

**OFFICE OF STRUCTURES
STRUCTURE HYDROLOGY AND HYDRAULICS DIVISION**

CHAPTER 11 APPENDIX G

**STREAM MORPHOLOGY STUDIES
FOR STRUCTURE CROSSINGS ON SECONDARY
(STATE/COUNTY) HIGHWAY SYSTEMS**



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HIGHWAY SYSTEMS

The Office of Structures continues to refine the project development process to assure that all significant aspects of hydrologic and hydraulic design are addressed. The reader is referred to the discussion in Chapters 3 and its Appendix (Policy) and Chapter 5 (Project Development) for an overview of the details involved in accomplishing these work tasks. The task of interest here concerns stream morphology.

In the conduct of a stream morphology assessment/study for a proposed bridge project, an understanding of the behavior and characteristics of the stream being crossed is needed in order to answer the following questions:

1. Will the proposed structure have an adverse impact on the morphology of the stream
2. Will the live bed or the clear-water scour mode occur at the structure for design conditions?
3. What is the potential for and anticipated depth of long-term channel degradation?
4. What is the potential for and extent of channel movement at the structure under consideration?

For proposed structures on secondary road systems, especially replacement or reconstruction projects on approximately the same alignment, consideration of stream morphology may not always be a significant issue. The Office of Structures suggests the following two alternative approaches for addressing questions about (1) the effect of the structure on the stream and its flood plain and (2) potential long-term changes to a stream on the stability of the structure:

A. IN-HOUSE STUDIES

A bridge owner may wish to evaluate these stream morphology questions using the in-house technical staff, particularly if they have had some training and experience in evaluating the behavior and characteristics of streams. We offer the following considerations for the conduct of such studies:

1. Will the proposed structure have an adverse impact on the morphology of the stream?

Guidance on answering this question is included in Chapter 14 – See rapid visual assessment.

Staff personnel may be able to conduct a preliminary study of a crossing site (described as a rapid visual assessment) in a one-day field trip. This study can serve the bridge owner in making a decision about the significance of stream morphology concerns in regard to the stability of the structure being evaluated and the potential impacts to the stream.

2. Will the live bed or the clear-water scour mode occur at the structure for design conditions? *Using the ABSCOUR program, evaluate scour for both live bed and clear water conditions, and select the more conservative values*
3. What is the potential for and anticipated depth of long-term channel degradation? *Use the guidance in the References listed below, particularly References A and B, to estimate long-term bed degradation at the structure. References A and B report on field studies conducted in the Blue Ridge and Western Piedmont Provinces to measure long term degradation. Reference B also provides a method that can be used to estimate long-term bed degradation at a structure. Additional guidance on long-term channel degradation will be available in the near future. In Phase 3, the Office of Structures has extended the sampling into urban regions (including impervious ground cover greater than 10%) of the Upland Section of the Piedmont Plateau Province in the following counties: Montgomery, Prince Georges, Baltimore, and Howard Counties. This study should be available by the end of FY 2015. In Phase 4, the long-term degradation study will be continued in Maryland streams in the Western Shore Coastal Plain in both urban and rural watersheds. In this project phase, we propose to extend the sampling into the Western Coastal Plain Province in the following counties: Prince Georges, Anne Arundel, Baltimore, Calvert, St. Mary's and Baltimore City.*
4. What is the potential for and extent of channel movement at the structure under consideration?
 - *For all channel and flood plain piers that could reasonably be affected by channel movement, estimate local pier scour for the worst case conditions, typically the conditions that exist in the thalweg of the channel; then compute total scour as per the ABSCOUR procedures.*
 - *For abutments, use the procedure in ABSCOUR to evaluate scour for the condition where the channel moves into the abutment*

The bridge owner needs to exercise judgment in the application and review of any such studies to evaluate the approach used, the answers obtained, and to make sure that the results are reasonable for the given site conditions. The approaches discussed above may provide conservative answers.

CONSULTANT STUDIES

It may be helpful to obtain the recommendations of a specialist who has knowledge and experience in evaluating the aspects of stream behavior discussed above and their contributions to scour at the structure. Bridge owners may prefer to obtain the services of a qualified consultant to make these assessments.

Upon request during the project development process, the Office of Structures will be pleased to provide the following assistance to bridge owners who wish to obtain help with the conduct of stream morphology studies for State or Federal-aid highway/structure projects:

- Provide a list of stream morphologists/water resources engineers who have conducted acceptable studies for the SHA in the past,
- Provide assistance in handling the details involved with the preparation and financing of any contracts needed to approve the conduct of the stream morphology studies,
- Provide assistance in the review of the results of the stream morphology studies as they pertain to the evaluation of scour at the structure.

A stream morphologist may be able to conduct a preliminary study of a crossing site (described as a rapid visual assessment) in a one-day field trip at a nominal cost. This study can serve the bridge owner in making a decision about the significance of stream morphology concerns in regard to the stability of the structure being evaluated.

1. REFERENCES:

- A. SHA Technical Report MD 11- SP909B4G, Long-Term Bed Degradation in Western Maryland Streams, March 2011, Arthur C. Parola Jr., Ward L. Oberholtzer, and David Black. See Chapter 14 of the H&H Manual, Appendix E
- B. Long-Term Bed Degradation in Maryland Streams (Phase 2): Blue Ridge and Western Piedmont Provinces; Arthur C. Parola, Jr., Ward L. Oberholtzer, and David W. Black, March, 2012. .
See Chapter 14 of the H&H Manual, Appendix E
- C. Office of Structures Manual for Hydrologic and Hydraulic Design, Chapter 14 Stream Morphology, 2014 Update.