STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

JAMES H. TROGDON, III
SECRETARY

MEMORANDUM TO: Project Engineers
Project Team Leaders
Bridge Inspection Superintendent

FROM: Brian Hanks, P. E.
State Structures Engineer

DATE: December 29, 2010 (Rev. September 6, 2018)

SUBJECT: Procedures for Critical Findings, Priority Maintenance, and Routine Maintenance

The policy and established procedure to assure critical findings are addressed in a timely manner has been updated to provide consistency with FHWA's *Metrics for the Oversight of the National Bridge Inspection Program*. Specifically, Metric #21: Inspection procedures – Critical Findings criteria stipulates:

- A procedure is established to assure that critical findings, as defined in 23 Code of Federal Regulations (CFR) §650.305, are addressed in a timely manner.
- FHWA is periodically notified of the actions taken to resolve or monitor critical findings.

23 CFR §650.305 defines a critical finding (CF) as a structural or safety related deficiency that requires immediate follow-up inspection or action. A priority maintenance (PM) need is defined as a deficiency that may lead to load posting and or bridge closure if left unaddressed until the next routine inspection.

In order to maintain compliance with Metric #21, document, communicate and follow up on structural deficiencies as outlined below.

Field Inspection

Bridge inspectors identify critical findings and priority maintenance needs during routine or damage inspections as well as structural deficiencies that need immediate action. A Prompt Action request is submitted for any defect meeting the criteria for a critical finding or priority maintenance need via the WIGINS bridge inspection system. Prior to submitting inspection reports, inspectors review the report to ensure that all Prompt Action requests have been issued with sufficient documentation of the deficiency.

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Immediate Action Deficiencies

In cases where the deficiency requires immediate action, i.e. there is risk of local or global failure, imminent danger to the traveling public, or closure may be necessary, the Inspection Team Leader will contact the following personnel:

- Bridge Inspection Superintendent or Bridge Inspection Area Supervisor.
- Division Bridge Maintenance Engineer (DBME) – for State bridges.
- Municipal Contact – for municipal bridges.

Submit the Prompt Action request(s) prior to submitting the inspection report via WIGINS for review and approval by the Bridge Inspection Superintendent or Area Supervisor.

The Bridge Inspection Superintendent or the Area Supervisor will follow up and coordinate how to address the deficiency with the DBME and provide updates to the Bridge Inspection Program Manager, the Assistant State Structures Engineer, and the State Structures Engineer.

The Bridge Inspection Program Manager will notify the Structures Management Project Engineer responsible for the Division. The Project Engineer will coordinate load posting, if necessary, with the DBME and assist the Division in developing repair plans when requested.

Categorizing Prompt Action Requests

To categorize each deficiency, a Prompt Action request is submitted, via WIGINS, by the inspection Team Leader. The request is reviewed by a Structures Management Field Operations Engineer for priority assignment based on severity, effect on load carrying capacity, and safety.

Use the criteria listed in the Critical Finds and Priority Maintenance Needs section, the *AASHTO Manual for Bridge Element Inspection*, and sound engineering judgement to assign each Prompt Action request to one of the following categories:

- Critical Finding
- Priority Maintenance
- Routine Maintenance

For deficiencies assigned as critical findings, the Project Engineer will immediately notify the DBME and discuss any new information on the deficiency such as need for load posting or closure. Discuss how to address the critical finding with the DBME and offer assistance with engineered repairs. If necessary, provide an advance copy of the inspection report to the DBME and collaborate with the DBME in developing the repair plan and schedule. Note that the inspection Team Leader will also notify the DBME of severe deficiencies at the time of the inspection finding.

For deficiencies assigned as priority maintenance, via WIGINS, SMU Field Operations engineers will utilize the comment field to provide contact information for the SMU Project Team Leader in case division bridge maintenance personnel require assistance with engineered repairs. For defects that may reduce the bridge load rating, perform an evaluation of the defect's impact on the load rating. Collaborate with the Project Engineer to complete the evaluation and provide information on the anticipated effect on load rating to the DBME via WIGINS.

After Prompt Action requests are categorized and, if necessary, effect on load rating information is provided, an electronic notice of the CF or PM is made available, via WIGINS, to Division bridge maintenance personnel. The DMBE should use WIGINS to provide documentation (sketches, photos and descriptions) before, during and after the repair is completed. It is anticipated that priority maintenance repairs on bridges that are not programmed for replacement or preservation work will be completed by the Division within 12 months.

Critical Findings and Priority Maintenance Needs

Critical findings and priority maintenance needs include, but are not limited to, the list of common criteria provided below. The inspection team shall refer to this list to determine if a Prompt Action request is necessary. For deficiencies not listed, use the definition in conjunction with the *AASHTO Manual for Bridge Element Inspection* to determine if a Prompt Action request is warranted.

General Items

Critical Finding:

- Missing or illegible weight limit/load posting sign.
- Drastic/excessive movement (e.g. sliding or deflection) in a structural component that poses an imminent danger to the structure.
- Condition that poses a safety hazard to traffic/public (e.g. broken or loose joint armor or concrete, exposed deck reinforcing steel, etc.).

Priority Maintenance:

- Excessive amount of scour – since previous inspection or close to Scour Critical depth (based on plans) or Scour Plan of Action (PoA) trigger.
- Excessive settlement of the approach slab or approach roadway adjacent to the structure which affects transition on to the structure.
- Excessive erosion at the end bent that may affect bridge approach roadway.
- Missing regulatory or warning signs (e.g. delineators, narrow bridge, etc.)
- Condition that may result in a reduction in the load carrying capacity.

Timber:

Critical Finding:

- Damaged/Decayed deck boards – Holed-thru, broken in traffic areas, excessive with potential to breaking thru.
- Broken or severely decayed timber joists.
- Decayed or Mushroomed piles – Hollowed with less than 1½" shell remaining or with less than 6" of heartwood remaining.
- Mud sill or footing bearing loss/undermining – >30% scour of footing bearing area.
- Missing or broken rail posts, rail boards, blockouts or wheel rub rails.

Priority Maintenance:

- Crushed/broken out nailer boards.
- Extensively decay or/and crushing in caps, crown strips or sills.
- Loose, damaged or heavily decayed rail posts, rail boards, and blockouts.
- Loose or unattached deck boards.
- Deteriorated or missing asphalt wearing surface that is creating hazard to traffic.
- Split/decayed nailers.
- Decayed or unusual/excessive splits in timber joists.
- Decayed or unusual/excessive splits in caps and sills, but still intact and not subject to extensive crushing.
- Decayed/split piles but not in imminent danger of failure.
- Decayed or missing abutment bulkhead boards with loss of fill.
- Bearing loss/undermining due to scour on timber mud-sill footing (<30% footing bearing area).
- Excessive drift causing excess pressure/scour on bridge substructure.
- Bracing boards for piles missing or not functioning on bents ≥ 12' high.

Concrete:

Critical Finding:

- Holed-thru concrete deck subject to enlargement by traffic.
- Deck spalls below the top mat of reinforcing steel, creating a hazard to traffic, or in danger of holing through.
- Loose or spalling concrete in imminent danger of falling onto traffic that could cause extensive damage or injury.
- Spalled concrete cap at girder bearing area that poses an imminent safety concern.
- Spalled/cracked columns with rebar section loss and with column subject to failure.
- Bearing loss/undermining due to scour on concrete spread footing (> 30% footing bearing area)

Priority Maintenance Need:

- Spalls with exposed rebar in the top of a concrete deck.
- Spalled prestressed girder with exposed/deteriorating strands.
- Unsound patches with rust staining in prestressed concrete members.
- Spalled reinforced concrete girder with exposed/deteriorating main rebar with section loss and more than one bar affected at same location on girder.
- Spalled concrete cap at girder bearing area resulting in any loss of bearing area.
- Spalled cap with extensive spalls and areas of exposed rebar.
- Spalled/cracked columns with extensive spalls and areas of exposed rebar.
- Bearing loss/undermining due to scour on concrete spread footing (<30% bearing area).
- Crack widths exceeding or equal to 1/2".

Steel:

Critical Finding:

- Beams, girders, or piles with deteriorated areas that are likely to cause failure, or have failed in buckling, crippling, etc.
- Impact damage to steel members that is likely to cause failure, or have failed in buckling, crippling, etc.
- Unmitigated crack in a fracture critical member (FCM) or weld connecting a FCM.
- Any damage to a FCM that causes deformation of the member.

Priority Maintenance Need:

- Beams/girders/steel piles with active corrosion and 25% section loss.
- Secondary members (diaphragms, bracing, etc.) with 25% or more section loss.
- Bolted Field Splice: Missing bolts or active corrosion and 10% section loss.
- Active measurable section loss in the tension zone on FCM's
- Unmitigated crack in a secondary steel member.
- Cracked welds on steel grid deck.

Culverts / Pipes:

Critical Finding:

- Any defect that may cause immediate danger to the roadway or structural integrity of the culvert.
- Any item from Priority Maintenance list below that is excessive in scope.

Priority Maintenance Need:

- Visible distortion, settlement, or misalignment.
- Defect allowing loss of fill.
- Holes in corrugated metal pipe.
- Spall greater than 6" in diameter with exposed rebar.
- Roadway settlement or erosion of shoulder.
- Undermining of toe wall, spread footing, or wing wall. (>20% bearing area)
- Undermining exceeding 18" along the length of pipe culverts without headwalls.
- Scour depths greater than 4'.

Guardrail:

Critical Finding:

- Connection shoe projecting into traffic.

Priority Maintenance Need:

- Loose or missing connection shoe.
- Impacted approach guardrail or end terminal/treatment in close proximity to the bridge.

High-mast Lighting Towers:

Critical Finding:

- Sections split or buckled.
- Welds cracked at pole/base connection.
- Significant section loss or member buckling.

Priority Maintenance Need:

- Loose nuts.
- Broken/damaged anchor bolt.
- Occasional cracked weld.
- Pack rust between sections.

Sign Structures & Traffic Signal/Strain poles:

Critical Finding:

- Sections extensively damaged, split or buckled.
- Broken anchor bolts on backside of cantilevered signs and in foundations.

Priority Maintenance Need:

- More than 10% of shear studs are missing with no through bolts present (each panel).
- Sign panel connectors deteriorated/missing, allowing sign to "flop" in wind.
- Welds cracked at pole/base connection or member/member connections.
- Loose nut(s) on base plate or splice connections.
- Broken/damage anchor bolts.
- Damaged member.

Monitoring Critical Findings

The Structures Management Project Engineer is responsible for monitoring progress on critical finding repairs. Ensure the DBME has developed and documented a repair plan in WIGINS within ten (10) calendar days of the critical finding, provided an estimated date of repair completion, and described any actions taken to temporarily address the critical finding. Periodically follow up with the DBME to monitor progress on the repair plan and to facilitate reporting to FHWA.

Acceptable resolution of a critical finding includes permanent repair, temporary shoring, load posting, or bridge closure. If repairs cannot be made immediately, consider load posting the bridge in accordance with the load rating analysis. Within 45 days of the date of notification, ensure documentation of the final resolution is submitted by the DBME via WIGINS for review and approval by the Structures Management Project Engineer.

The Bridge Inspection Program Manager will provide the FHWA Division Bridge Engineer and the Assistant State Structures Engineer with a quarterly report on the status of critical findings.

Review and Approval of Repairs

Effective asset management and decision making is facilitated by quality and consistency in each of the supporting activities, such as inspection, maintenance, repair, preservation and rehabilitation. To this end, the Structures Management Project Engineer is responsible for review and approval of completed critical finding and priority maintenance repairs to assure quality and consistency.

Ensure the Division provides sufficient documentation on work that was performed. Documentation should include photographs and detailed descriptions of the following:

- The critical finding defect.
- Steps taken to complete the repair, such as the extent of removal of any deteriorated or damaged material and additional preparatory work done to the remaining section prior to performing the repair and application of the repair, such as welding procedures, material injection, etc.
- Repair materials used including any non-routine materials used such as special grout, chloride reducers, penetrating sealers, corrosion inhibitors, epoxy, etc.
- Miscellaneous requirements such as set up of special traffic control measures taken prior to demolition or access methods.
- QA/QC procedures or testing to ensure the robustness of the repair.
- Items that may require special inspection during future routine inspection.

Thoroughly review repair documentation provided by the Division via WIGINS to determine if the repair, is

- Consistent with standard repair details.
- Considered permanent or temporary.

If the repair is not consistent with standard repair details, provide feedback to the Division. Discuss and resolve any additional concerns with the DBME prior to approval and provide comments in WIGINS.

If the repair is deemed temporary to keep the bridge open, notify the Structure Inventory & Appraisal (SI&A) group to take the following actions:

- Item #103 – “Temporary Structure Designation” of the structure data should be coded “T”
- Add a “Temporarily Shored sheet” to the next inspection report.

If an increase in load rating is warranted upon approval of the repair, ensure a new load rating is performed, the bridge data is updated accordingly, and a record of the Critical Finding or Priority Maintenance is archived in the bridge file.

Routine Maintenance Needs

Routine maintenance needs are defined as minor to moderate deficiencies to primary or secondary bridge elements or non-structural upkeep such as debris removal, deck and drainage systems cleaning, and removal of vegetation.

Routine maintenance needs include, but are not limited to, the list provided below.

General Items:

- Cracked AWS not causing traffic hazard.
- Leaking or damaged expansion joints.
- Clogged deck drains.
- Loose fasteners, but still functioning as intended.
- Debris on bridge deck or cap/bridge seats.
- Drift not causing excess substructure pressure/scour.
- Excess vegetation around bridge area.
- Masonry members out of alignment or with unsound patching.
- Restriction of movement for bearings.
- Minor settlement.
- Minor scour.

Timber:

- Decayed/missing bulkhead boards with no loss of fill.
- Decayed timber wing-wall system not causing loss of fill or overturning.

Concrete:

- Exposed coarse aggregate due to abrasion in concrete deck.
- Cracking/unsound patches/delamination/minor spalls in concrete members.
- Exposed rebar in concrete members without measurable section loss.
- Loose coarse aggregate due to abrasion in concrete members.

Steel:

- Failed paint system on steel members.
- Gouges in steel flanges that do not warrant a Priority Maintenance or Critical Find. (These may prompt a call to the DBME).

Guardrail:

- Failed handrail paint system.
- Decayed or damaged wheel guard not presenting danger to vehicles.

The majority of routine maintenance needs are captured by the proper identification of defects and condition states during a routine element level inspection. Routine maintenance needs that do not correspond to bridge elements are to be identified through the scoring of NC SMU Inspection Items found on the National Bridge and NC Inspection Items sheet of the routine inspection report.

This revised policy is effective immediately and it supersedes the memorandum titled *Critical Findings Guidance*, dated December 29, 2010. The *Inspection Manual* will be updated at a later date.

BCH/DCM/DNS/ksl

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