



# FOLLOWING UP ON BRIDGE INSPECTION FINDINGS

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- Priority 1: Reduce percentage of Structurally Deficient bridges.
- Priority 2: Reduce percentage of Structurally Deficient bridges.
- Priority 3: Reduce percentage of Structurally Deficient bridges.

American Road a Transportation Builders Association State	Congressional Districts	About Full Rank	ing Top Deficient Bridges	Economic Reports	
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39	Virginia	13,931	646	4.6	25
40	Washington	8,278	382	4.6	34
41	Arkansas	12,892	588	4.6	26
42	Tennessee	20,177	871	4.3	20
43	Alabama	16,130	689	4.3	23
44	Delaware	863	34	3.9	50
45	Georgia	14,879	494	3.3	28
46	District of Columbia	244	8	3.3	52
47	Florida	12,435	328	2.6	35
48	Vermont	2,778	66	2.4	48
49	Utah	3,061	66	2.2	49
50	Arizona	8,294	150	1.8	46
51	Nevada	1,979	27	1.4	51
52	Texas	54,131	695	1.3	22

2001: 6.6% 2008: 3.6% 2019: 1.3%

# **Successful Approach**

- Formal process in place for addressing any Critical Findings.
- Bridge Division is automatically notified anytime a bridge is designated Structurally Deficient.
- Addressing Structurally Deficient bridges has been, and will remain, a priority.
- But how to prevent them from becoming critical or Structurally Deficient in the first place?





- Great deal of effort goes towards meeting requirements of the FHWA's Bridge Inspection Program.
- With thousands of inspections performed each year, not always enough attention given to follow-up actions.
- Findings and recommendations from inspections not always correct.
- Frequently bridges stay off the radar until major issues are identified.



- Focusing on reducing the percentage of Structurally Deficient bridges has had consequences in other areas.
- Percentage of "Good" bridges becoming "Fair" is on the rise.
- The rate of bridges becoming "Poor" is likely to increase given the aging inventory and lack of early repair and maintenance actions.



#### **Steel Piling – 2012 Routine Safety Inspection**



NOTE: Heavy rust & flaking with significant pitting along waterline of steel piles in main channel – est. up to 10% section loss. Light rust on remaining steel piles on channel banks – est. 2% section loss.

#### **Steel Piling – 2014 Routine Safety Inspection**



April 2019

# **Steel Piling – 2016 Routine Safety Inspection**





#### **Steel Piling – 2018 Routine Safety Inspection**



Photo 13: Bent 4, Pile 2; corrosion holes up to 9" diameter, looking Southwest

#### **Steel Piling – 2018 Routine Safety Inspection**

Resulted in immediate closure of State Highway in urban area.



April 2019

#### **Steel Piling – 2018 Routine Safety Inspection**

Resulted in immediate closure of State Highway in urban area.



# Bump in the bridge...







# **Immediately Closed, Dewatering Operations Commenced**



#### **Immediately Closed, Dewatering Operations Commenced**











![](_page_19_Picture_1.jpeg)

#### Bank Erosion – 2018 Routine Safety Inspection

![](_page_20_Picture_1.jpeg)

# Bank Erosion – 2019 Emergency Closure

![](_page_21_Picture_1.jpeg)

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# Bank Erosion – 2019 Emergency Closure

![](_page_22_Picture_1.jpeg)

#### **Critical Findings**

Previous inspection (2016), noted broomed timber pile.

![](_page_23_Picture_2.jpeg)

![](_page_23_Picture_3.jpeg)

Current inspection (2018), only core remains

- Long bridge in East Texas over ship channel. Made up primarily of precast concrete approach spans, with steel girders over the channel.
- Damage initially identified as "buckling of bottom flange."
- Superstructure condition rating lowered, making bridge Structurally Deficient.
- Because eligible, initially programmed for complete bridge replacement.

![](_page_24_Picture_5.jpeg)

# **Buckling?**

![](_page_25_Picture_1.jpeg)

- Minor impact damage in one location.
- Repair completed in one afternoon.

![](_page_26_Picture_3.jpeg)

- Interstate direct connect decks rated "6" during Routing Safety Inspections.
- Resisted rehab work because 'too much traffic at this location."
- In-depth damage survey performed. Condition rating of three direct connectors lowered to "3," making them Structurally Deficient.
- Bridges immediately load-posted.
- Now facing multi-week closures.
- Cold mix for patching?

![](_page_27_Picture_7.jpeg)

- Interstate bridge in urban area, over shipping channel.
- From Fracture Critical Inspection, recommendation was to clean and repair areas under finger joints.

![](_page_28_Picture_3.jpeg)

![](_page_28_Picture_4.jpeg)

#### **Need to Get it Right**

From Routine Safety Inspection, severe corrosion observed after cleaning. Led to critical finding, and immediate multi-day, multi-lane closure.

![](_page_29_Picture_2.jpeg)

#### **New Focus**

- Must hold ourselves and consultants accountable.
- Ensure that inspectors are properly identifying and categorizing damage and deterioration.
- Internally, make sure we are acting on follow-up actions and recommendations from inspections.

![](_page_30_Picture_4.jpeg)

#### **Piling – Inspection and Follow-up Issues**

- Corrosion and deterioration does not happen overnight. We are emphasizing the importance of closely inspecting steel and timber piling, particularly when water may be present.
- Presence of water and/or debris cannot be a deterrent to observing critical bridge elements.

![](_page_31_Picture_3.jpeg)

- Must access steel and timber piling. Use waders, waterproof boots, or boats as necessary.
- Review National Bridge Inventory coding to ensure coded properly if underwater inspection is needed.
- If impeded by debris, identify as urgent finding to ensure debris removal and followup inspection can be conducted.
- Evaluate full length of piling.
- Report percentage of section remaining, not percentage of section loss.

![](_page_32_Picture_6.jpeg)

#### **Risk-Based Inspection**

- TxDOT's Primary Goal: Spend more time and resources on higher-risk bridges.
- Following June 8, 2018 FHWA guidance document:
  - Formed a Risk Assessment Panel (RAP).
  - Define risk levels based on probability and consequence of various damage modes.
  - Develop methodology for categorizing bridges into three risk tiers: 12-, 24-, and 48-month frequencies.

![](_page_33_Picture_6.jpeg)

- Initial framework based on NCHRP Report 782, "Proposed Guideline for Reliability-Based Inspection Practices."
- Primary challenge: Developing a scalable method for Texas' large inventory of bridges.
  - Not realistic to assess thousands of bridges one-by-one.
  - Leveraging NBI data where possible.
  - Utilizing statistics and machine learning for initial probability levels
  - Utilizing expert judgement (through RAP) and statistics for consequence levels and final probability levels
- Will submit methodology and a summary report to the FHWA for approval.
- Regarding safety and serviceability as separate concerns with different levels of importance.
- Maintaining frequency of maintenance (off-year) inspection frequencies.

#### Making the Right Decisions – Rehab, Repair, or Leave it Be

- Just because a bridge is eligible for replacement, that may not be the best option. Repair or rehab is often the better way to go.
- On the flip side, TxDOT is frequently opting not to rehab in favor of replacement.
  - Cost of new bridge construction very low, especially when compared to rehab.
  - Quality of new bridges very good. Heavy reliance on standards and prefabricated elements.
- Handle case by case, and ensure there is good engineering basis for final decision.
- Currently reevaluating eligibility criteria.

![](_page_35_Picture_7.jpeg)

![](_page_36_Picture_0.jpeg)

![](_page_36_Picture_1.jpeg)

# **QUESTIONS?**

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