

RESEARCH SUMMARY

Long-Term Bed Degradation in Maryland Streams (Phase IV): Western Shore of the Coastal Plain Province

WHAT WAS THE NEED?

Estimation of potential long-term down-cutting of the stream bed is necessary for evaluation and design of bridges for scour and culverts for fish passage. Existing guidelines for assessing this potential long-term bed degradation (LTBD) in Maryland streams require expertise that may not be available and/or field studies that, depending on the project budgets, may be cost prohibitive, especially for replacement of county structures. The morphological techniques recommended by these guidelines also lack verification data and may lead to overly conservative estimates, unnecessarily large foundation depths, and consequently, significantly higher costs.

WHAT WAS THE GOAL?

The purpose of this study was to improve predictions of LTBD in Maryland streams through the measurement and analysis of stream bed and waterway structure survey data and bridge plans. A primary objective was the development of equations for estimating potential LTBD in streams on the Western Shore of the Coastal Plain Province.

A total of 22 sites in Baltimore City and Harford, Baltimore, Anne Arundel, Prince George's, Calvert, Charles, and St. Mary's counties were selected for data collection.

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PRINCIPAL INVESTIGATOR:
Seyed Saadat, PE, CFM
RK&K
ssaadat@rkk.com

WHAT DID THE RESEARCH TEAM DO?

Phases I and II examined LTBD of streams in non-urbanized watersheds of the Allegheny Plateau, Blue Ridge, and the Western Piedmont physiographic provinces. Phase III Part 1 and Part 2 examined urban watersheds of the Piedmont Plateau province in Montgomery, Baltimore, and Howard counties and Baltimore City. In this Phase IV project, drainage areas of the 22 sites ranged from 0.7–30.5 mi². At each sampling site, the vertical drop at the outlet of the structure was measured with a pocket rod and a hand level. These rapid measurements were conducted where a step, a series of steps, a steep section, or a riprap-protected streambed was at the outlet of a culvert or a bridge with a paved or riprap-protected invert or down-stream apron.

WHAT WAS THE OUTCOME?

Five factors that may influence a site's risk of LTBD were investigated: (1) the valley slope, (2) the effective floodplain width, (3) discharge, (4) downstream channel entrenchment, and (5) bed material characteristics. The possibility of developing regional relations between LTBD and percent impervious area was evaluated for the physiographic province, but the data were inconclusive. Three relations between LTBD and the risk factors were examined: LTBD and valley slope; LTBD and an index combining factors 1-4; and LTBD and an index of bed mobility. Data indicated no

trend in LTBD with either of the two indices. The relationship based on valley slope was compared to the one based on drainage area. The comparison revealed that valley slope was a better predictor of the susceptibility of a site to LTBD than drainage area. The relationship between valley slope and LTBD was recommended to estimate LTBD for streams with slopes of less than 0.014 ft/ft.

The development of rate relationships for LTBD was also considered, but the number of available structure plans was insufficient to develop a rate relationship.

HOW WILL THE RESULTS BE USED?

The relationship and the database of LTBD field measurements will serve as a basis for MDOT SHA decisions related to both design and planning projects involving foundations for waterway crossings, depth of utility crossings, culvert replacements requiring fish passage, and mitigation projects involving stream restoration or stream stability. The relationship would also be of great help to all counties that lack resources to perform detailed stream morphology studies on their waterway crossing projects.

LEARN MORE

To view the complete report, click [here](#). To view the reports of the previous three phases, click [Phase I](#), [Phase II](#), [Phase III Part 1](#), and [Phase III Part 2](#).

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