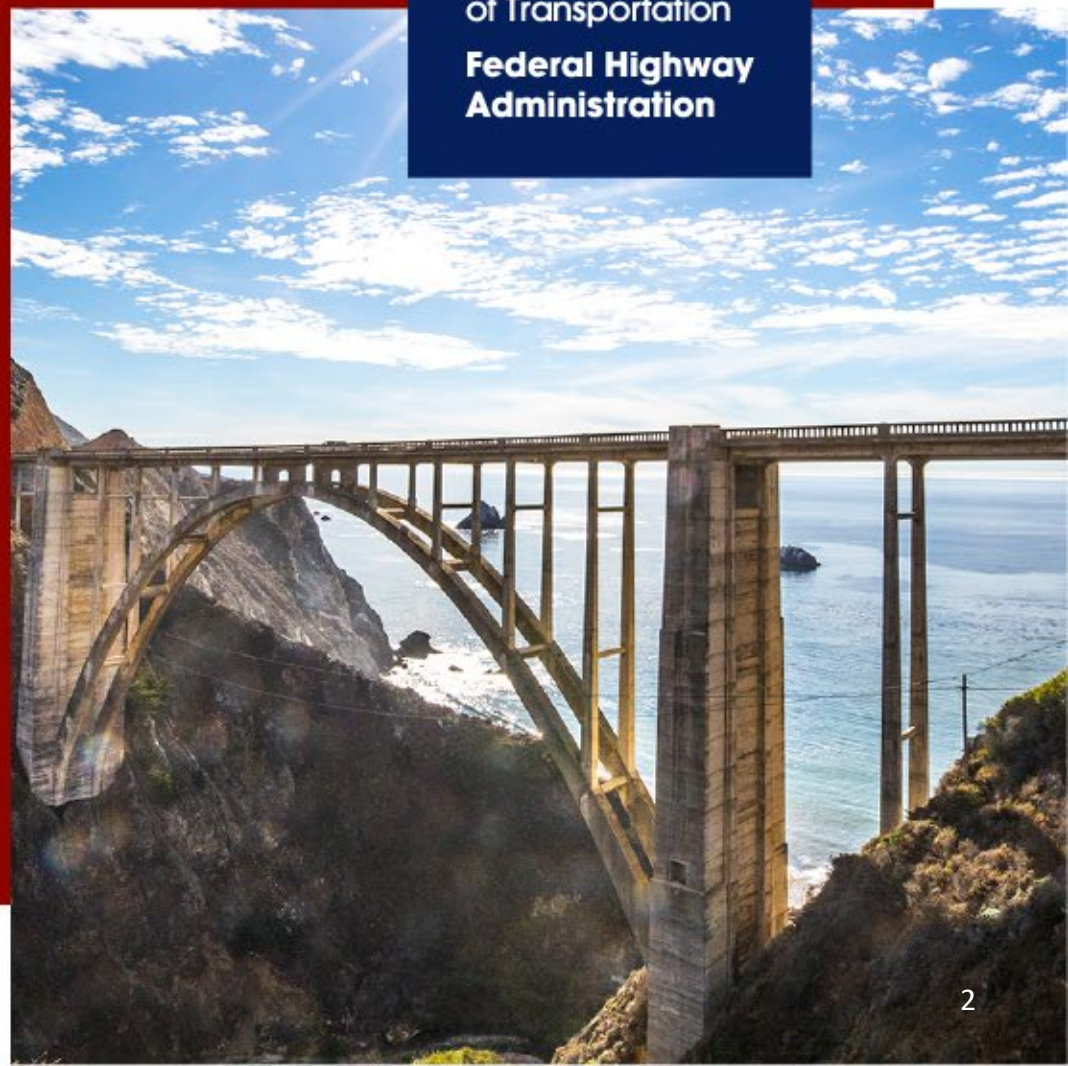
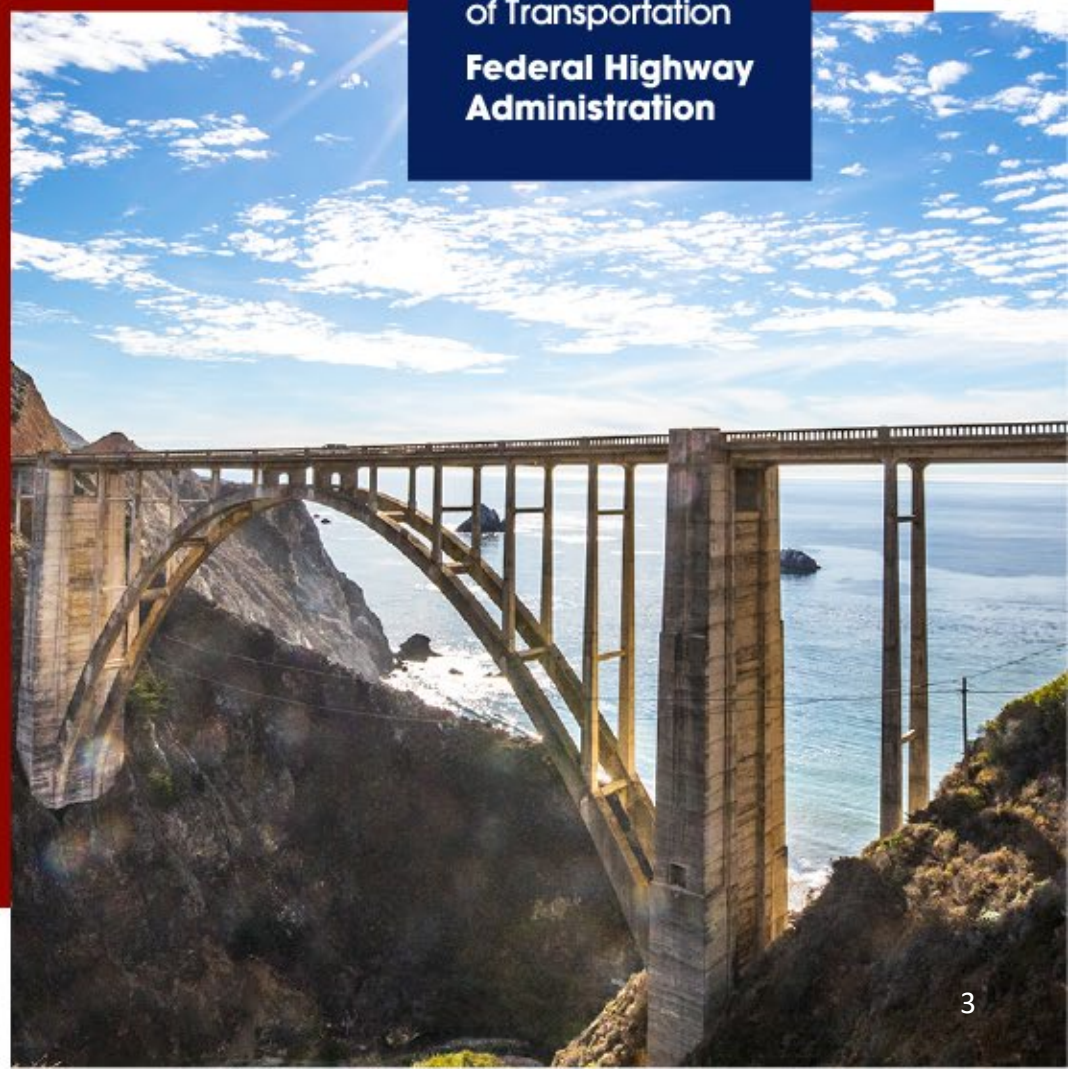


Today's Update:

- Bridge Investment Program
  - Large Bridge Projects NOFO
  - Bridge and Planning Projects NOFO
- Fern Hollow Bridge Collapse Investigation

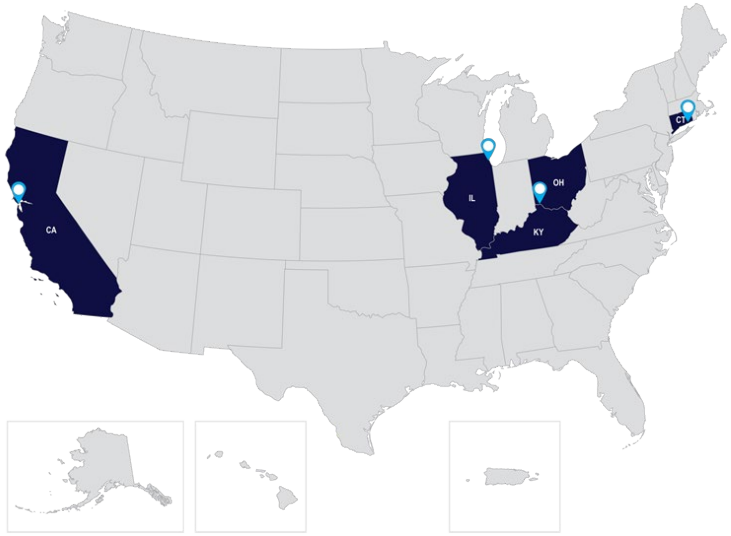


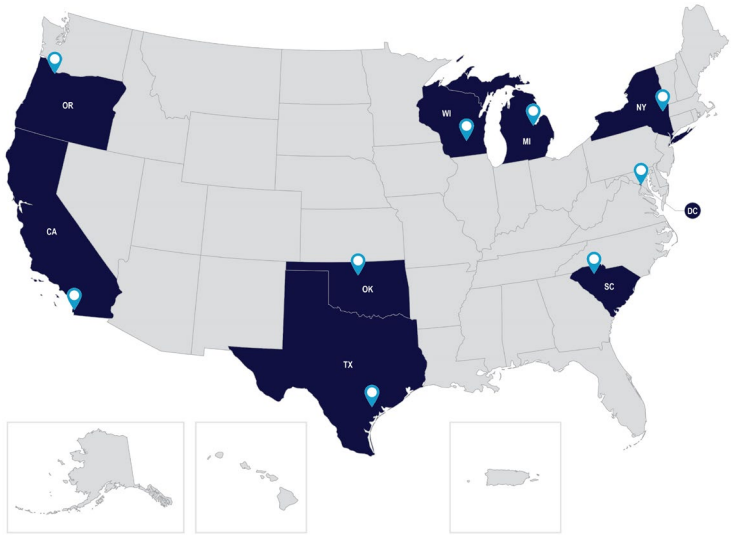
BIP: Bridge Investment Program (discretionary grants)

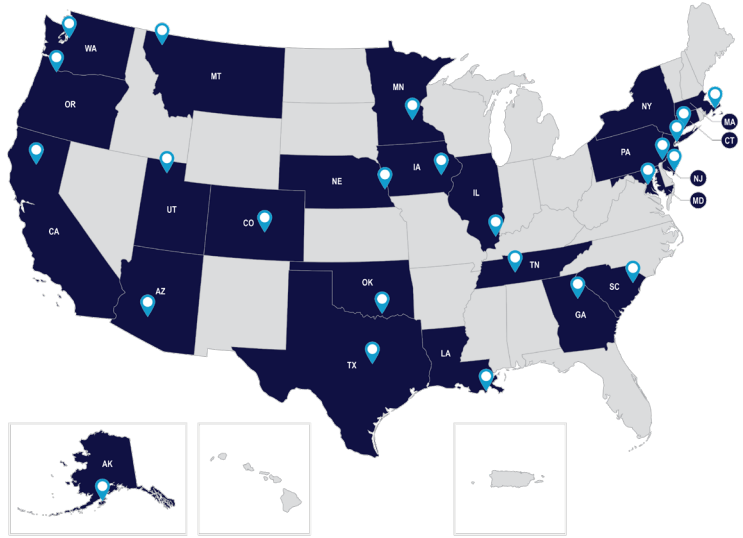
U.S. Department of Transportation
Federal Highway Administration

Purpose	Improve bridge (and culvert) condition, safety, efficiency, and reliability
Funding	**$12.5 B** (FY 22-26), including— • $3.3 B (FY 22-26) in Contract Authority from the HTF; and • $9.2 B (FY 22-26) in advance appropriations from the GF
Eligible entities	• State, MPO (w/ pop. >200K), Local government, Special purpose district/public authority with a transportation function, Federal land management agency, or Tribal government
Eligible projects	• Project to replace, rehabilitate, preserve or protect **one or more bridges on the National Bridge Inventory** • Project to replace or rehabilitate culverts to improve flood control and improve habitat connectivity for aquatic species
Other key provisions	• **Large Bridge Projects (>$100M)** are eligible for up to 50% of project costs and have the option for multi-year funding agreements • **Bridge Projects (≤$100M)** are eligible for up to 80% of project costs • Sets aside of $20M per FY for **Planning grants** • Sets aside of $40M per FY for Tribal transportation bridges

FY 2022 Bridge Investment Program







Large Bridge Projects

- $2.1 billion
- 4 Projects in 5 States
  - Brent Spence Bridge (KY, OH)
  - Golden Gate Bridge (CA)
  - Gold Star Mem. Bridge (CT)
  - Calumet River Bridges (IL)

Bridge Projects

- $296 million
- 9 Projects in 9 States

Planning Grants

- $20 million (statutory set-aside)
- 24 Projects in 24 States, including:
  - Interstate Replacement Bridge (OR)
  - Cape Cod Bridges (MA)
  - East River Bridges (NY)

BIP Large Bridge Projects NOFO: Changes for FY2023 – FY2026

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- Application Intake (rolling) and Eligibility Review
  - Applications submitted before the applicable application deadline will be considered for the current review cycle
    - November 27, 2023, for FY23/24 Funding Cycle
    - August 1, 2024, for FY25 Funding Cycle
    - August 1, 2025, for FY 26 Funding Cycle
  - Applications determined to be eligible move to the Technical Review
  - Applicants will be notified of a determination of ineligible
    - Applicants will be offered an opportunity to request a debrief or to submit an amended application
    - Amended applications must be submitted within 14 days of the notification from FHWA or from the date of the debrief

BIP Large Bridge Projects NOFO: Changes for FY2023 – FY2026

U.S. Department of Transportation
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- Technical Review Process
  - All applicants will be notified of their Merit Criteria rating, Economic Analysis Rating, Project Readiness Rating, and Overall Preliminary Rating within 90 days of the closing date for the current funding cycle
  - Upon notification of their preliminary ratings, an applicant will be offered an opportunity to submit an amended application or request a debrief within 14 days
  - An applicant has 14 days from notification or debrief to submit an amended application

BIP Large Bridge Projects NOFO: Changes for FY2023 – FY2026

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- A report to Congress will be developed for each funding cycle
  - Projects recommended for funding with currently available funding as selected by the Secretary of Transportation
  - Projects not recommended for funding and eligible under the BIP for funding in future years
- Unfunded eligible projects will automatically be considered for future FY funding cycles
  - Projects will have an opportunity to submit amendments to their applications to improve their ratings
  - Applicants are responsible for ensuring all aspects of their project are updated

BIP Bridge Projects NOFO: Changes for FY2023 – FY2026

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- Application Intake (rolling) and Eligibility Review
  - Applications submitted before the applicable application deadline will be considered for the current review cycle
    - March 19, 2024, for FY23/24 Funding Cycle
    - November 1, 2024, for FY25 Funding Cycle
    - November 1, 2025, for FY 26 Funding Cycle
  - Applications determined to be eligible move to the Technical Review
  - Applications determined to be ineligible will not move forward

BIP Bridge Projects NOFO: Changes for FY2023 – FY2026

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- Technical Review Process
  - Eligible applications that received medium or higher rating for Merit Criteria will be evaluated for Economic Analysis Rating and the Project Readiness Rating
  - Applications determined to be Not Recommended based on Merit Criteria will not move forward
  - Applicants will be notified of a preliminary rating if their application,
    - Received a medium or higher rating for Merit Criteria but was rated Not Recommended due to the Economic Analysis Rating and/or the Project Readiness Rating, or
    - Was rated Highly Recommended and Recommended.
  - Upon notification of their preliminary ratings, an applicant will be offered an opportunity to submit an amended application or request a debrief within 14 days
  - Following a debrief, an applicant will have 14 days to submit an amended application

BIP Bridge Projects NOFO: Changes for FY2023 – FY2026

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- Unfunded Highly Recommended and Recommended projects will automatically be considered for future FY funding cycles
  - Projects will have an opportunity to submit amendments to their applications to improve their ratings
  - Applicants are responsible for ensuring all aspects of their project are updated

BIP Information

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- Questions: BridgeInvestmentProgram@dot.gov
- Website: https://www.fhwa.dot.gov/bridge/bip/index.cfm (fhwa bip)
  - Application Templates
  - BCA Tool
  - Prerecorded overviews
  - Q&A
  - More...

Fern Hollow Bridge Collapse

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Federal Highway Administration

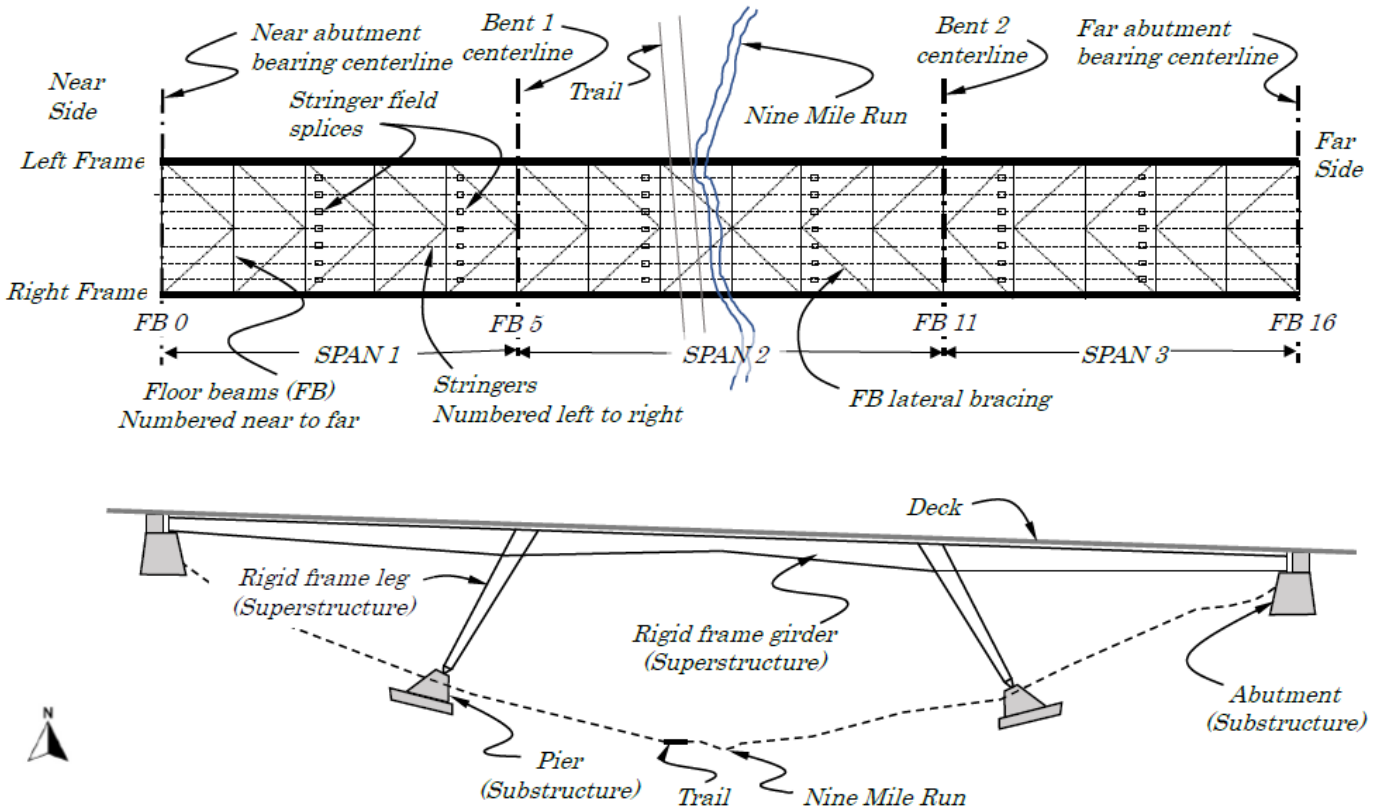
- January 28, 2022
- Forbes Avenue over Nine Mile Run in Frick Park
- 6 minor injuries
- 3-span rigid (K) frame of 497-feet in length
- Fracture Critical (NSTM) Bridge
- Poor Condition (annual inspections)
- Posted at 26 tons

NTSB Highway Accident Report

U.S. Department of Transportation
Federal Highway Administration

- Likely available at the end of March 2024.
- The summary information included in this presentation is subject to further review and editing to reflect changes approved during the February 21, 2024, Board meeting and should only be considered preliminary and nonbinding at this time.
- Investigation resulted in 19 Findings (statements of fact).
- The statement of probable cause included primary, contributory, and tertiary causes.
- https://www.ntsb.gov/investigations/Pages/HWY22MH003.aspx (NTSB Fern Hollow Docket)

Plan/Elevation



Collapsed Bridge

Wreckage

Southwest Leg

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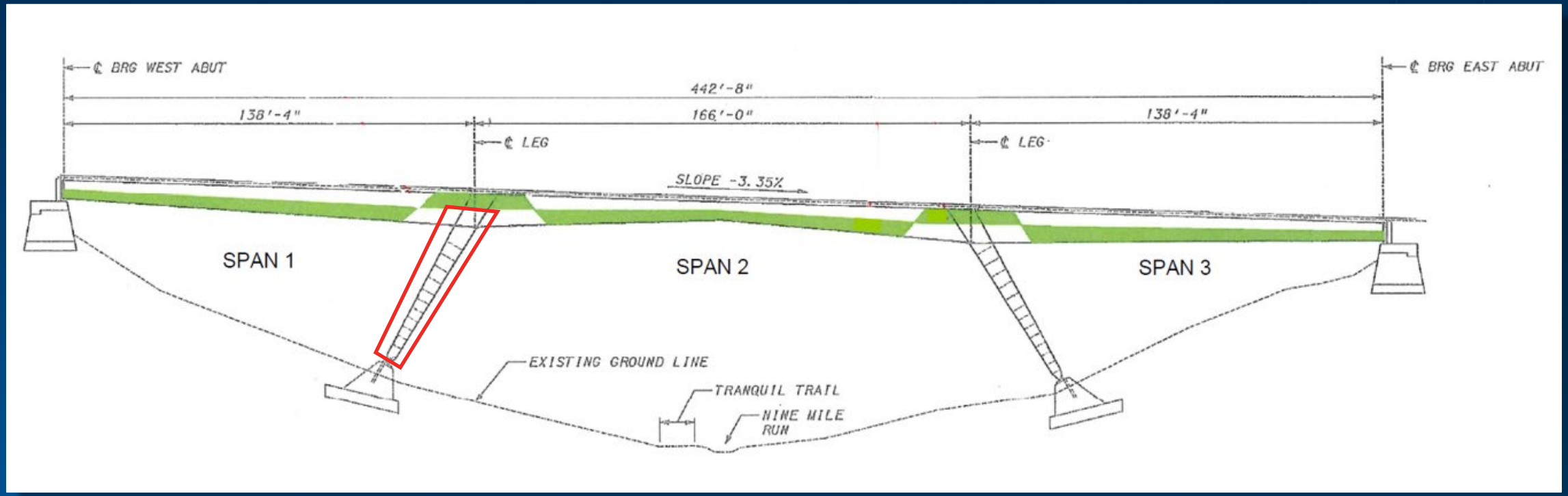
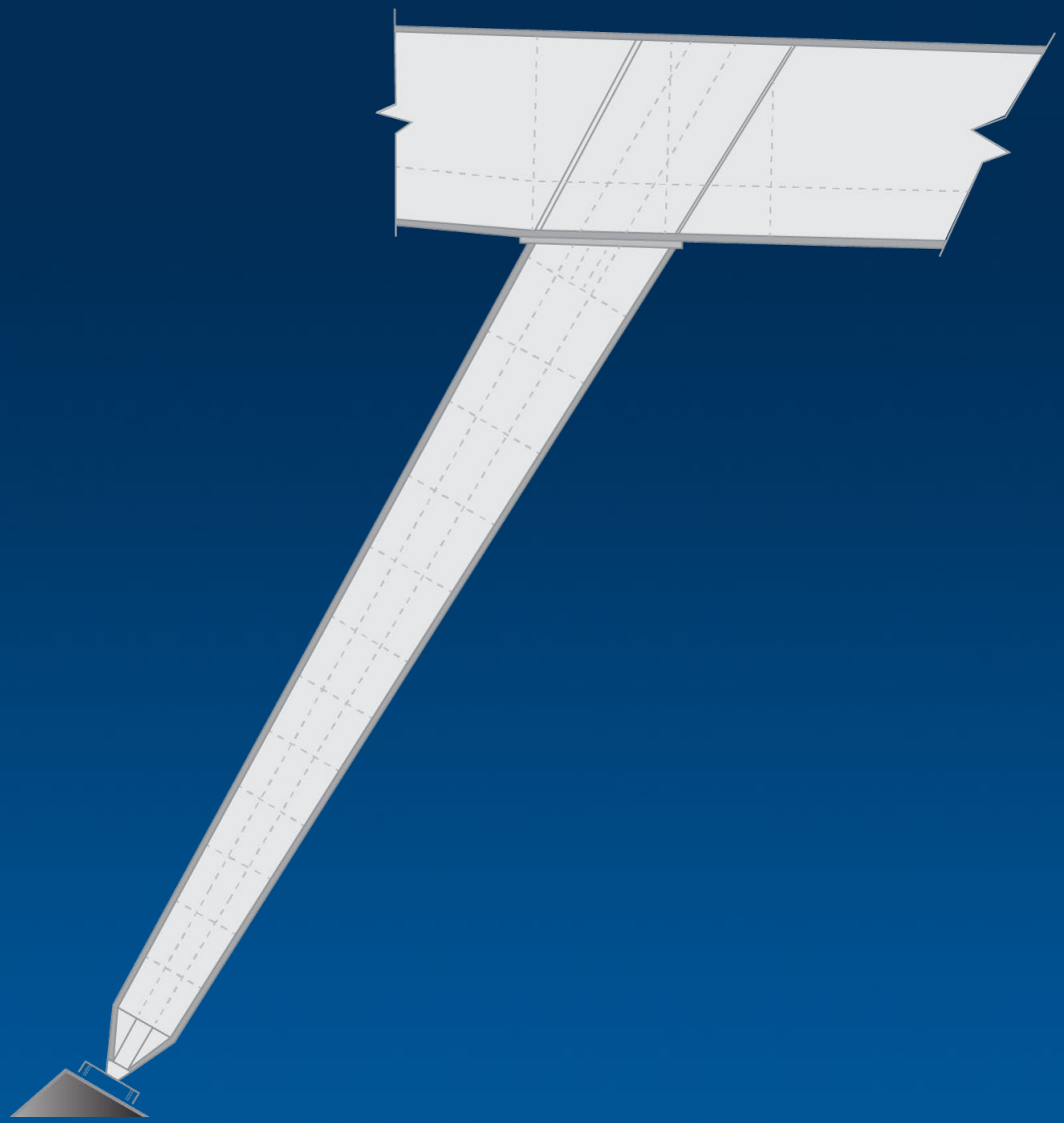
Federal Highway Administration

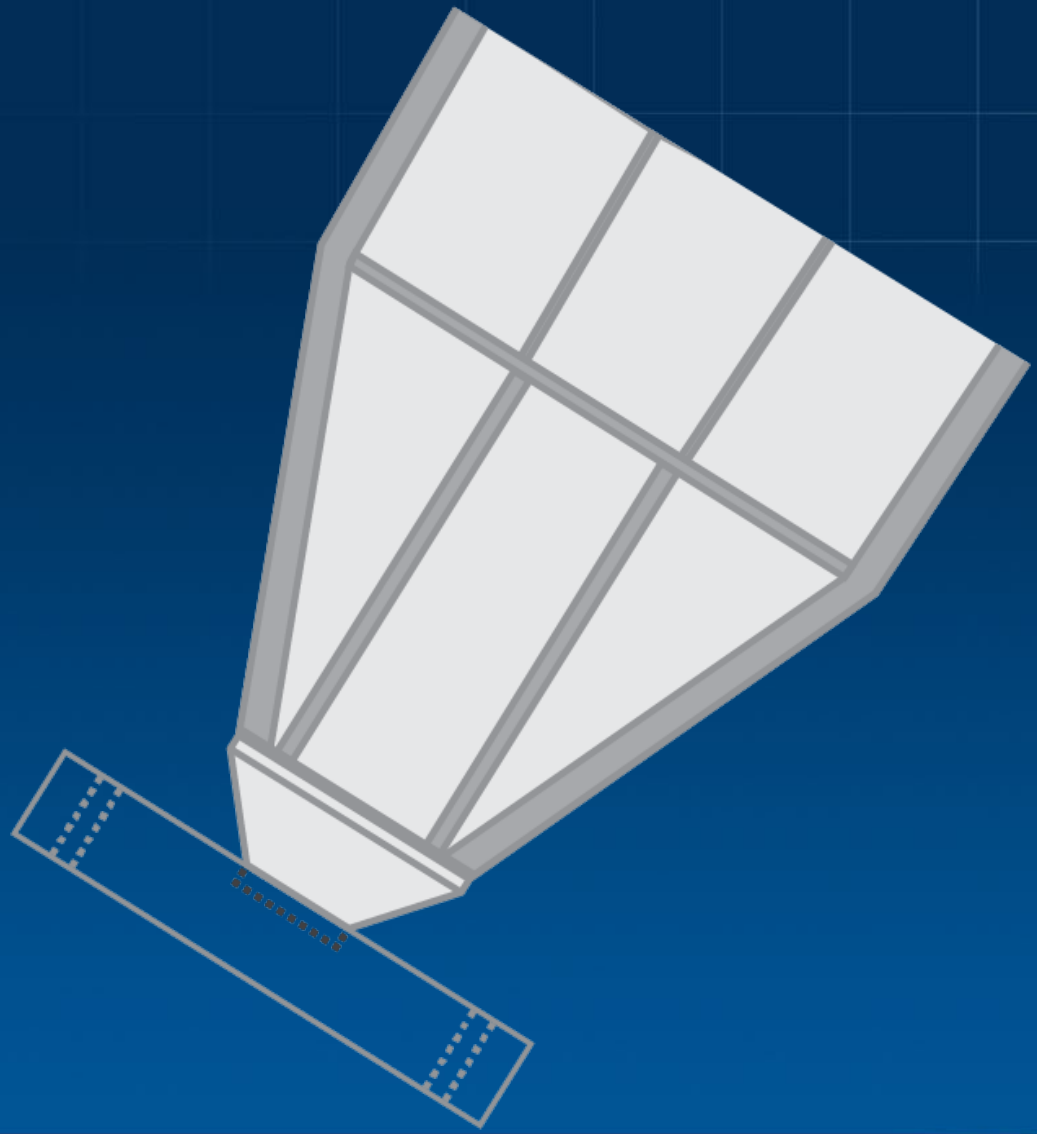
Rigid Steel Slant Legged Frame (K-Frame) Bridge



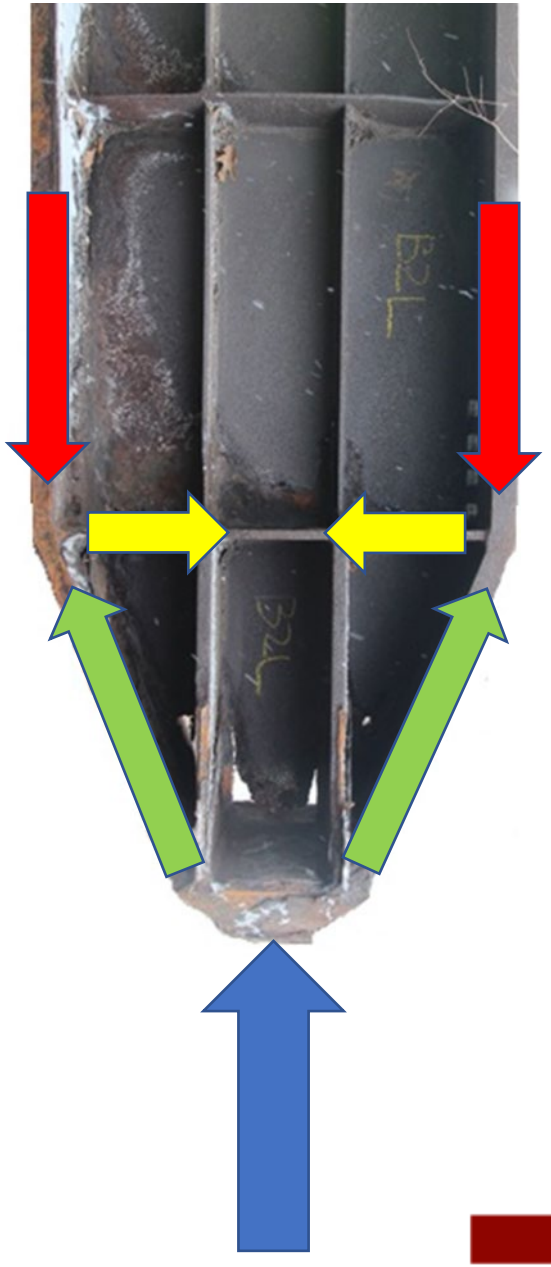
NTSB

Postcollapse Identification of FCMs





Shoe Statics



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Paraphrased (draft) Probable Cause

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Primary: the failure of the transverse tie plate on the southwest leg of the bridge, a fracture-critical member..., due to corrosion and section loss resulting from the...failure to act on repeated maintenance and repair recommendations from inspection reports.

Contributory: the poor quality of inspections, the incomplete identification of the bridge's fracture-critical members..., and the incorrect load rating calculations for the bridge.

Tertiary: insufficient oversight by the...Department of Transportation of the City...bridge inspection program.

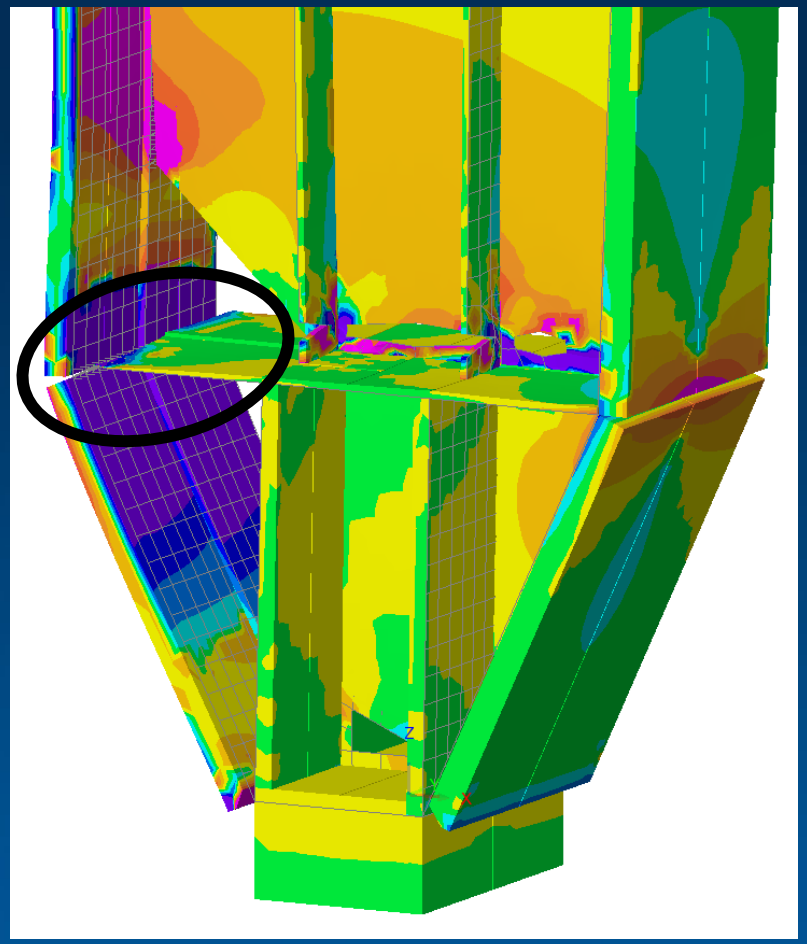
Corrosion – Leg Shoe

Corrosion product build-up

Holes

Transverse tie plate thinning

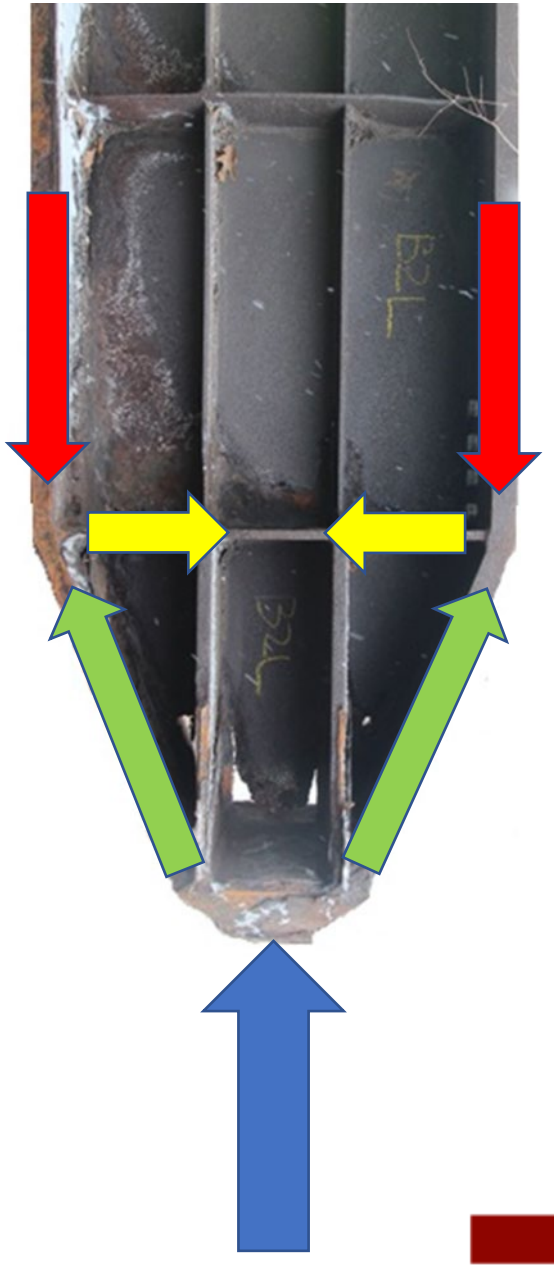
FE Model – Cause of Collapse



Source: Modjeski & Masters

- Global behavior of structure during collapse
  - As-designed bridge had sufficient capacity to support all loads
- Local behavior of bottom of legs
  - Model of southwest leg shows corrosion present results in decreased capacity
    - When loaded, separation of transverse tie plate at the flange occurs first

Shoe Statics



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What We Found: *Corrosion and Cause of Collapse*

- The southwest leg failed because it had reduced capacity due to extensive corrosion and section loss
  - The collapse initiated at the corroded transverse tie plate
- The following were excluded as factors in the collapse:
  - Use of uncoated weathering steel
  - Materials fabrication
  - Weld quality
  - Bridge design

Fern Hollow Bridge Inspections

- City of Pittsburgh responsible for inspection and maintenance
- Subject to Routine and FCM inspections
- Interim FCM inspections required
  - Reduced load rating in 2014 – 26 tons
  - Poor condition rating
- Conducted by two or more certified bridge safety inspectors

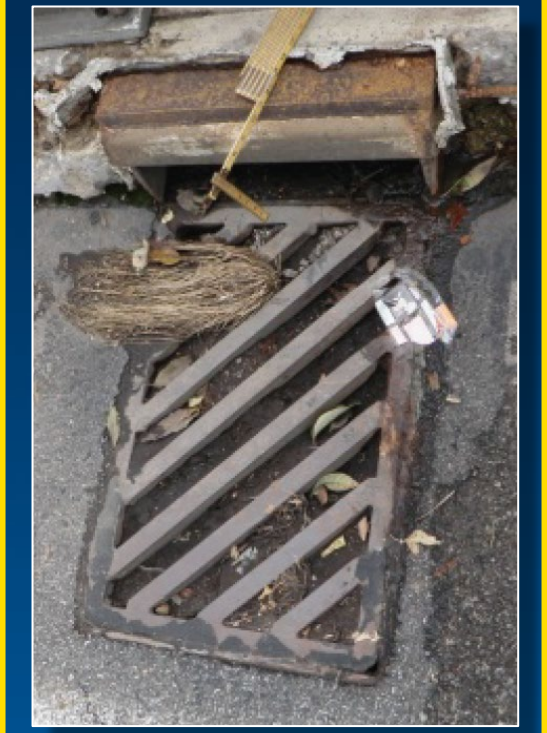
Inspection Date	Inspection Type
September 2005	Routine & FCM
September 2007	Routine & FCM
September 2009	Routine & FCM
September 2011	Routine & FCM
September 2013	Routine & FCM
September 2014	Interim FCM
September 2015	Routine & FCM
September 2016	Interim FCM
September 2017	Routine & FCM
March 2018	Interim FCM
September 2018	Interim FCM
September 2019	Routine & FCM
September 2020	Interim FCM
September 2021	Routine & FCM

Clogged Drainage Inlets

2005

Source: 2005 inspection report

2011



Source: 2011 inspection report

2017

Source: 2017 inspection report

2021

Source: 2021 inspection report

Stiffeners on Southwest Leg

2013

Source: 2013 inspection report

2021

Source: 2021 inspection report

Cross-Bracing

2005 (Southwest Leg)

Source: 2005 inspection report

2021 (Southeast Leg)

Source: 2021 inspection report

What We Found: *Incomplete Maintenance*

- Significant corrosion and section loss on the southwest leg
- Failure by City of Pittsburgh to act on repeated maintenance and repair recommendations
- Progressive deterioration and structural failure

Quality of Fern Hollow Bridge Inspections

- Failed to:
  - Clean corrosion before measuring
  - Accurately quantify remaining material
  - Accurately rate the general bridge superstructure condition
  - Recommend a structural review of the bridge legs

Source: 2015 inspection report

What We Found: *Lack of Quality Inspections*

- Inspectors failed to perform the inspections in compliance with the NBIS
- These failures contributed to the bridge's failure to support the loads it was rated for before the collapse

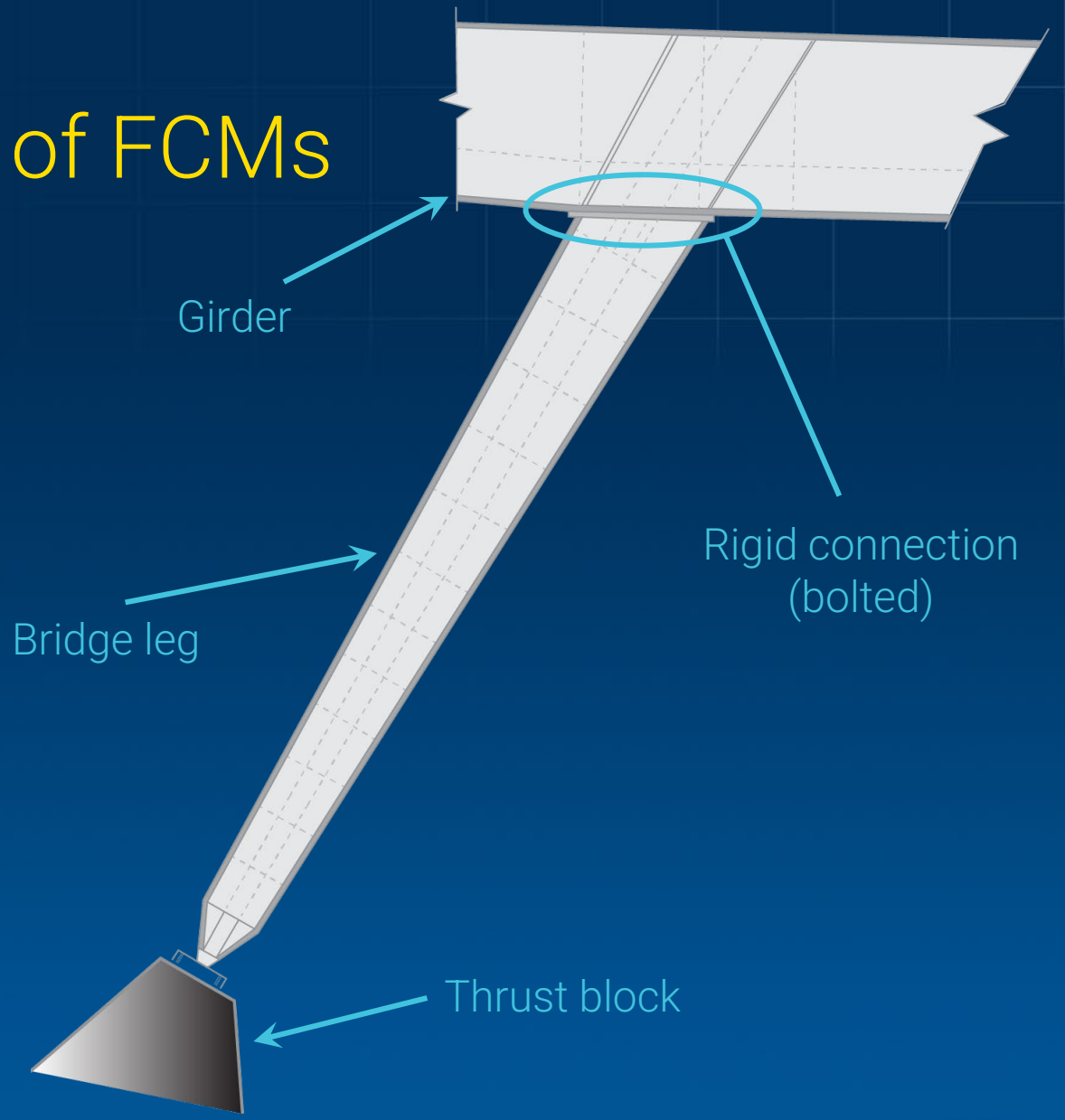
Fracture-Critical Member Inspections

- Required under NBIS for all bridges that contain FCMs
- More rigorous than routine inspections
  - Must identify defects that could lead to failure of critical components

- FCM inspection requirements
  - Written and well documented FCM inspection plan
  - Hands-on (within arm's reach) inspection of all FCMs or member components
  - May include visual inspection as well as other nondestructive evaluation

Postcollapse Identification of FCMs

- Rigid connection between girders and bridge legs would have transferred bending moments
- Transferred bending moments (forces) would have added to those originating in the legs due the angled connection



Fracture Critical Member

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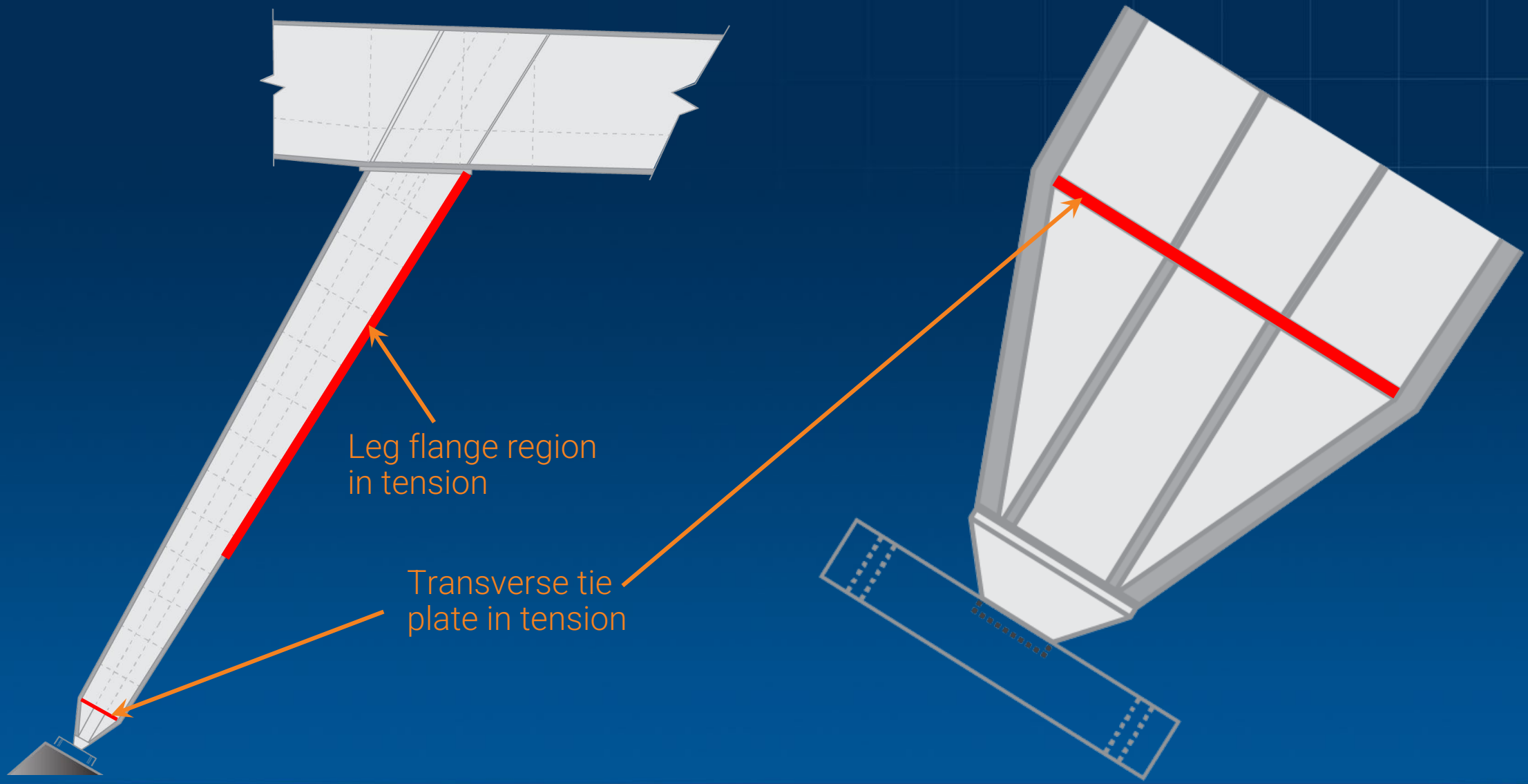
- A steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse.
- Revised to Nonredundant Steel Tension Member in May 2022 (23 CFR 650.305).

Postcollapse Identification of FCMs



What We Found: *FCM Inspection Plans*

- Bridge legs were not properly identified as fracture-critical
- Bridge legs did not consistently undergo an in-depth FCM inspection
- Maintenance and repair recommendations for the bridge legs were not assigned appropriate priority codes
- Repairing the bridge legs could have prevented the collapse
- The correct identification of FCMs is crucial
- What we propose:
  - One recommendation to the Federal Highway Administration

(draft) Recommendation to FHWA

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Federal Highway Administration

2. Update your Bridge Inspector's Reference Manual to include guidance that addresses the identification of localized tension zones and tension components in nonredundant steel members that are generally considered to be fully or partially in compression.

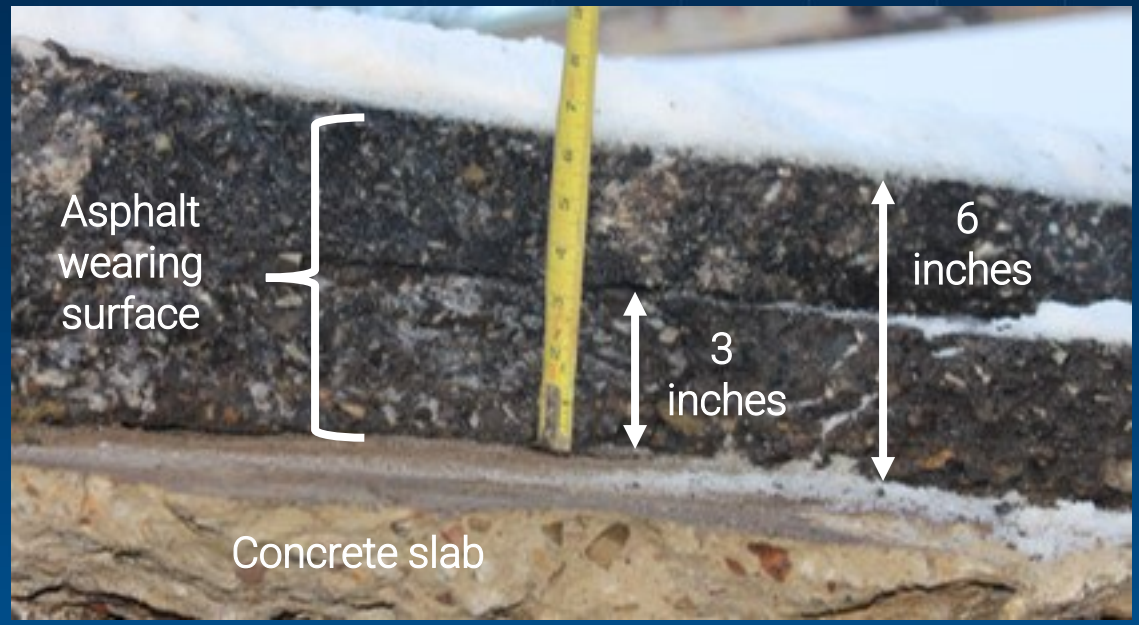
Fern Hollow Bridge Posted Weight Limit

- Posted weight limit of 26 tons
- Load rating analysis conducted in 2014
- In response to 2013 routine inspection report to perform an analysis of the structure's stability
- NTSB investigators found 3 issues with the 2014 load rating analysis

Source: Google street view looking to the west. Imagery date July 2017.

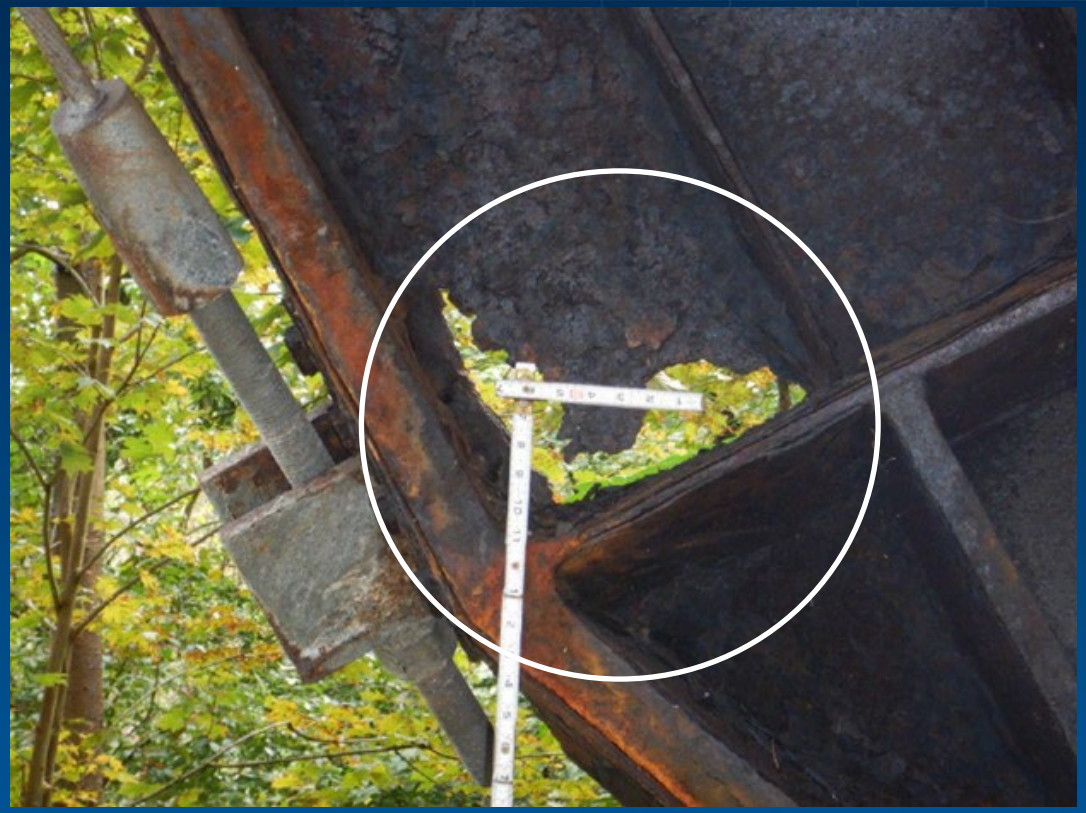
Wearing Surface Thickness

- Thickness of asphalt wearing surface was 3 inches in 2014 load rating
- Postcollapse, the wearing surface thickness was measured to be about 6 inches
- Doubled wearing surface would have resulted in a load posting of less than 26 tons



Section Loss of Leg Web

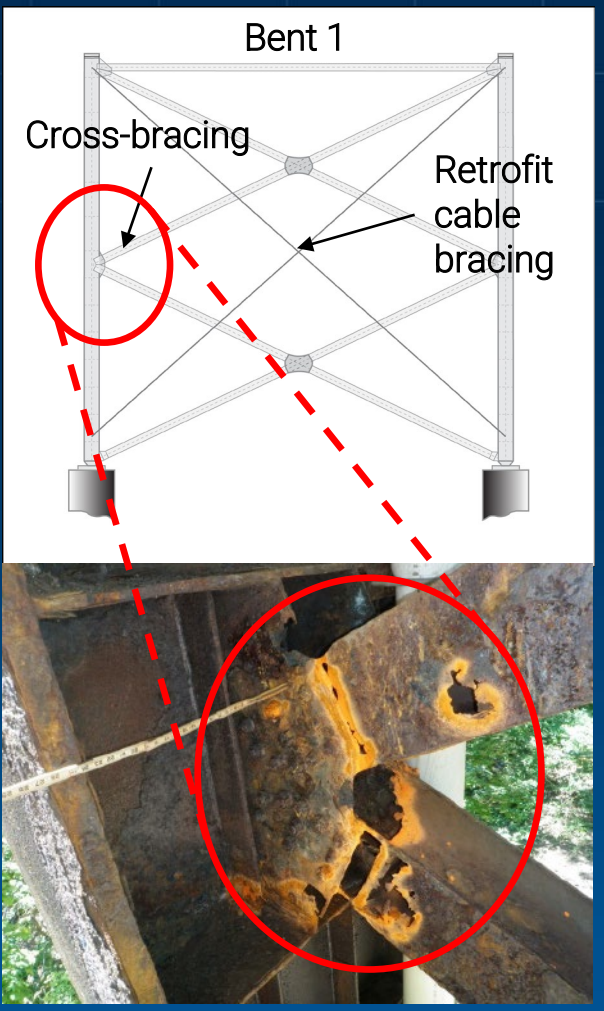
- Distributed the loss material over the entire length of the leg
- Load rating calculated a new equivalent web thickness for the legs
- Resulted in overestimation of the bridge's capacity



Source: 2021 inspection report

k-factor for the Bridge Legs

- Load rating assumed an incorrect k-factor
  - When the cross-bracing for the legs was intact
- 2013 routine inspection report indicated the cross-bracing exhibited 100% section loss
- Retrofit cable bracing between the legs was not designed to provide lateral support
- k-factor overestimated each leg's capacity



Source: 2013 inspection report

(draft) Recommendation to FHWA

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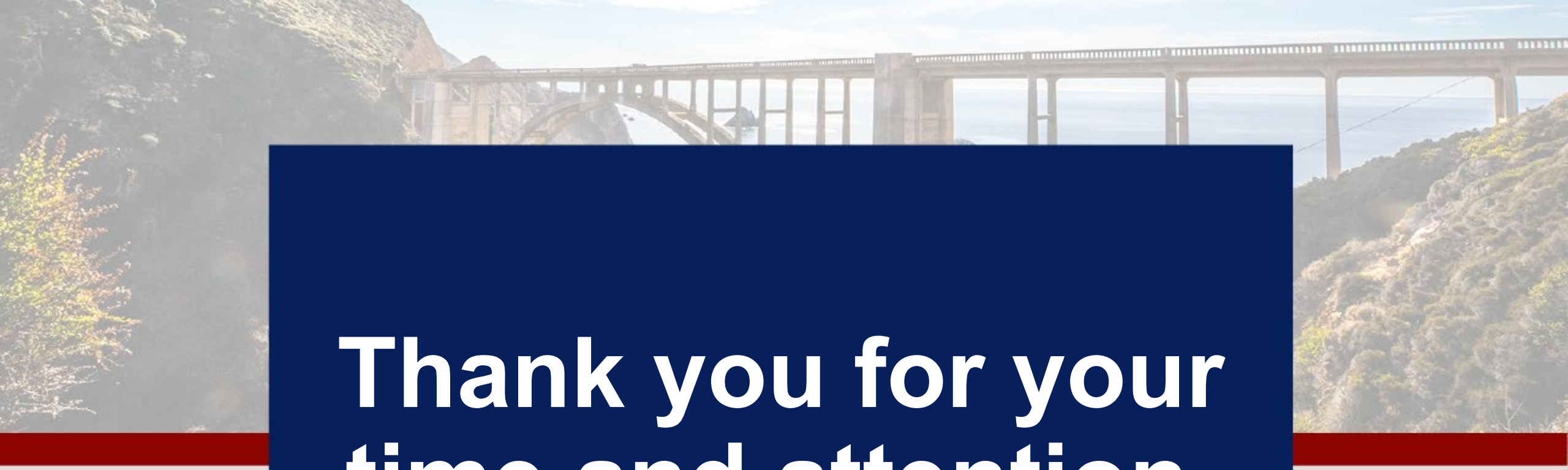
4. Establish a process for conducting targeted reviews of the safety issues identified in this investigation, to include at a minimum (1) an evaluation of bridge owners' determinations of the need to conduct new load ratings of bridges with advancing deterioration, and (2) an evaluation of inspection reports on bridges with advanced deterioration to determine if the assumptions and methods used in the load rating calculations are correct; and incorporate the results of these reviews into the National Bridge Inspection Program Compliance Review Manual as necessary.

Safety Issues

- Repeated lack of action on recommendations from inspections
- Bridge inspection program failures
  - Noncompliance with guidance
  - Failure to identify fracture-critical members
  - Inaccurate bridge load rating calculations
- Insufficient oversight at city, state, and federal level



Thank you for your time and attention.

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