



**BRIDGE ADVISORY**  
**Construction & Technology Division**  
**Bridge Operations Section**

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**BRIDGE ADVISORY NUMBER:** BA-2008-06

**DATE:** December 12, 2008

**SUBJECT:** Evaluating Culverts for Scour

**ISSUED BY:** MDOT Bridge Operations Engineer

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The Bridge Inspectors Reference Manual<sup>1</sup> defines a culvert as, “a structure designed hydraulically to take advantage of submergence to increase water carrying capacity. Culverts, as distinguished from bridges, are usually covered with embankment and are composed of structural material around the entire perimeter, although some are supported on spread footings with the streambed serving as the bottom of the culvert.”

When a highway culvert or bridge is greater than or equal to 20 feet long as measured along the centerline of roadway, it is considered National Bridge Inventory (NBI) length. This includes multiple side-by-side culverts. These structures are subject to the scour evaluation and plan of action requirements discussed in MDOT Bridge Advisory BA-2008-04.

A culvert that does not have a structural bottom is called a bottomless culvert, and if it is founded on spread footings placed on erodible soil, it may be susceptible to scour like a bridge structure and requires the same scour evaluation as a bridge.

The second edition of the Hydraulic Evaluation Circular (HEC) 18 Manual<sup>2</sup> shows an example *Structure Scour Evaluation Plan for Existing Structures*. Wording has been taken from this plan to provide the following guidance to help evaluate culvert type structures having structural bottoms as follows:

Culverts having structural bottoms typically are not as likely to result in sudden instability or catastrophic failure like a bridge type structure, therefore, unless scour conditions are observed as described below, culverts and pipes having structural bottoms can be classified as non-scour critical structures (coded “8” on Structural Inventory and Appraisal Item 113) and they do not require Level 2 evaluation.

Scour can occur at the upstream or downstream end of a culvert as water rapidly flows and is constricted into the culvert’s inlet or as it exits and sometimes falls out of the outlet. Piping<sup>3</sup> is defined as “removal of soil material through subsurface flow of seepage water that develops channels or "pipes" within the soil bank. During flood events, piping can occur adjacent to the outside surface of a culvert and cause instability of the embankment material adjacent to and above the culvert. If during a field inspection, a culvert shows evidence of loss of soil material from the upstream or downstream end of the culvert, or if there is settlement of the roadway above the

culvert that could cause instability of the culvert or the roadway above, Item 113 of the Structural Inventory and Appraisal form should be coded 0 through 3 as appropriate, and an action plan should be developed for the structure.

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<sup>1</sup> Page 165, Bridge Inspector's Reference Manual, Publication No. FHWA NHI 03-001, October, 2002, Revised December, 2006

<sup>2</sup> Page 166, Evaluating Scour at Bridges, Hydraulic Engineering Circular, Second Edition, February, 1993. (at the time of issue of this bridge advisory, this document is available on the internet at the following link: <http://www.fhwa.dot.gov/engineering/hydraulics/pubs/hec/hec18ed2.pdf>)

<sup>3</sup> Page 34, Bridge Inspector's Reference Manual.