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TO: Region Engineers
Region Construction
Region Bridge Engineers

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SUBJECT: Authority for Bridge Closures

This memo serves to establish the technical basis for the closure of bridges to traffic, or the closure of roadways below bridges to traffic. In general, the provisions below cover all bridges in Michigan, whether in-service, closed, or under construction.

Information regarding responsibilities and procedures for bridge closures during the National Bridge Inspection Standards (NBIS) inspection process, scour determinations, or other operational aspects of in-service bridges can be found in the Michigan Department of Transportation (MDOT) Structure Inspection Manual (MiSIM), Chapter 10.

Bridge construction activities are often complex, requiring specific erection procedures and analyses for complex bridges, and careful thought on element erection, material and equipment placement, and sequencing of work activities.

As part of the National Transportation Safety Board (NTSB) investigation and final report of the Florida International University Pedestrian Bridge Collapse (NTSB HR1902), the NTSB made several recommendations to bridge owner agencies, one of which is outlined below:

- **TO THE FLORIDA DEPARTMENT OF TRANSPORTATION:** Revise local agency program agreements to specify that when structural cracks are initially detected during bridge construction, the engineer of record, construction engineering inspector, design-build firm, or local agency that owns or is responsible for the bridge construction must immediately close the bridge to construction personnel and close the road underneath; fully support the entire bridge weight using construction techniques that do not require placing workers on or directly under the bridge during installation; and restrict all pedestrian, vehicular, and construction traffic on the bridge until the complete support is in place and inspected.

Although addressed specifically to the Florida Department of Transportation, this recommendation is to be implemented by MDOT on state-owned bridges during the construction phase to formalize and align various efforts in the continuous improvement of public life safety relative to bridges in the state.

Supporting Regulatory and Specification Requirements:

The applicable federal regulatory language relative to construction of bridges is found in the Code of Federal Regulations (CFR).

23 CFR part 635.105 addresses the Supervising Agency for maintenance and construction projects:

- (a) The State Transportation Department (STD) has responsibility for the construction of all Federal-aid projects, and is not relieved of such responsibility by authorizing performance of the work by a local public agency or other Federal agency. The STD shall be responsible for insuring that such projects receive adequate supervision and inspection to insure that projects are completed in conformance with approved plans and specifications.
- (b) Although the STD may employ a consultant to provide construction engineering services, such as inspection or survey work on a project, the STD shall provide a full-time employed State engineer to be in responsible charge of the project.
- (c) When a project is located on a street or highway over which the STD does not have legal jurisdiction, or when special conditions warrant, the STD, while not relieved of overall project responsibility, may arrange for the local public agency having jurisdiction over such street or highway to perform the work with its own forces or by contract; provided the following conditions are met and the Division Administrator approves the arrangements in advance.
 - (1) In the case of force account work, there is full compliance with subpart B of this part.
 - (2) When the work is to be performed under a contract awarded by a local public agency, all Federal requirements including those prescribed in this subpart shall be met.
 - (3) The local public agency is adequately staffed and suitably equipped to undertake and satisfactorily complete the work; and
 - 4) In those instances where a local public agency elects to use consultants for construction engineering services, the local public agency shall provide a full-time employee of the agency to be in responsible charge of the project.

23 CFR part 635.108 addresses health and safety:

Contracts for projects shall include provisions designed:

- (a) To ensure full compliance with all applicable Federal, State, and local laws governing safety, health and sanitation; and
- (b) To require that the contractor shall provide all safeguards, safety devices, and protective equipment and shall take any other actions reasonably necessary to protect the life and health of persons working at the site of the project and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

23 CFR part 650.307 addresses Bridge Inspection Organization and Inventory:

- (a) Each State transportation department must inspect, or cause to be inspected, all highway bridges located on public roads that are fully or partially located within the State's boundaries, except for bridges that are owned by Federal agencies.
- (b) Federal agencies must inspect, or cause to be inspected, all highway bridges located on public roads that are fully or partially located within the respective agency responsibility or jurisdiction.
- (c) Each State transportation department or Federal agency must include a bridge inspection organization that is responsible for the following:
 - (1) Statewide or Federal agencywide bridge inspection policies and procedures, quality assurance and quality control, and preparation and maintenance of a bridge inventory.
 - (2) Bridge inspections, reports, load ratings and other requirements of these standards.
- (d) Functions identified in paragraphs (c)(1) and (2) of this section may be delegated, but such delegation does not relieve the State transportation department or Federal agency of any of its responsibilities under this subpart.
- (e) The State transportation department or Federal agency bridge inspection organization must have a program manager with the qualifications defined in 650.309(a), who has been delegated responsibility for paragraphs (c)(1) and (2) of this section.

1951 Public Act 51 addresses State Trunkline Highway System; construction, maintenance, improvement; control of state highway commissioner; change in line of road:

“All state trunk line highways now or hereafter established as provided by law, shall be constructed, maintained and improved in accordance with the provisions of this act under the direction, supervision and control of the state highway commissioner. The commissioner shall make surveys and proper plans and specifications and take charge of the construction and maintenance of the state trunk line highways. For the purpose of securing a more direct and favorable location, minor changes in the line of any road may be made when, in the judgment of the state highway commissioner, the changes make for the safety of public travel.” MCL 247.651a.

The logistics of closing bridges currently under construction is addressed in the MDOT Standard Specifications for Construction, section 103.02.D, which describes the Suspension of Work Ordered by the Engineer.

MDOT Standard Specifications for Construction, section 104.01 generally describes the Authority of the Engineer. More specifically, section 104.01.B describes the Authority of the Engineer to Suspend Work during construction.

The Michigan Occupational Safety and Health Act (MIOSHA) Act 154 of 1974, section 408.1009 addresses employee safety:

“The safety, health, and general welfare of employees are primary public concerns. The legislature hereby declares that all employees shall be provided safe and healthful work environments free of recognized hazards.”

The Occupational Safety and Health Administration (OSHA) regulation for Workers' Right to Refuse Dangerous Work also addresses employee safety:

Your right to refuse to do a task is protected if all the following conditions are met:

- Where possible, you have asked the employer to eliminate the danger, and the employer failed to do so; and
- You refused to work in "good faith." This means that you must genuinely believe that an imminent danger exists; and
- A reasonable person would agree that there is a real danger of death or serious injury; and
- There is not enough time, due to the urgency of the hazard, to get it corrected through regular enforcement channels, such as requesting an OSHA inspection.

Determination of Unsafe Condition:

Should issues arise during bridge construction activities, all personnel on site shall ensure safety and notify The Engineer, or the Contractor's Safety Supervisor.

After initial assessment, closure actions may be initiated by:

- The Engineer/Construction Administrator
- The Design Engineer of Record (EOR)
- The Contractor's Safety Supervisor, or Site Superintendent
- The Bridge Owner

During construction operations, should an unsafe structural condition to either the immediate work site and/or the traveling public develop, the personnel noted above must take immediate action to close, remove traffic, and make the site safe. These unsafe conditions may include, but are not limited to the following conditions related to construction loads, and/or other load effects on structural elements:

- Cracking of concrete elements:
 - The American Concrete Institute (ACI) 224R-01 indicates 0.016 inches as a reasonable crack width for reinforced concrete elements under load
 - Non-shrinkage types of cracks greater than 0.016 inches should be marked, and regularly checked for crack propagation
 - Cracks of any width on pre-tensioned concrete elements
 - Flexural, shear, or torsional cracks, or multiple crack types connecting, and propagating through interface areas, i.e. flange to web, etc.
- Cracking of welds or base metal on welded connections, or deviations of bolted connections of steel elements from engineered drawings
- Cracking, yielding or buckling of steel elements
- Excessive elongation of post-tensioning rods and tendons
- Signs of instability of bridge temporary works such as scaffolding, forms, work platforms, fascia jacks, temporary supports, shoring towers, cranes, etc.
- Signs of instability of cofferdams, tremie pours, and other temporary earth retaining structures and internal bracing
- Signs of instability of earth slopes or trench areas
- Unexpected settlement, displacement or distortion of any structural elements
- Excessive deformation of the structure
- Insufficient bracing of structural elements during staged construction, especially for heavily skewed and curved structures
- Excessive heave or settlement of approach slabs

Bridge Closure Procedure during Construction:

Upon notice of any single, or combination of elements that represent an unsafe condition, and after brief consultation with qualified personnel with structural expertise, or with the EOR if time allows, site personnel should immediately:

- i. Close the roadway, whether over or under structural elements in question, or adjacent to temporary earth retaining structures, or slopes in question. This can be achieved with vehicles, traffic control devices, and other methods for initial closure
- ii. Immediately evacuate the bridge construction operations area
- iii. Contact local law enforcement for assistance in setting up permanent closure and detour
- iv. Use appropriate traffic control devices to safely detour after immediate closure, and evacuation of construction operations area
- v. Restrict access to the structural elements in question
- vi. Immediately provide bracing or temporary shoring for elements noted to be unstable

These actions must be taken in a fastidious, and expedited manner, and in accordance with the MDOT Work Zone Safety and Mobility Manual, section 1.03.03, Emergency Maintenance.

Evaluation and Mitigation Procedure:

Once the site is deemed safe, and access is appropriately restricted, it is critical the decision-making process is not solely based on what is economically feasible, or least impactful to the motoring public. The appropriate technical evaluation and analysis is to be conducted as follows, considering the recommended timeframes:

| Decision/Escalation Action | Recommended Timeframe |
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| 1. The Engineer will notify the MDOT Chief Bridge Engineer, or the MDOT Deputy Chief Bridge Engineer, who will in turn notify the Federal Highway Administration, and other Agency Executives as appropriate. | Within 24 hours of decision to close |
| 2. The EOR must be engaged to evaluate and apportion causation. <ul style="list-style-type: none"> • Evaluation to determine if false positive. | EOR to be engaged as soon as issue is identified in the field, but no more than 24 hours |

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| <p>3. The EOR must present findings, evaluation methodology, likely causes, and make recommendations for mitigation based on having the specialized knowledge and experience with similar issues based on Good Industry Practice.</p> <ul style="list-style-type: none"> • For complex bridges, the evaluation, analysis, and recommendations from the EOR must be reviewed and verified by a qualified independent technical expert. | <p>Timeframes vary based on complexity of issue</p> |
| <p>4. A multi-disciplinary team including the EOR, the MDOT Chief Bridge Engineer, and/or the MDOT Deputy Chief Bridge Engineer, the Engineer, and other qualified personnel with complex bridge, structural, geotechnical and hydraulics expertise will be formed as necessary to conduct an evaluation of the current site situation, evaluate the findings, and consider recommendations for mitigation.</p> | <p>The multi-disciplinary team to be mobilized, and consider EOR evaluation, and recommendations prior to re-opening actions.</p> |
| <p>5. Once the appropriate mitigation is agreed upon, the EOR will provide stamped and sealed plans, specifications, and calculations for the replacement elements/repair procedures.</p> <ul style="list-style-type: none"> • Should deficient elements be strengthened or retrofitted in place, a load rating of the structural elements in accordance with the NBIS shall be conducted to ensure the impacted structural elements obtain rating factors greater than 1.0 for all Michigan legal loads. | <p>Timelines to be established by the multi-disciplinary team</p> |
| <p>6. The Engineer staff will direct the Contractor to rectify any deficiencies that affect the impacted structural elements, which may include, but is not limited to the following:</p> <ul style="list-style-type: none"> • Removal and replacement of the deficient structural element(s) | <p>Within the critical path timeframes as appropriate for the individual items of work.</p> |

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| <ul style="list-style-type: none">• Strengthening or retrofitting of the deficient structural element(s)• Installation of temporary shoring, or structural supports to allow for safe removal of the deficient structural element(s)• Flattening or stepping of cut slopes• Addition of lightweight fills or ground improvements• Additional surficial and/or underground water control measures• Placement of additional structural bracing for temporary earth retaining structures• Conducting destructive and non-destructive testing of the deficient structural element(s), if appropriate to determine or verify material properties | |
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Opening the Roadway and Documentation Procedure:

Once the Contractor addresses the deficiencies, the multi-disciplinary team will review all appropriate documentation, and perform a site review to determine structural adequacy and safety. Upon completion of this, and there is consensus amongst the multi-disciplinary team that the structural deficiencies have been addressed, the Engineer will direct the Contractor to begin removal of the closure and detour maintenance of traffic items, and re-open the roadway, bridge, etc.

All appropriate documentation of the incident, evaluation, and mitigation shall be retained in the construction project file, and bridge project file for future use.

Policy Implementation and Contract Implications:

The procedures noted in this memo will be published in the MDOT Construction Manual, and MDOT Bridge Design Manual.

Considering the various modern project delivery methods, it is recommended that the procedures as noted in this document be written into Design/Build books, or P3 contract documents to ensure the appropriate performance requirements for structural elements.

For all contracts, for project delays caused by this policy shall be addressed in accordance with the MDOT Standards Specifications for Construction, section 103.02.D Suspension of Work Ordered by the Engineer.

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