



U.S. Department  
of Transportation

**Federal Highway  
Administration**

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

**December 2011**



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## **Background and Objectives**

The Federal Highway Administration (FHWA) reviewed the current state of highway bridge inspection practice for identifying and following up on critical findings and through a contract with HDR Engineering developed this report to summarize best practices and areas for improvement based on site visits to twelve States. The requirement for highway bridge owners to address critical findings is established in the National Bridge Inspection Standards (NBIS) (CFR 650.313 (h)). The standards require that 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.” The standards define a critical finding as “a structural or safety related deficiency that requires immediate follow-up inspection or action.” The 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, and our experience with the national program indicates that state practices for addressing critical findings may be improved with more robust and consistent national policies. Many states have developed excellent procedures to deal with critical findings, and the FHWA wants to showcase these. Additionally, we feel it important to uncover areas of concern or areas the inspection community has identified as needing improvement or clarification, and the report aims to provide this too. The information should be useful for federal policy development, but also for inspectors and inspection program managers who want to develop or improve their own procedures.

## **Introduction**

Twelve States were visited during June-August, 2011 by HDR Bridge Safety Experts as part of an independent review team to assess processes and procedures for reporting and tracking critical bridge inspection findings (*critical findings*). The team visited State offices and bridge sites (selected by the State DOTs) to review bridge inspection information and gain a better understanding of how this important area of the bridge safety program is administered. The team interviewed FHWA staff, State bridge inspectors and State inspection program managers, and investigated aspects of bridge inspection and other events that can lead to *critical findings*. This 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.

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

## **Findings**

Areas of good practice include: developing and communicating policy, definitions, and descriptions of *critical findings* and categorizing the deficiencies; monthly schedule/audit reporting of *critical findings*; automated *critical findings* notification systems; tracking *critical findings*; and follow-up inspections/posting guidelines to close the loop on *critical findings*.

Areas of improvement include: 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.

The items highlighted above, for both areas of good practice and improvement, will be described in more detail below.

### **Common Areas of Good Practice**

The following findings detail the common areas of good practice discovered during the *Critical Findings* site visits to twelve States. See Appendix E for the full listing of good practices.

#### **Finding No. 1 – Critical Finding Policy, Definitions, Descriptions and Categorizing Deficiencies**

Several States have developed and communicate policy, definitions, descriptions and tracking procedures for *critical findings*, including having a Plan of Action with maximum timeframes for remediation based on assigned priority. Some categorize the deficiencies and their urgency, assigning priority until permanent repairs are performed. See Appendix C for examples of state-developed definitions and policy.

4/12 or 33% of the States visited developed policy, definitions, descriptions or deficiencies as part of their *critical findings* process.

#### **Finding No. 2 – Monthly Schedule/Audit Reporting and Tracking of Critical Findings**

Several States generate reports to inform the FHWA Division of *critical findings*. These include Bridge Problem Reports, Bridge Schedule Reports, Electronic Bridge Inspection Audit Reports and *Critical Finding* Reports. The reports can be used to log and track *critical findings* from discovery through final resolution. A few States have processes in-place to aid in tracking *critical findings*. One has a sortable database of bridges that contains inspection and load rating information, as well as records of *critical findings*. An example report is shown below:

Period	Calc. Ratio	Actual	Possible	Target	RedPoint			
January 2010	100.00%	7.00	7.00	100.00	95.00	<a href="#">Details</a>	<a href="#">Trend</a>	<a href="#">Breakdown</a>
February 2010	100.00%	1.00	1.00	100.00	95.00	<a href="#">Details</a>	<a href="#">Trend</a>	<a href="#">Breakdown</a>
March 2010	100.00%	4.00	4.00	100.00	95.00	<a href="#">Details</a>	<a href="#">Trend</a>	<a href="#">Breakdown</a>
April 2010	100.00%	7.00	7.00	100.00	95.00	<a href="#">Details</a>	<a href="#">Trend</a>	<a href="#">Breakdown</a>
May 2010	100.00%	2.00	2.00	100.00	95.00	<a href="#">Details</a>	<a href="#">Trend</a>	<a href="#">Breakdown</a>
June 2010	100.00%	3.00	3.00	100.00	95.00	<a href="#">Details</a>	<a href="#">Trend</a>	<a href="#">Breakdown</a>
August 2010	100.00%	4.00	4.00	100.00	95.00	<a href="#">Details</a>	<a href="#">Trend</a>	<a href="#">Breakdown</a>
September 2010	100.00%	2.00	2.00	100.00	95.00	<a href="#">Details</a>	<a href="#">Trend</a>	<a href="#">Breakdown</a>
October 2010	100.00%	1.00	1.00	100.00	95.00	<a href="#">Details</a>	<a href="#">Trend</a>	<a href="#">Breakdown</a>
November 2010	100.00%	3.00	3.00	100.00	95.00	<a href="#">Details</a>	<a href="#">Trend</a>	<a href="#">Breakdown</a>
December 2010				100.00	95.00	<a href="#">Details</a>	<a href="#">Trend</a>	<a href="#">Breakdown</a>

7/12 or 58% of the States visited generate reports to track *critical findings*.

### **Finding No. 3 – Automated *Critical Findings* Notification Systems**

Several States use automated e-mail to inform the FHWA Division when a *critical finding* is opened, revised or closed. Another use is to automatically notify local agencies of due and overdue bridge inspections. The 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.

### **Finding No. 4 – *Critical Finding* Follow-up Post-Repair Inspections**

Follow-up inspections are performed after *critical findings* have been mitigated. These inspections, which provide a record of repair, include photographs of the repaired areas. This enables the owner to 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*.



Photo 1. Shown is a deteriorated abutment that was identified as a critical finding. The reinforcing steel is corroded and deformed, and concrete is spilling down the slope wall.



Photo 2. Temporary columns are shown that support a steel beam under the existing concrete deck, in preparation to replace the abutment that was a critical finding in Photo 1.



Photo 3. Photo documentation is used to confirm that the repair was completed and the critical finding in Photo 1 has been addressed.

4/12 or 33% of the States visited use *critical finding* follow-up post-repair inspections.

## **Finding No. 5 – Follow-up Load Posting Certifications or Guidelines**

A few States have 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.



Photo 4. Shown here is a 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.

2/12 or 16% of the States visited have policies or guidelines for follow-up load posting.

### **Common Areas of Improvement**

The following findings detail the common areas of improvement discovered during the *Critical Findings* site visits to twelve States. See Appendix F for the full listing of improvements.

#### **Finding No. 1 – Lack of a detailed formal Definition in the Standards Leaves Ambiguity in Determining *Critical Findings***

The lack of a detailed national definition of a *critical finding* can result in inconsistencies between different States processes and procedures. This can also result in ambiguity when determining which deficiencies are critical and which are not. One State's district engineers must make the determination that an identified finding is an actual *critical finding*, thus more formal definitions might make this an unnecessary step in the process.

A broad definition for "*critical finding*" is provided in the regulation to allow flexibility to establish, with agreement of the FHWA, criteria and reporting procedures specific to a

particular State or Federal Agency. The FHWA non-regulatory supplement in the Federal Aid Program Guide (FAPG) section 23 CFR 650C provided an example of an FHWA process for follow-up on *critical findings* that include criteria for *critical findings*. Following is the section from the FAPG:

NON-REGULATORY SUPPLEMENT 23 CFR 650C (listed 6/21/05)

b. One FHWA process for follow-up might include the following components: A procedure where the State promptly submits to the Division office a copy of inspection reports or recommendations contained therein for all on-system and off-system bridges which meet the following criteria:

- (1) Bridges with recommendations for immediate work on fracture critical members;
- (2) Bridges with recommendations for immediate correction of scour or hydraulic problems;
- (3) Bridges with condition ratings of 3 or less for the superstructure or substructure or appraisal ratings of 3 or less for waterway adequacy; and
- (4) Bridges with 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*.

**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 *critical findings* 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.

One innovative approach allows local agencies into the Participation-Waived/Equivalent-Match Program. A county can choose to waive their percentage of bridge replacement costs if the funds are used in an approved manner on other deficient bridges within 3 years. This encourages local agencies to address critical deficiencies in a timely manner, and has the added benefit to bring other structures up to state standards.

12/12 or 100% of the States visited cited a lack of control for non-State owned bridges.

**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.



#### **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.



Photo 5. Shown here are barricades in each lane on the bridge approach. One of the barricades has a sign that says, “Road Closed,” and one can see water-filled barriers in the distance, immediately before the bridge, that provide a barrier to any vehicle that might go around the barricades. This is an example of good signing for a bridge closure resulting from a *critical finding*. It can be difficult, particularly in rural areas, to maintain posting or closing signs.

2/12 or 16% of the States visited cited challenges maintaining barricades and signs on closed or posted bridges.

#### **Summary Observation**

An illustrative “take away” derived from visiting twelve States and discussing *critical findings* with various FHWA and State DOT staff can be stated as follows:

Whenever someone is about to cross a bridge, they do not care whether the bridge is on a State-owned highway, a locally owned roadway, or a toll facility...all they care about is that the structure is safe for them to traverse.

Therefore, a critical finding on any bridge needs to be addressed properly in accordance with established protocols and processes, regardless of who owns, maintains and inspects the

structure. While roadway users may not be aware of what agency owns a bridge, they do expect it to be safe to cross.

This obligation to society is codified in nearly all engineering professions, “Engineers shall hold paramount the safety, health and welfare of the public.” (American Society of Civil Engineers Code of Ethics: Canon 1) To this end, it is paramount that bridge-related *critical findings* be mitigated and resolved without regard to ownership, maintenance or inspection responsibilities.

## **Conclusion**

The products from twelve State *critical findings* reviews, areas of good practice and areas of improvement, will improve processes used by bridge owners to take timely corrective measures to avoid bridge closures that may occur due to deficiencies and to prevent bridge failures.

Areas of good practice include: *critical findings* definitions; *critical findings* reports; automated *critical findings* notification systems; tracking *critical findings*; and follow-up inspections/posting guidelines to close *critical findings*. Areas of improvement include: lack of a formal definition of *critical findings*; lack of control for non-State owned bridges; lack of policy regarding mitigating, reporting and verifying *critical findings*; and maintaining barricades and signage.

Sharing common areas of good practice and common areas of improvement with other bridge owners will support the overall objective to improve the *critical findings* process and will also provide tools for the FHWA to better manage the bridge inspection program. There are many examples of good processes in place that can be used by state and local agencies who are interested in establishing or improving the way they address *critical findings*.

## **Team Members**

### **HDR Engineering, Inc.**

Brian Leshko, PE, Vice President / Senior Professional Associate / Contract Manager

- Three Site Visits – Review Team Leader
- Attended In-briefings and Interviews for all Twelve Site Visits (for Consistency)

Tom Howell, PE, Structural Engineer / Professional Associate

- Three Site Visits – Review Team Leader

Ann Griessmann, PE, Bridge Inspection Engineer

- Two Site Visits – Review Team Leader

Jim Murphy, PE, Structural Engineer

- Two Site Visits – Review Team Leader

Steve Wells, PE, Structural Engineer

- One Site Visit – Review Team Leader

Nick Clark, PE, Bridge Engineer/Inspector

- One Site Visit – Review Team Leader

### **FHWA Office of Infrastructure – Bridge Technology**

Steve Ernst, PE, Senior Engineer - Safety and Security

- Nine Site Visits – Review Team Facilitator

Jon Nekritz, PE, Senior Bridge Safety Engineer

- Two Site Visits – Review Team Facilitator

Tom Drda, PE, Senior Bridge Safety Engineer

- One Site Visit – Review Team Facilitator

John Thiel, PE, Senior Bridge Safety Engineer

- Part-Time (One Site Visit - Participant)

## **Appendix A – Dates of Twelve State Site Visits**

<b>State</b>	<b>Dates</b>
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

## **Appendix B – List of Acronyms**

FHWA – Federal Highway Administration

DOT – Department of Transportation

BIM – Bridge Inspection Manual

BIS – Bridge Inspection System

FCM – Fracture Critical Member

FPD – Fatigue Prone Detail

NBIS – National Bridge Inspection Standards

ADTT – Average Daily Truck Traffic

P/S – Prestressed Concrete

EBIT – Emergency Bridge Inspection Team

GFO – Guidelines for Operation

QC – Quality Control

POA – Plan of Action

BLM – Bureau of Land Management

USACE – U.S. Army Corps of Engineers

BIA – Bureau of Indian Affairs

RFA – Request for Action

NBI – National Bridge Inventory

AASHTO – American Association of State Highway and Transportation Officials

## **Appendix C – Examples of State DOT Critical Finding Definitions**

1. *Critical Findings* are defined as **Priority Code 0 – CRITICAL** and **Priority Code 1 – HIGH PRIORITY**.

Non-Critical Findings are defined as priority codes greater than 1.

- **Priority Code 0 – CRITICAL**

If not addressed immediately, such deficiencies could directly or indirectly cause partial or total structure collapse resulting from component instability and/or localized element failure; or result in loss of vehicle operator control; or failure to contain errant vehicles on the bridge deck. Emergency Flexaction [flexible action] work (e.g. repair, replacement, posting/closing) is necessary to immediately mitigate the structural safety deficiencies with the required timeframe.

- **Priority Code 1 – HIGH PRIORITY**

This code is applicable to a serious structural deficiency to a primary bridge element that could lead to load restrictions, lane and/or bridge closures or, if not corrected, may jeopardize public safety. Flexactions to address these deficiencies should be performed independently of the normal work schedule to complete the Flexaction within the required timeframe.

Critical and high priority maintenance items are documented and tracked in the bridge management system database and by Plan of Action documents that must be prepared for each item (bridges owned and maintained by this DOT require formal Plans of Action). Target timeframes for resolution of items is 7 days and 6 months from the date of finding for critical and high priority items respectively. If necessary, temporary remediation of critical and high priority items is implemented immediately and may include full closure, partial closure, weight restriction, temporary shoring, etc.

2. **CRITICAL RECOMMENDATIONS** [**CRITICAL FINDINGS**] – When the condition of a structure is identified as posing a threat to public safety, the Residency Administrator and/or the responsible manager shall be notified of the situation and shall be informed of a proposed method of correction. Conditions requiring the issuance of a critical recommendation [*critical finding*] include, but are not limited to:

- Critical repairs to fracture critical members.
- Correction of critical scour and/or hydraulic induced problems.
- Condition rating of 3 or less for deck, superstructure, substructure or culvert.
- Immediate work to prevent substantial reduction in safe load capacity.

3. "...bridges needing special consideration (which includes all bridges that have any Condition Rating of 4 or lower) must be brought to the immediate attention of the District Bridge Inspection Coordinator, both verbally and in writing. If the inspection indicates significant deterioration of any structural element, documentation such as notes, measurements, sketches, and photos must be included."

This DOT's Bridge Division staff noted they specifically excluded using the term "*critical finding*" due to a lack of guidance from FHWA. This would permit accommodation of a precise definition of a *critical finding* at a future date.

## **Appendix D – Photos of Typical *Critical Findings***



Photo A1. The underside of a steel girder bridge is shown, and one interior girder is severely distorted from collision and bent out-of-plane.



Photo A2. A concrete abutment is shown with exposed and deteriorated timber piles. There is debris in the channel and the remains of a curtain wall that once encased the pile foundation. This bridge is closed because of this critical finding.



Photo A3. A timber deck on steel stringer bridge is shown. The structure has low timber guide rails, and concrete piers are tilted. The bridge is rated "3" for deck, superstructure and substructure, and the bridge is closed.

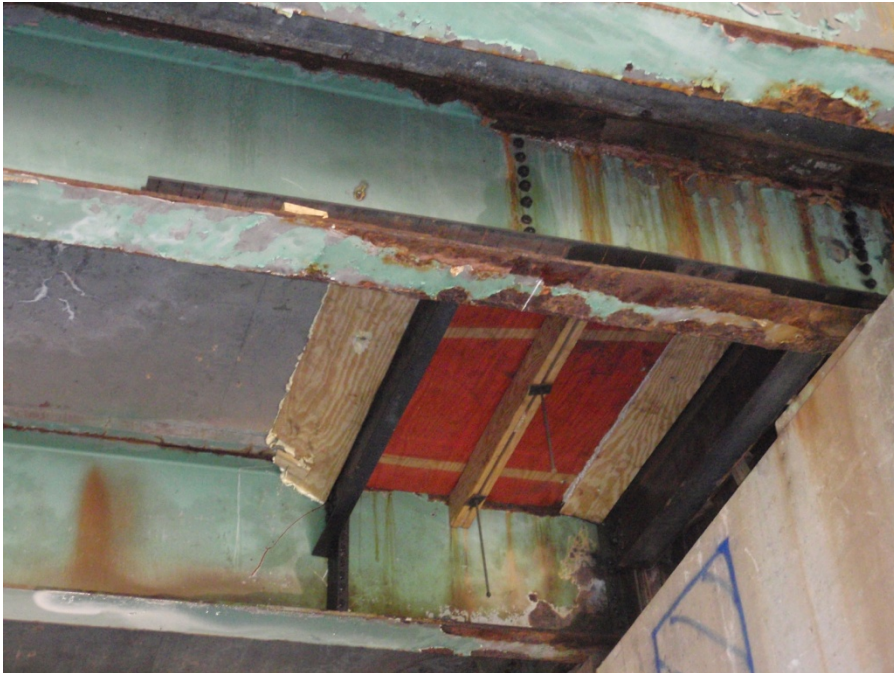


Photo A4. The underside of a steel girder with concrete deck bridge is shown, and also shown is the forming between an exterior and 1<sup>st</sup> interior girder for a failed section of deck and adjacent steel diaphragms.





Photo A5. A close-up view of a timber stringer over a concrete abutment is shown, and the stringer is exhibiting crushing due to extensive rot and deterioration at this location.



Photo A6. Shown is the underside of a bridge, and visible is a corrugated metal deck on a rail car superstructure. The end of the rail car rests on a salvaged concrete slab founded on precast concrete blocks. This repair removed an existing critical finding.

## **Appendix E – Common Areas of Good Practice**

- 1.1. Policy, definitions, descriptions and tracking procedures for critical findings. Procedures include a requirement that each critical finding have a Plan of Action that complies with maximum established timeframes for remediation based on assigned priority. This DOT's Performance Metrics Dashboard tracks completion of these items on a monthly basis.
- 1.2. Communication of policy, definitions, and descriptions of critical findings is provided to the consultant inspection pool performing routine and fracture critical element inspections through inclusion in the scope of services attached to contracts. This ensures consistent information is provided to all inspection resources. In order to provide the same information to this DOT's internal forces performing fracture-critical and underwater inspections, an identical definition for a critical finding is provided in this DOT's Bridge Inspection Manual (BIM). Consultant contracting at the Bridge Division level ensures consistent application across the State's inspection personnel. Also, by contracting all consultant forces at the Division level, this DOT ensures reasonable costs through application of economy of scale. The logistics of interfacing with 254 counties and 25 districts is reduced to a small pool of qualified consultant firms, maximizing replacement costs and conserving resources.
- 1.3. This DOT has defined categories for deficiencies and their urgency. Deficiencies are categorized as *Minor*, *Severe/Major*, *Critical-Structural* and *Critical-Hazard*. *Critical-Structural* and *Critical-Hazard* categories require immediate action. Each deficiency is also assigned an Urgency identifier. These terms are *Immediate Corrective Action*, *As soon as possible* and *Prioritize*. This process allows for prioritization of action on deficiencies.
- 1.4. For this DOT, after *critical findings* are mitigated, and therefore considered closed, they are categorized as *priority* until permanent repairs are performed.
- 1.5. Bridge Problem Reports are generated by this DOT to inform the FHWA Division of *critical findings*.
- 1.6. This DOT's Bridge Schedule Reports include monthly counts of on-system and off-system inspections due by month and are generated for use by the districts to help scheduling to ensure compliance and to inform the FHWA Division of upcoming inspection activities. These listings are subdivided by district and, within districts, by county. Also provided to the FHWA are closure and posting recommendations sent to the districts and any acute events affecting bridges. Annually, *critical findings* are summarized and reported to the FHWA.
- 1.7. This DOT has created and maintains a *Critical Finding Report* in order to log and track the *critical finding* from discovery through final resolution.
- 1.8. This DOT has Electronic Bridge Inspection Audit Reports for the following:
  - Past due routine inspections
  - Past due fracture critical inspections

- Past due fatigue-prone detail inspections
  - Bridge list with *critical findings*
- 1.9.** The FHWA Division is automatically notified via e-mail when a *Critical Finding* is opened, revised or closed by this DOT using the Critical Recommendation Form.
- 1.10.** This DOT's State Bridge Inspection Mailbox immediately notifies key DOT personnel of *critical findings*.
- 1.11.** For this DOT, an automated notification system has been developed that notifies local agencies about due and overdue bridges. Though the system is relatively new, feedback has been universally positive from local agencies. This fosters a level of cooperation which may facilitate proper *critical findings* reporting.
- 1.12.** Warnings are triggered to alert the bridge owners automatically when they have bridges that have not been inputted into this DOT's Bridge Inspection System (BIS). The program runs every month and checks the bridge list to see if it is past due. The automated notifications check all types of inspections (Routine, Fracture Critical, Underwater, etc). This may ensure *critical findings* are identified and reported.
- 1.13.** This DOT has built a sortable database for bridges that contains inspection and load rating information, as well as records of *critical findings*. This aids in tracking *critical findings*.
- 1.14.** After a *critical finding* has been mitigated, the mitigation must be documented by a re-inspection of the findings or by photographs of repairs taken by this DOT's maintenance department.
- 1.15.** After repairs are made to a structure, an element inspection is usually performed. In lieu of the element inspection, this DOT's maintenance personnel sometimes take photos of repairs and provide them to the Bridge Inspection Unit as a record of completed repair in lieu of an element inspection.
- 1.16.** As a QC of critical recommendations, this DOT requires that the structure be inspected after the critical recommendation work is completed to ensure that the critical recommendation has been adequately addressed and to close the loop on the *critical finding*.
- 1.17.** For bridges in which *critical findings* have been repaired, this DOT's procedures require re-inspection of the repaired structure by the same inspection forces that initially identified the critical finding. The requirement is a prerequisite for re-opening the structure and ensures satisfactory completion of recommended repair activities.
- 1.18.** Local agencies are given flexibility with respect to how bridges with critical deficiencies may be addressed. When funding or other feasibility limitations restrict options for immediate repair of a bridge, guidelines for the posting of the bridge are provided in this DOT's Bridge Inspection Manual's Guidelines for Operation (GFO). These posting guidelines allow bridges to safely remain open until the critical deficiency can be addressed.

- 1.19.** This DOT conducts yearly load posting certifications for bridges that have been posted for vehicle weight restrictions. This certification program ensures that local agencies have followed-up on plans to post the designated bridge, that the signs are located at the proper locations, and that the posting sign matches the required values.
- 1.20.** For this DOT, the frequency of bridge inspections is dependent on the condition rating. Bridges with a Condition Rating of 4 are inspected on a 12 month basis. Bridges with a Condition Rating of 3 or less are inspected on a 6 month cycle.
- 1.21.** For this DOT, all NBIS Routine Inspections are “hands-on” inspections.
- 1.22.** This DOT performs “hands-on” inspections of Fatigue Prone Details (FPD) for all interstate structures and all structures with ADTT > 500.
- 1.23.** This DOT requires bridge inspectors (State inspectors and consultants) to attend a biennial 3-day refresher course. One aspect of the training is “Hot Topics”. In the past, Hot Topics have covered many topics including: gusset plates, maintenance priorities, rocker bearing measurements, scour plans of action, and adjacent non-composite P/S box beams.
- DOT developed a spreadsheet program, guidance and training for the evaluation of gusset plate capacities.
  - DOT developed guidance and training on rating rocker bearing condition and functionality.
  - Scour critical bridge standardized policy, procedures, plan of action template and field manual for significant flood event monitoring and post significant flood event inspection.
- 1.24.** This DOT has an Emergency Bridge Inspection Team (EBIT), which assists local agencies in verifying inspection findings and making recommendations for bridges with critical deficiencies. Members of a specified EBIT team are generally equipped with expertise specific to the deficiency and are available for immediate deployment. When requesting EBIT assistance, inspectors, local agencies and contractors are required to submit a detailed EBIT request in addition to back-up photo documentation. The detailed EBIT request ensures that the EBIT is staffed by personnel with specific areas of expertise that match the bridge deficiency involved.
- 1.25.** In addition to critical structural deficiencies, this DOT identifies safety hazards as *critical findings*. With very few exceptions, safety-related *critical findings* are addressed by field division maintenance forces prior to the end of the inspection, greatly enhancing public safety. Typical examples of safety-related *critical findings* in this category are guardrail damage, concrete delamination over active travel lanes, and severe potholes in travel lanes.
- 1.26.** Management of the inspection program is completely centralized. All, except for three state-owned bridges, are managed by this DOT.
- 1.27.** This DOT’s Bridge Division prequalifies consultant firms and provides the list of prequalified consultants from which the Eight Field Divisions and various local agencies can select. Invoicing, reviews, and other administrative functions are

performed at the Field Division level. In addition, the Bridge Division develops standard contracts for inspection of on- and off-system bridges for use in contracting consultant forces. Within the contract are specific items concerning critical findings reporting procedures, ensuring consistency among consultant inspectors.

- 1.28.** This DOT has been attaching small decals to various locations on bridges in the field and requiring that the inspectors find and record the decal information and return them during the course of routine inspections. The intent is to ensure that all portions of all bridges are inspected during each inspection.
- 1.29.** As a component of their plans of action for each scour critical bridge, this DOT implemented BridgeWatch, a patented web-based scour-monitoring software tool that enables this DOT to monitor, in real-time, bridges and hydraulic infrastructures. The program provides a “forward thinking” technical approach to identify weather events that may result in a critical finding at the bridges.
- 1.30.** This DOT’s Participation-Waived/Equivalent-Match Program allows counties that follow this DOT’s posting and closure recommendations to waive their percentage of bridge replacement costs if the funds are used in an approved manner within 3 years. For example, if the county's share of a new on-system bridge is \$100k, this DOT offers to pay this portion of the costs provided:
  - The county uses its matching \$100k on other approved bridge projects, and
  - The county follows this DOT’s recommendations regarding bridge posting and closures.
- 1.31.** This DOT retains the majority of federally-provided funding that is designated for local agencies and uses State funds to fund local agency projects. This practice is due to the less-restrictive conditions placed on use of State funds versus federal funds, enabling simpler execution of projects at the district, city and county levels. This program also allows more direct enforcement of compliance at the local agency level by this DOT, though this is seldom necessary.

## **Appendix F – Common Areas of Improvement**

- 1.1. The lack of a formal detailed definition of a Critical Finding may result in inconsistencies between States with respect to their Critical Findings Processes.
- 1.2. The definition of *critical finding* as put forth by this DOT leaves ambiguity in determining which deficiencies are critical and which are not. Determining what deficiencies are *critical findings* are left to the inspector and to this DOT's key personnel. In the past, this has led to deficiencies which are not critical being reported as *critical findings*. This DOT is currently working on a draft further defining *critical findings* and providing examples.
- 1.3. Due to the ambiguity of the definition of a *critical finding*, this DOT's district engineers must confirm before the finding is identified as an actual *critical finding*. A better definition of a *critical finding* would potentially alleviate this step in the process.
- 1.4. Critical inspection findings and status are currently reported and tracked for this DOT's bridges. Other agencies and local jurisdictions are reporting findings but not status, i.e. follow-up actions. This DOT is actively developing policy to address this concern.
- 1.5. Currently, the local agencies are using their own process for documenting and following up on *critical findings*. As a result, *critical findings* may not be reported to the Program Manager, and the documentation of items such as *critical findings* may or may not be recorded. Local agencies are mandated to follow all NBIS required activities. This DOT also provides bridge advisories for State specific mandates. The only Federal mandate for reporting *critical findings* is reporting a structure in NBI condition state 2 "Critical condition" on the bridge safety inspection report. This DOT and local agency bridge owners do this.
- 1.6. The principal concern for this DOT is the responsibility for inspection, load rating, and management of locally-owned bridges without significant recourse avenues to enforce compliance. For local agency structures, once the *critical finding* is reported and the bridge closed or otherwise addressed, responsibility for the eventual repair or replacement of the structure rests wholly with the owner. This DOT is usually not informed of the disposition of the structure until review of Pontis data from subsequent inspections, up to 24 months from initial identification of the *critical finding*.
- 1.7. One of the major concerns is that it is difficult to follow-up or enforce repairs/closures on local agency owned bridges. While this DOT manages the inspection and makes recommendations for repairs/closures, it is up to the local agency to actually follow through with these recommendations.
- 1.8. For one DOT, local agency compliance with the NBIS may be effected by the level of federal aid funds available to them. Cities and Counties in this State receive a small portion of federal aid funds. This is due to a program where this DOT retains the majority of the federal funding and disburses State funds to the local agencies.
- 1.9. Coordination amongst the many local agencies and consultants is a continual

challenge for this DOT's Maintenance Bureau. Assisting local agencies with inspections/ratings/repairs, overseeing quality control, enforcing compliance, and maintaining open communication with such a large number local agencies is often a challenge.

- 1.10. This DOT currently inspects municipally-owned bridges, but has no jurisdiction over repair or follow-up actions. This DOT is only able to make recommendations to municipalities.
- 1.11. This DOT works with municipalities to find solutions to deficiencies whenever possible, but cannot require cities to act when municipally-owned bridges require repair.
- 1.12. The bridges owned by the US Forest Service and National Park Service are no longer contained in this DOT's Bridge Management System. Records were transferred over the course of two years, and at that time a majority of federal bridge records were out of date or missing information. There was always a problem of this DOT obtaining updated inspection information for these bridges. As a result of removing inspection records for federally-owned bridges from the dataset and the history of outdated inspection findings, this DOT is concerned about a potential void in the *critical findings* summary for bridges in this category.
- 1.13. This DOT cannot inspect privately owned bridges that carry public roads. This poses a potential gap in ensuring the safety of bridge structures.
- 1.14. The current procedure for addressing critical bridge findings contained in this DOT's guidelines for operation includes the initial requirements for adjustments to load postings and inspection cycles; however, there is no clear, written policy regarding the timeline for mitigation of deficiencies nor is there a clear procedure for reporting and verifying corrective actions have been taken.
- 1.15. When this DOT's Critical Recommendation Form is initiated, the effects of the critical condition can be mitigated; however, the source of the critical condition may remain unchanged. As an example, an isolated fascia beam may have localized severe deterioration at the beam end resulting in a Condition Rating of 3 or less, which would initiate a Critical Recommendation Form. Two methods of mitigation could be to place a temporary parapet to restrict traffic from traveling over the affected fascia beam, or timber blocking could be installed at the beam end to support the deck at that location. The critical condition would be mitigated with the traffic restriction; however, the severely deteriorated beam end remains, and for CF tracking purposes, the critical condition no longer exists.
- 1.16. This DOT has experienced considerable difficulty in maintaining barricades and signage on affected bridges. Vandalism and removal of bridge posting signs, rails, and other ancillary structures is problematic, results in considerable investment of limited resources, and presents a risk to the traveling public.
- 1.17. In rural areas, this DOT has experienced considerable difficulty in maintaining barricades on closed bridges. Examples include removed barricades, destroyed signage, and barrier removal. Currently, no published State standards exist for

barricading, though standards are now developed and will be included in the newest edition of the Bridge Inspection Program Manual. The most effective technique in the cases of timber deck bridges is partial or complete deck removal. There is intermittent resistance from risk management personnel to allow for temporary bridge reopening for emergency uses.

- 1.18. For this DOT, when *critical findings* are found or occur as a result of damage, not all incidents are documented fully. A common practice is to have the inspector fill out an RFA (Request for Action) form to document their finding and what needs to be done to analyze or repair the deficiency. This provides a paper trail of information about the *critical finding*, load analysis, and repair. The inspector will then follow-up on the RFA until the deficiency is repaired. However, this does not happen in all cases. For many of the incidents, the *critical finding* or damage is found and action is taken immediately to repair the problem. As a result, the documentation of the event becomes a lesser priority.
- 1.19. Scour issues are problematic for a large number of structures for this DOT. New development in rural areas has led to accelerated stream degradation leading both to lateral stream migration and bridge foundation undermining. The cost of repairs from high flow events can exceed discretionary budgets, leaving some structures closed—awaiting programmed funding.
- 1.20. There are serious security concerns with inspecting the bridges along the international border with Mexico. As the security situation deteriorates along the border, the physical safety of inspection personnel has become a concern. Consequently, only portions of the international bridges up to the Rio Grande's centerline are inspected at this time. If *critical findings* exist beyond this point, they are not identified or tracked. International bridges are inspected internally by this DOT's Bridge Division personnel. Prior to these personnel safety concerns, this DOT would conduct international border bridge inspections jointly with government officials from Mexico.
- 1.21. For this DOT, there are three in-house inspectors that cover six districts throughout the State. Each inspector, covering two districts, works alone for the majority of the assigned bridges. This results in a potential safety hazard in the event that an inspector is injured on site. While this DOT has restructured somewhat in the past to provide new positions, there is currently no funding available for additional inspectors.
- 1.22. In this State, the NBI condition states, as contained in the FHWA's Coding Guide, are a key criteria for characterizing maintenance recommendations including routine, urgent, critical, and significant maintenance recommendations. Based on the condition state assigned by an inspector during an inspection, the State will characterize the maintenance need accordingly. The current NBI rating system, which includes rating from 0 to 10, is a key part of this State's CF process. From a "program" perspective this is very helpful in that the State can differentiate between those maintenance recommendations in need of attention and those that can be deferred. The FHWA is being asked by Congress to re-evaluate its approach to managing the nation's bridge assets, and the approach being considered aligns closely with AASHTO's new element-level coding approach. A move by FHWA to the new AASHTO coding levels (4 condition states) would require a change to the State's *critical findings* process.