Michigan Department of Transportation

BRIDGE ADVISORY
Construction &Technology Division
Bridge Operations Section

BRIDGE ADVISORY NUMBER: BA-2008-05 **DATE**: September, 9, 2008

SUBJECT: Plan of Action Report for Scour Critical Bridges in the Michigan Bridge Inspection System (MBIS)

ISSUED BY: MDOT Bridge Operations Engineer

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Effective August 26, 2008, a special inspection report called "Scour Action Plan" was added to the Michigan Bridge Inspection System (MBIS). All bridge owners are asked to fill out this report for all of their bridges that are rated scour critical (Federal Structural Inventory and Appraisal Item 113 = 0 to 3). The report is also available for bridges over rivers and streams having unknown foundations, and bridges that have scour counter measures installed (Federal Structural Inventory and Appraisal Item 113 = 7).

Attached are instructions for filling out the form. These instructions will also be placed on the Michigan Department of Transportation's Bridge Operations website.

Attachment: INSTRUCTIONS FOR COMPLETING THE MICHIGAN DEPARTMENT OF TRANSPORTATION SCOUR CRITICAL BRIDGE – ACTION PLAN FORM

INSTRUCTIONS FOR COMPLETING THE MICHIGAN DEPARTMENT OF TRANSPORTATION SCOUR CRITICAL BRIDGE – ACTION PLAN FORM

As per the FHWA's National Bridge Inspection Standards (NBIS), Subsection 650.313.e.3 says, "Bridges that are scour critical, prepare a plan of action to monitor known and potential deficiencies and to address critical findings. Monitor bridges that are scour critical in accordance with the plan." Bridges are identified as being scour critical in the FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges, Report No. FHWA-PD-96-001. Action plans must be filled out when Item 113 is coded U (unknown foundation), 3 or below, or when Item 113 is coded 7 and the countermeasures are of the type that require periodic monitoring.

Form Header

All information, except Watershed, is automatically filled out from the bridge database, and these fields can not be modified in this form.

Watershed – Fill out the name of the major Michigan watershed that the bridge is part of. A map of Michigan's major watersheds is provided by the Department of Natural Resources (DNR), Land and Water Management Division. It can be viewed and downloaded from the following website:

http://www.dnr.state.mi.us/spatialdatalibrary/PDF_Maps/Watersheds/Major_Watersheds_24k.pdf

Section 1 – Scour Vulnerability Rating

Abutment A – Foundation, Abutment B – Foundation - Check boxes are provided for "In Water, Spread Footing, Piles (deep foundation), and Unknown". Multiple boxes can be checked. "In Water" should be checked when the abutment is in the water during the 100 year flood. MDOT's hydraulics unit, or the engineer who did a Level I or II scour analysis will be able to provide this information. If the foundation bears on spread footings or another type of shallow foundation, "Spread Footing" should be selected. If the foundation bears on piles or another type of deep foundation, "Piles (deep foundation)" should be selected. Since most deep foundation are not scour critical, it is likely one of the structure's other foundations has made the bridge scour critical or it has been predetermined that the piles are not of adequate length to support the structure during the 100 year flood. If the structure's foundation is not known because plans are not available, "Unknown" should be selected.

Abutment A – Foundation Soil Type, Abutment B – Foundation soil Type - Check boxes are provided for "Non Cohesive, Cohesive, Rock, and Unknown". Multiple boxes can be checked. Check all that apply for each of the bridge's substructure units.

Total Number of Piers – The total number of piers is automatically input from the bridge database, and this field can not be modified in this form. Comments – For structures having multiple piers, and multiple types of foundations; i.e. – piles and spread footing, check both boxes and indicate foundation type details in the comments. The comments field should also be used to provide any other needed information regarding the abutment and pier foundations.

Piers in water for 100 year event (by footing type) - Enter the number of piers in the water during the 100 year flood, organized by foundation type; i.e. - Spread Footing, Piles (Deep Foundation),

and Unknown. MDOT's hydraulics unit, or the engineer who did a Level I or II scour analysis will be able to provide this information.

Pier Foundation Soil Types – Check boxes are provided for "Non Cohesive, Cohesive, Rock, and Unknown". Multiple boxes can be checked. Check all that apply for each of the bridge's substructure units. The comment field, above, can be used to describe in more detail.

Observed Scour - If scour is observed outside of the routine bridge inspection, such as during preparation of the Scour Critical Bridge – Action Plan, provide the date and describe the scour. This information should be passed on to the bridge inspector so an overall rating of the bridge or channel can be updated if necessary. Click on Show Comments History to see all previous comments regarding observed comments and the dates they were made.

Scour Evaluation Report, Executive Summary – Comments and summary for the Level I or II scour analysis should be provided here. MDOT's hydraulics unit, or the engineer who did a Level I or II scour analysis will be able to provide this information. This field should list the reasons why the bridge has been rated scour critical for Item 113. (Note: For MDOT bridges, this field can only be filled out by the hydraulics unit)

Evaluating Scour at Bridges FHWA–NHI–01– 001 (HEC–18) presents the state of knowledge and practice for the design, evaluation and inspection of bridges for scour. This document is available through the National Technical Information Service, Springfield, VA 22161. HEC-18 can be downloaded from the following web site;

http://www.fhwa.dot.gov/engineering/hydraulics/library_arc.cfm?pub_number=17&id=37

Anticipated Surface Elevation (ft.) – For the 25, 50 year, and 100 year flood events, provide the "Anticipated (water) Surface Elevation". MDOT's hydraulics unit or the engineer who did a Level II scour analysis will be able to provide this information. Water surface elevation during a flood event can be compared to the listed events in order to measure or compare the intensity of the current event.

Distance Below Bottom Chord (ft.) – During a flood event, it would be difficult for the person monitoring the bridge to relate water surface elevation to the survey datum used in "Anticipated Surface Elevation," therefore, as a point of reference, distance from the superstructure's (beam's) bottom chord are provided. Most often this only needs to be recorded to the nearest foot. If the beams are very high in relation to the water surface, thus making the distance to the superstructures bottom chord ineffective as a reference, indicate the reference point that inspector should use in the comments. If the superstructure is an arch, indicate the "Distance below Bottom Chord" at the top of the arch.

Anticipated Flow (cubic ft/sec) – For the 10, 50 year, and 100 year events, provide the Anticipated (estimated or calculated) Flow (cubic feet per second). MDOT's hydraulics unit or the engineer who did a Level II scour analysis will be able to provide this information. Discharge (flow) during an event can be compared to the listed events in order to measure or compare the intensity of the current event.

Section 2 – Bridge Inspection Coding Information

The information provided in this section is automatically input from the bridge database, and it is information from other Bridge Inspection Reports that could be useful to the person filling out the action plan form and to inspectors during a flood event. These fields can not be modified in this report.

Section 3 – Countermeasure Condition and Recommendation

Guidance on the selection and design of scour countermeasures may be found in FHWA Hydraulic Engineering Circular No. 23, *Bridge Scour and Stream Instability Countermeasures,* Second Edition, 2001. To facilitate the selection of alternative scour countermeasures, a matrix describing the various countermeasures and their attributes is presented in this circular. A link to this document is provided below:

http://isddc.dot.gov/OLPFiles/FHWA/010592.pdf

Existing Countermeasures - Describe the type of counter measures that have been placed at this bridge and describe their condition. If the countermeasures are designed to withstand the 100 year flood event, Item 113 may be recoded to 7, "Countermeasures have been installed to correct a previously existing problem with scour. Bridge is no longer scour critical." Some scour countermeasures, such as rip-rap may need to be monitored periodically (often with the routine bridge inspection) to assure that the counter measures remain in good condition and are still effective. Notify the bridge inspector if the condition of the scour countermeasures is different from what is shown in the Bridge Inspection Reports; (For example, there is rip rap, but the Pontis Rip Rap Smart Flag does not show the condition state.)

Inspector Recommendations - Provide recommendations if scour countermeasures should be placed, and indicate priority (high, medium, or low). If it is known that scour countermeasures are not feasible for this bridge, check the box. If counter measures are already in place, and need attention, describe work needed in the comment field.

Section 4 – Monitoring Plan

Routine Inspection Frequency, Underwater Inspection Frequency (months) - Routine inspection and underwater inspection frequency is automatically input from the bridge database and it is provided for information. If a scour condition or scour counter measures require inspection at a greater frequency, the routine bridge inspector should be contacted. List the recommended frequency in the "Items to Watch:" text field.

Cross Section Elevations, Date Last Taken, and Frequency in Months - Provide the date when stream bottom cross sections were last taken upstream and down stream of the structure and indicate the recommended frequency when cross section should be taken. The cross sections need to be included in the bridge file.

Items to Watch – Provide recommendations on any items to watch, such as scour holes, stream degradation, debris accumulation, substructure settlement or tilt, or any other signs of possible distress to the structure resulting from scour.

Fixed Monitoring Device, Type of Instrumentation, Installation Location(s) - If a fixed monitoring device has been placed on the structure, indicate the type and location.

Agency Responsible for Monitoring During High Flow - List the agency that is responsible for monitoring the bridge during a flood event. This is not limited to monitoring of a fixed monitoring device. It includes monitoring the bridge during flood events.

Responsible Agency Location, Work Number, and Cell Number - List the work location, work phone number, and cell phone number of the person or agency responsible for monitoring the bridge during a flood event.

Flood Monitoring Resources: Links to the National Oceanic and Atmospheric Administration's (NOAA) and the United States Geological Survey (USGS) websites are provided. These sites can be used to determine gauge height (water surface elevation), and discharge (stream flow) of specific rivers or streams. Knowing the water shed, and location of your scour critical bridges, this information can be used to determine when more involved monitoring may be needed.

Section 5 – Bridge Closure - The bridge inspector or engineer performing the inspection must exercise sound engineering judgment for the continued use of a structure during the flood event and advise the bridge owner accordingly. They should document their observations (preferably with pictures) and state the limitations caused by the conditions at the time of the inspection and affecting their judgment. If, in the judgment of the inspector, action must be taken to close the bridge or limit traffic on portions of the bridge, the inspector is obligated to contact the bridge owner and verbally convey these concerns. If immediate communication with the bridge owner is not possible, the inspector must contact local law enforcement and divert traffic from the structure. The bridge owner should have a predetermined emergency response/incident management plan that will be activated in the event that a bridge must be closed.

Conditions to Evaluate for Bridge Closure, Other: General conditions have been listed that could indicate the need to close a bridge. Additional conditions specific to the bridge can also be listed by selecting "Other." When "Other" is selected, you will be able to describe the condition in the accompanying text box. Contact People for Bridge Closure. The name, phone number, and title of contact people for bridge closure can be selected from a global list of people for the particular agency. New contact people can be added by selecting the "Add New Contact" button. The Michigan State Police shall be notified of all bridge closures. The Michigan State Police emergency contact phone number is 517-241-800 (Fax 517-241-6815). The Michigan State Police will contact MDOT's Safety and Security Administration Office, who will notify the Federal Highway Administration Division Office when the bridge is on the National Highway System or other significant route. Contact for Re-Opening After Inspection: The name and phone number of the responsible person having the authority to reopen the bridge should be listed here. The bridge should not be reopened until the flood waters have receded enough for the bridge to be inspected by a qualified bridge inspector for displacement or damage. It is important to check the structure for misalignment or damage to members after the flood. The level of inspection detail will vary

depending on the intensity of the flood event and the damage sustained to the structure. The qualified bridge inspector should report any damage to the structure on an updated Bridge Safety Inspection Report (BSIR) and place a copy in the bridge file. The Michigan State Police shall be notified when a bridge is reopened. The Michigan State Police emergency contact phone number is 517-241-800 (fax 517-241-6815). The Michigan State Police will contact MDOT's Safety and Security Administration Office, who will notify the Federal highway Administration Division Office when the bridge is on the National Highway System or other significant route.

Section 6 – Detour Route Possible Detour Route - Describe the detour route to be used in case the bridge needs to the closed.

Bridge/Culverts on Detour Route: List the bridges and culverts on the detour route that may also be susceptible to scour and possible closure during the same flood event. If a tentative detour route has bridges in the same flood plain or on the same river or stream that are also scour susceptible, the route may not be suitable as a detour for this bridge. The form can show bridges within a 10 mile radius and these bridges can be selected to be shown as bridges on the detour route. Detour Structure Number, Feature Intersected/ Water Way, Load Limitations, and Scour Rating are shown for each selected bridge.

Section 7 – Documentation of High Flow Event - The purpose of this section is to provide a location for the bridge inspector to document the conditions at the bridge during a flood event. In the case where it is not prudent to directly measure scour with the usual means, the inspector/engineer should record the conditions that can be safely observed or measured at the time.

New High Flow Event - This box is selected to allow a new flood event to be record.

Date Monitored and Time Monitored - List the date and time the bridge was monitored. For some flood events, the bridge may be monitored several times a day and this form allows the inspector to record conditions during each monitoring session.

Storm Duration -For storm events, if available, indicate in hours from the beginning of rainfall.

Estimated Total Rainfall - If available, indicate the total rainfall during a flood event. This information may be useful to the bridge inspector during a future flood event as a comparison.
Estimated USGS Flow Discharge - If available, indicate the USGS flow discharge from nearby gauges or from the USGS website. This information may be useful to the bridge inspector during a future flood event. The inspector should be aware that the time of peak flow usually does not correspond directly to the time of peak rain. Peak flow may occur several days after a rain storm has passed. Peak flow can also result from run-off created by spring snow melt.

High Water Distance From Bottom Chord - List the distance from bottom chord to the high water level during the flood event. This should be compared to the distance below bottom chord values shown for the 25 year, 50 year, and 100 year events, and this information is useful when determining if the bridge should be closed and it will be useful to the bridge inspector during a future flood event. If the high water is above the bottom chord (the structure is experiencing

pressure flow), enter the approximate distance that the water is above the bottom chord as a negative number, and indicate that the structure is experiencing pressure flow in the comments.

Whirlpools Observed - During a flood event, indicate if whirlpools are observed and indicate location. This information is useful when determining if the bridge should be closed and it will be useful to the bridge inspector during a future flood event.

Debris Accumulation - During a flood event, indicate if debris accumulated at the bridge. This information will be useful to the bridge inspector during a future flood event.

Action Taken/Closure and Comments - Describe the action taken and indicate in the following comment field the reasons for the action. The inspector should document their observations (preferably with pictures placed in the bridge file) and state the limitations caused by the conditions at the time of the inspection and affecting their judgment.