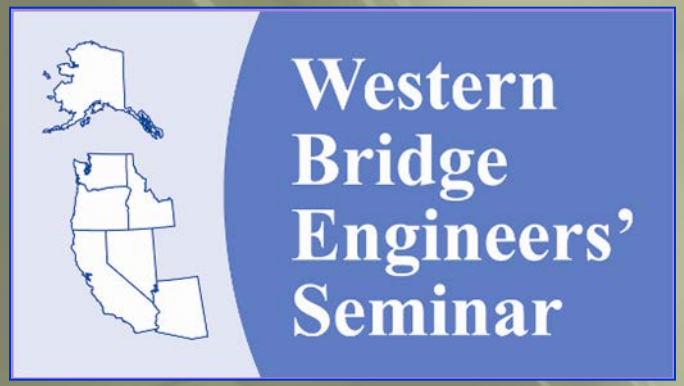
2013 Western Bridge Engineers' Seminar

Advances in Design, Construction, Inspection & Preservation of Bridges

Session 7B



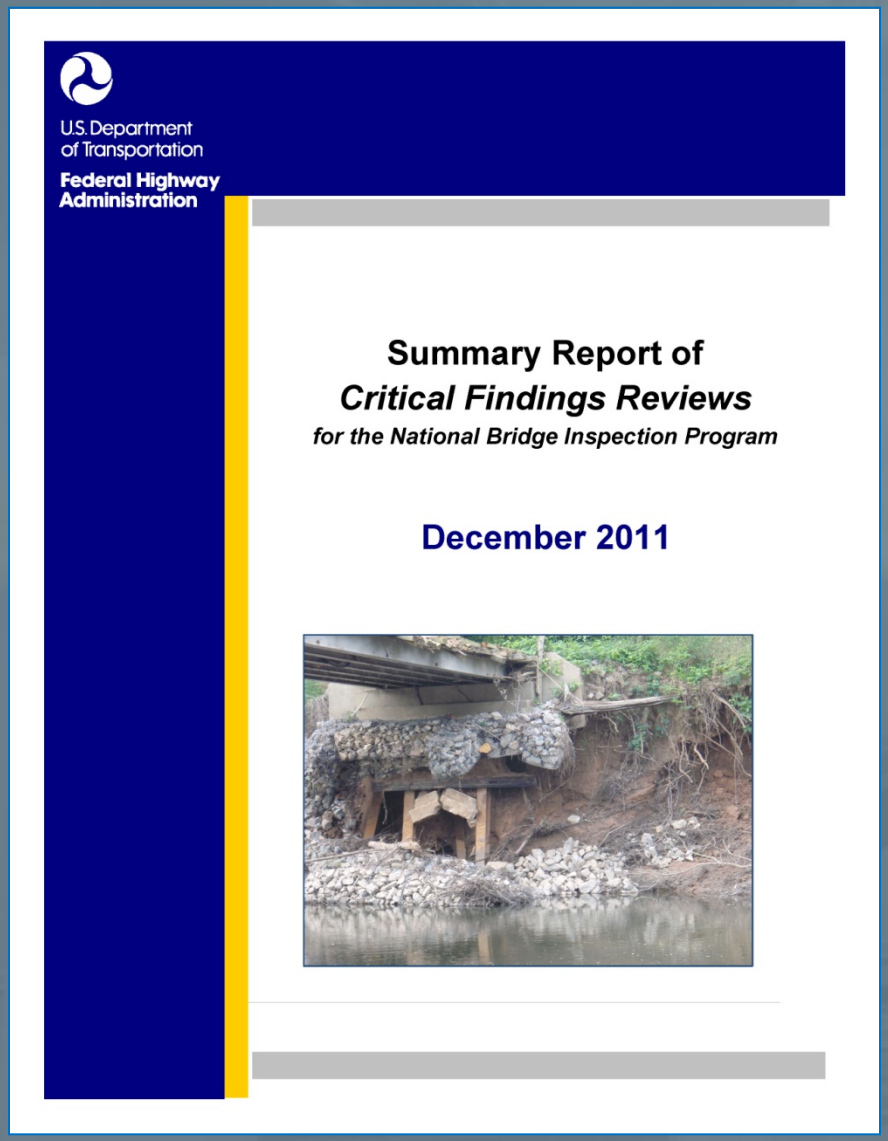
Sept. 5, 2013

Summary of *Critical Findings* Reviews for the National Bridge Inspection Program

Brian J. Leshko, PE

HDR

FHWA Document - Now Available

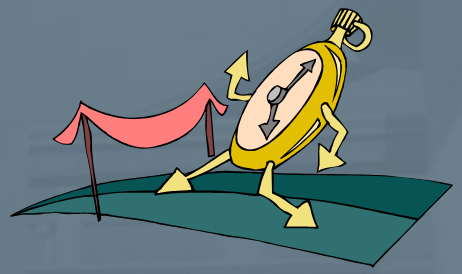


Outline

- Background and Objectives
- Introduction
- Findings
  - Typical *Critical Findings*
  - Common Areas of Good Practice
  - Common Areas of Improvement
- Conclusions

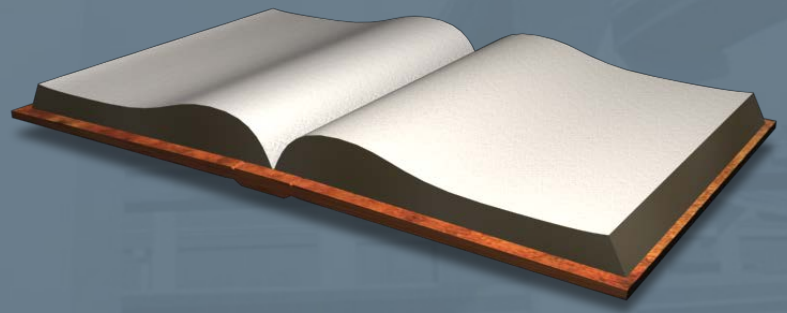
Background and Objectives

- The Federal Highway Administration (FHWA) contracted with HDR to review the current state of highway bridge inspection practice for identifying and following up on *critical findings*.
  - General Services Administration (GSA) Delivery Order: Bridge Safety Technical Support Services for the FHWA Office of Bridge Technology (OBT)
  - Base Year (2011) with extensions through March 2013



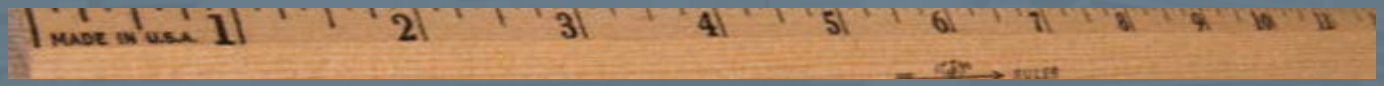
Background and Objectives

- The requirement for highway bridge owners to address *critical findings* is established in the National Bridge Inspection Standards (NBIS) (CFR 650.313 (h)):
  - Owners must "assure that *critical findings* are addressed in a timely manner," and they must "notify the FHWA of the actions taken to resolve or monitor *critical findings*."
  - A *critical finding* is "a structural or safety related deficiency that requires immediate follow-up inspection or action."



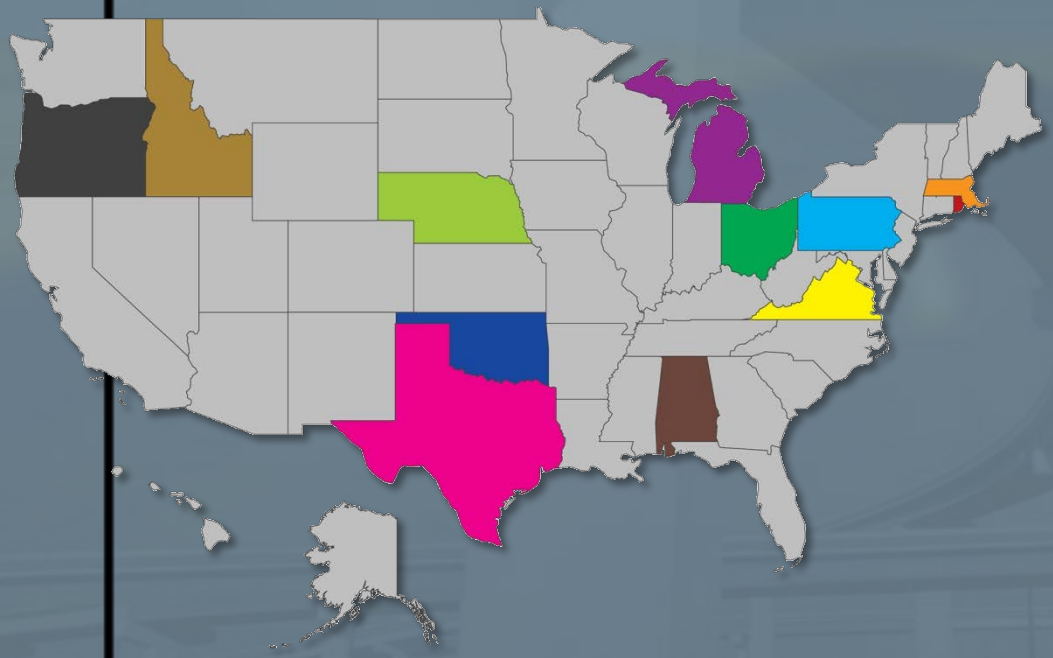
Background and Objectives

- FHWA believes this study necessary because it is this area of the bridge inspection program that addresses the most serious safety-related conditions on the nation's bridges.
  - Experience with the national program indicates that state practices for addressing *critical findings* may be improved with more robust and consistent national policies.
  - Information useful for federal policy development, but also for inspectors and inspection program managers who want to develop or improve their own procedures.



Introduction

- Summary report of site visits to twelve States
  - Assess processes and procedures for reporting and tracking critical bridge inspection findings (*critical findings*)



Pennsylvania	June 1-3, 2011
Texas	June 6-8, 2011
Virginia	June 13-14, 2011
Rhode Island	June 20-21, 2011
Massachusetts	June 22-23, 2011
Michigan	June 27-28, 2011
Ohio	June 30-July 1, 2011
Alabama	July 18-19, 2011
Nebraska	July 25-26, 2011
Oklahoma	July 28-29, 2011
Idaho **	August 8-9, 2011
Oregon **	August 15-16, 2011

** WBES States

Introduction

- Independent Review Team:
  - Visited State offices and bridge sites (selected by the State DOTs)
    - Reviewed bridge inspection information
    - Gained understanding of how the bridge safety program is administered
  - Interviewed FHWA staff, State bridge inspectors and State inspection program managers
    - Investigated aspects of bridge inspection that can lead to *critical findings*
    - Included: fracture critical findings, scour critical deficiencies and plans of action, load rating calculations, *critical findings* on any primary bridge component, and other safety deficiencies

Introduction

- Developed at the request of the FHWA to help document the current state of the practice
- Incorporates what was discovered on the *Critical Findings* site visits
- Provides a basis for improved processes for:
  - identifying,
  - monitoring, and
  - correcting *critical deficiencies*.

Findings

- Typical *Critical Findings*
  - Areas of Good Practice:
    - Developing and communicating policy, definitions, and descriptions of *critical findings* and categorizing the deficiencies;
    - Monthly schedule/audit reporting and tracking of *critical findings*;
    - Automated *critical findings* notification systems; and
    - Follow-up inspections/posting guidelines to close the loop on *critical findings*.

Findings

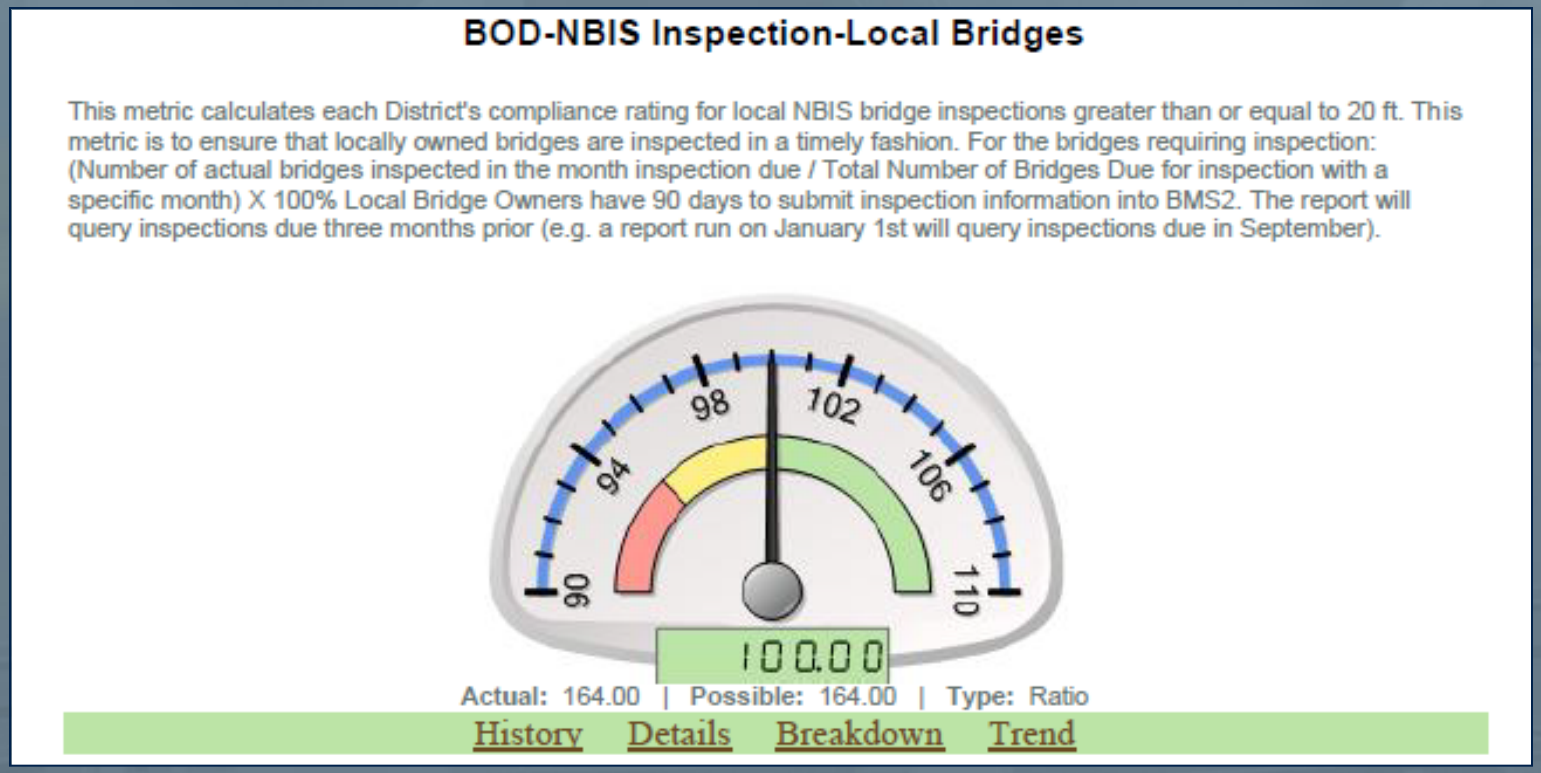
- Typical *Critical Findings*
  - Common Areas of Improvement:
    - Lack of a detailed formal definition leaves ambiguity in determining ***critical findings***;
    - Lack of control for non-State owned bridges (locally-owned or other agency owned bridges) with respect to ***critical findings*** policy, procedures, tracking and reporting;
    - Lack of policy regarding timeline for mitigating or for reporting and verifying corrective actions for ***critical findings***; and
    - Maintaining barricades and signage on closed or posted bridges.

Findings

- Common Areas of Good Practice
  - Finding No. 1 – *Critical Finding* Policy, Definitions, Descriptions and Categorizing Deficiencies:
    - Developed and communicate policy, definitions, descriptions and tracking procedures for ***critical findings***.
    - Have a Plan of Action with maximum timeframes for remediation based on assigned priority.
    - Categorize the deficiencies and their urgency, assigning priority until permanent repairs are performed.
  - 4/12 or 33% of the States visited developed policy, definitions, descriptions or deficiencies as part of their ***critical findings*** process.

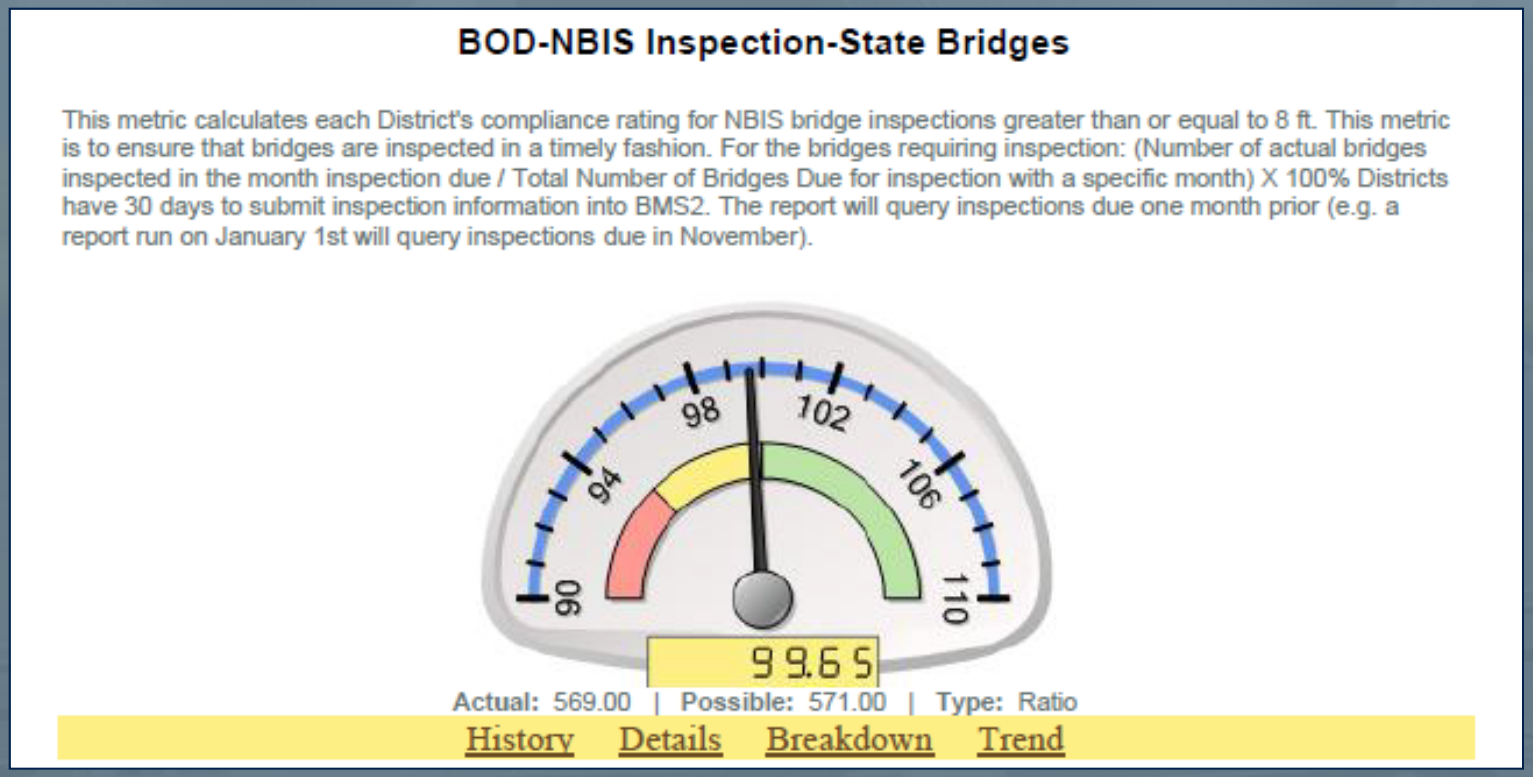
Findings

- Common Areas of Good Practice
  - Finding No. 1 – Performance Metrics Dashboard 1:



Findings

- Common Areas of Good Practice
  - Finding No. 1 – Performance Metrics Dashboard 2:



Findings

- Common Areas of Good Practice
  - Finding No. 2 – Monthly Schedule/Audit Reporting and Tracking of *Critical Findings*:
    - Generate reports to inform the FHWA Division of ***critical findings***.
    - Bridge Problem Reports, Bridge Schedule Reports, Electronic Bridge Inspection Audit Reports and *Critical Finding* Reports.
    - Reports can be used to log and track ***critical findings*** from discovery through final resolution.
  - 7/12 or 58% of the States visited generate reports to track ***critical findings***.

Findings

- Common Areas of Good Practice
  - Finding No. 2 – Sortable database of bridges that contains inspection and load rating information, as well as records of *critical findings*:

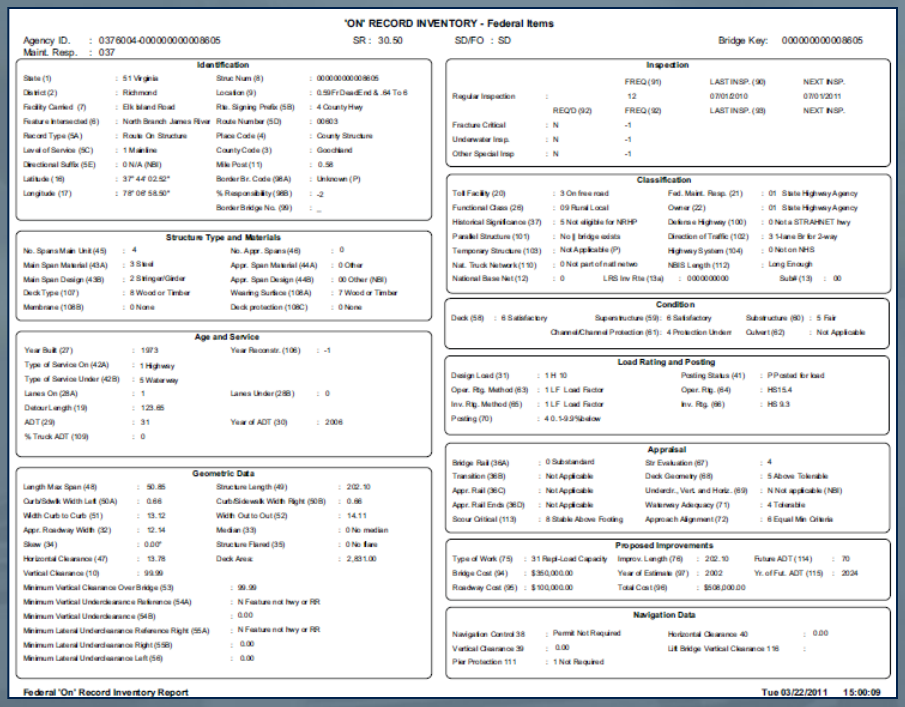
Period	Calc. Ratio	Actual	Possible	Target	RedPoint			
January 2010	89.74%	35.00	39.00	100.00	95.00	Details	Trend	Breakdown
February 2010	97.96%	48.00	49.00	100.00	95.00	Details	Trend	Breakdown
March 2010	97.50%	39.00	40.00	100.00	95.00	Details	Trend	Breakdown
April 2010	100.00%	36.00	36.00	100.00	95.00	Details	Trend	Breakdown
May 2010	100.00%	41.00	41.00	100.00	95.00	Details	Trend	Breakdown
June 2010	100.00%	20.00	20.00	100.00	95.00	Details	Trend	Breakdown
July 2010	100.00%	29.00	29.00	100.00	95.00	Details	Trend	Breakdown
August 2010	100.00%	24.00	24.00	100.00	95.00	Details	Trend	Breakdown
September 2010	98.39%	61.00	62.00	100.00	95.00	Details	Trend	Breakdown
October 2010	85.29%	29.00	34.00	100.00	95.00	Details	Trend	Breakdown
November 2010	100.00%	22.00	22.00	100.00	95.00	Details	Trend	Breakdown
December 2010	100.00%	22.00	22.00	100.00	95.00	Details	Trend	Breakdown

Findings

- Common Areas of Good Practice
  - Finding No. 3 – Automated *Critical Findings* Notification Systems:
    - Use automated e-mail to inform the FHWA Division when a *critical finding* is opened, revised or closed.
    - Automatically notify local agencies of due and overdue bridge inspections.
    - Program runs monthly and checks all types of inspections (Routine, Fracture Critical, Underwater, etc.).
  - 4/12 or 33% of the States visited have automated *critical findings* notification systems.

Findings

- Common Areas of Good Practice
  - Finding No. 3 – SharePoint Team Site tracks status of all critical recommendations (initiation, work complete, follow-up inspection):



'ON' RECORD INVENTORY - Federal Items

Agency ID. : 0376004-000000000008605 SR : 30.50 SD/FO : SD Bridge Key: 000000000008605
Maint. Resp. : 037

Identification

State (1)	: 51 Virginia	Struc Num (8)	: 000000000008605
District (2)	: Richmond	Location (9)	: 0.59 Fr DeadEnd & .64 To 6
Facility Carried (7)	: Elk Island Road	Rte. Signing Prefix (8B)	: 4 County Hwy
Feature Intersected (6)	: North Branch James River	Route Number (5D)	: 00603
Record Type (5A)	: Route On Structure	Place Code (4)	: County Structure
Level of Service (5C)	: 1 Mainline	County Code (3)	: Goochland
Directional Suffix (5E)	: 0 N/A (NBI)	Mile Post (11)	: 0.58
Latitude (16)	: 37° 44' 02.52"	Border Br. Code (98A)	: Unknown (P)
Longitude (17)	: 78° 08' 58.50"	% Responsibility (98B)	: -2
		Border Bridge No. (99)	: _

Structure Type and Materials

No. Spans Main Unit (45)	: 4	No. Appr. Spans (46)	: 0
Main Span Material (43A)	: 3 Steel	Appr. Span Material (44A)	: 0 Other
Main Span Design (43B)	: 2 Stringer/Girder	Appr. Span Design (44B)	: 00 Other (NBI)
Deck Type (107)	: 8 Wood or Timber	Wearing Surface (108A)	: 7 Wood or Timber
Membrane (108B)	: 0 None	Deck protection (108C)	: 0 None

Age and Service

Year Built (27)	: 1973	Year Reconstr. (106)	: -1
Type of Service On (42A)	: 1 Highway		
Type of Service Under (42B)	: 5 Waterway		
Lanes On (28A)	: 1	Lanes Under (28B)	: 0
Detour Length (19)	: 123.65		
ADT (29)	: 31	Year of ADT (30)	: 2006
% Truck ADT (109)	: 0		

Geometric Data

Length Max Span (48)	: 50.85	Structure Length (49)	: 202.10
Curb/Sidewk Width Left (50A)	: 0.66	Curb/Sidewalk Width Right (50B)	: 0.66
Width Curb to Curb (51)	: 13.12	Width Out to Out (52)	: 14.11
Appr. Roadway Width (32)	: 12.14	Median (33)	: 0 No median
Skew (34)	: 0.00°	Structure Flared (35)	: 0 No flare
Horizontal Clearance (47)	: 13.78	Deck Area:	: 2,831.00
Vertical Clearance (10)	: 99.99		
Minimum Vertical Clearance Over Bridge (53)		: 99.99	
Minimum Vertical Underclearance Reference (54A)		: N Feature not hwy or RR	
Minimum Vertical Underclearance (54B)		: 0.00	
Minimum Lateral Underclearance Reference Right (55A)		: N Feature not hwy or RR	
Minimum Lateral Underclearance Right (55B)		: 0.00	
Minimum Lateral Underclearance Left (56)		: 0.00	

Inspection

		FREQ (91)	LAST INSP. (90)	NEXT INSP.
Regular Inspection	:	12	07/01/2010	07/01/2011
	REQ'D (92)	FREQ (92)	LAST INSP. (93)	NEXT INSP.
Fracture Critical	: N	-1		
Underwater Insp.	: N	-1		
Other Special Insp	: N	-1		

Classification

Toll Facility (20)	: 3 On free road	Fed. Maint. Resp. (21)	: 01 State Highway Agency
Functional Class (26)	: 09 Rural Local	Owner (22)	: 01 State Highway Agency
Historical Significance (37)	: 5 Not eligible for NRHP	Defense Highway (100)	: 0 Not a STRAHNET hwy
Parallel Structure (101)	: No ‖ bridge exists	Direction of Traffic (102)	: 3 1-lane Br for 2-way
Temporary Structure (103)	: Not Applicable (P)	Highway System (104)	: 0 Not on NHS
Nat. Truck Network (110)	: 0 Not part of natl netwo	NBIS Length (112)	: Long Enough
National Base Net (12)	: 0	LRS Inv Rte (13a) : 000000000	Subrt (13) : 00

Condition

Deck (58) : 6 Satisfactory Superstructure (59): 6 Satisfactory Substructure (60) : 5 Fair
Channel/Channel Protection (61): 4 Protection Undert Culvert (62) : Not Applicable

Load Rating and Posting

Design Load (31)	: 1 H 10	Posting Status (41)	: P Posted for load
Oper. Rtg. Method (63)	: 1 LF Load Factor	Oper. Rtg. (64)	: HS15.4
Inv. Rtg. Method (65)	: 1 LF Load Factor	Inv. Rtg. (66)	: HS 9.3
Posting (70)	: 4 0.1-9.9%below		

Appraisal

Bridge Rail (36A)	: 0 Substandard	Str Evaluation (67)	: 4
Transition (36B)	: Not Applicable	Deck Geometry (68)	: 5 Above Tolerable
Appr. Rail (36C)	: Not Applicable	Undercltr., Vert. and Horiz. (69)	: N Not applicable (NBI)
Appr. Rail Ends (36D)	: Not Applicable	Waterway Adequacy (71)	: 4 Tolerable
Scour Critical (113)	: 8 Stable Above Footing	Approach Alignment (72)	: 6 Equal Min Criteria

Proposed Improvements

Type of Work (75)	: 31 Repl-Load Capacity	Improv. Length (76) : 202.10	Future ADT (114) : 70
Bridge Cost (94)	: $350,000.00	Year of Estimate (97) : 2002	Yr. of Fut. ADT (115) : 2024
Roadway Cost (95)	: $100,000.00	Total Cost (96) : $508,000.00	

Navigation Data

Navigation Control 38	: Permit Not Required	Horizontal Clearance 40	: 0.00
Vertical Clearance 39	: 0.00	Lift Bridge Vertical Clearance 116	:
Pier Protection 111	: 1 Not Required		

Federal 'On' Record Inventory Report Tue 03/22/2011 15:00:09

Findings

- Common Areas of Good Practice
  - Finding No. 4 – *Critical Finding* Follow-up Post-Repair Inspections:
    - Follow-up inspections are performed after ***critical findings*** have been mitigated.
    - Provide a record of repair, include photographs of the repaired areas.
    - Update the NBI data in accordance with the NBIS, while providing visual documentation of the repair.
    - This action definitively closes the loop on the ***critical finding***.
  - 4/12 or 33% of the States visited use ***critical finding*** follow-up post-repair inspections.

Findings

- Common Areas of Good Practice
  - Finding No. 4 – Deteriorated abutment identified as a *critical finding*: The reinforcing steel is corroded and deformed, and concrete is spilling down the slope wall.

Findings

- Common Areas of Good Practice
  - Finding No. 4 – Temporary columns support a steel beam under the existing concrete deck, in preparation to replace the abutment that was a *critical finding* in previous Photo.

Findings

- Common Areas of Good Practice
  - Finding No. 4 – Photo documentation is used to confirm that the repair was completed and the *critical finding* has been addressed.

Findings

- Common Areas of Good Practice
  - Finding No. 5 – Follow-up Load Posting Certifications or Guidelines:
    - The load posting certification program ensures that local agencies follow-up on plans to post bridges with required signs at proper locations.
    - The load posting guidelines allow bridges to safely remain open until the critical deficiency can be addressed.
  - 2/12 or 16% of the States visited have policies or guidelines for follow-up load posting.

Findings

- Common Areas of Good Practice
  - Finding No. 5 – Load posting sign setting the weight limit for various vehicle configurations at 3 tons. One possible outcome from a *critical finding* is to load post the structure.

Findings

- Common Areas of Improvement
  - Finding No. 1 – Lack of formal Standards Definition Leaves Ambiguity in Determining *Critical Findings*. Example Criteria:
    - Recommendations for immediate work on fracture critical members;
    - Recommendations for immediate correction of scour or hydraulic problems;
    - Condition ratings of 3 or less for the superstructure or substructure or appraisal ratings of 3 or less for waterway adequacy; and
    - Recommendations for immediate work to prevent substantial reduction in the safe load capacity.
  - 3/12 or 25% of the States visited cited ambiguity in the definition of *critical findings*.

Findings

- Common Areas of Improvement
  - Finding No. 2 – Lack of Control for Non-State Owned Bridges :
    - All States reported a lack of control for non-State owned bridges (locally-owned or other agency owned bridges) with respect to policy, procedures, tracking and reporting.
    - The DOTs do not have jurisdiction over municipally-owned bridges with *critical finding* repair or follow-up actions. It is difficult to follow-up or enforce repairs/closures on locally owned bridges.
  - 12/12 or 100% of the States visited cited a lack of control for non-State owned bridges.

Findings

- Common Areas of Improvement
  - Finding No. 3 – Lack of Policy for Mitigating, Reporting and Verifying Corrective Actions:
    - A few States reported a lack of a written policy regarding the timeline for mitigation of deficiencies or a procedure for reporting and verifying corrective actions for *critical findings*.
    - When one State's Critical Recommendation Form is initiated, the effects of the *critical finding* can be mitigated (i.e. with a traffic restriction); however, the source of the critical finding may remain unchanged.
  - 2/12 or 16% of the States visited cited a lack of policy regarding corrective actions.

Findings

- Common Areas of Improvement
  - Finding No. 4 – Maintaining Barricades and Signage on Closed or Posted Bridges:
    - A few States reported difficulty maintaining barricades/barriers on closed bridges, and vandalism and removal of bridge load posting signs.
    - The most effective technique for closed timber bridge deck bridges is partial or complete deck removal.
  - 2/12 or 16% of the States visited cited challenges maintaining barricades and signs on closed or posted bridges.

Findings

- Common Areas of Improvement
  - Finding No. 4 – Barricades in each lane on the bridge approach. Water-filled barriers in the distance, before the bridge, that provide a barrier to any vehicle that might go around the barricades.

Conclusions

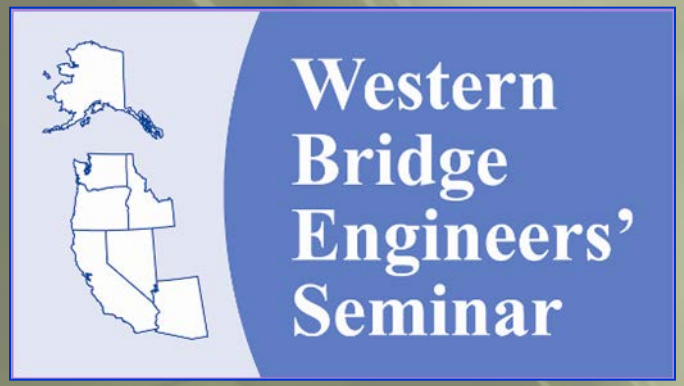
- Products from twelve State *critical findings* reviews will improve processes used by bridge owners to take timely corrective measures to:
  - avoid bridge closures that may occur due to deficiencies
  - prevent bridge failures
- Common Areas of Good Practice
- Common Areas of Improvement

Conclusions

- Sharing results with bridge owners will:
  - Improve the *critical findings* process.
  - Provide tools to better manage the bridge inspection program.
- Examples of good processes that can be used by State and local agencies interested in establishing or improving the way they address *critical findings*.

QUESTIONS?

Session 7B



Sept. 5, 2013

Summary of *Critical Findings* Reviews for the National Bridge Inspection Program

Brian J. Leshko, PE

HDR