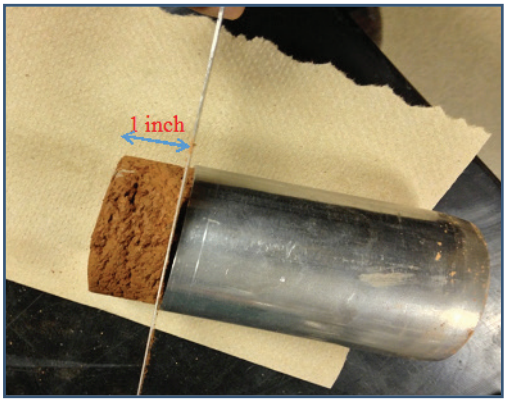
MOUNTAIN-PLAINS CONSORTIUM

PROJECT BRIEF | March 2015

Geotechnical Limit to Scour at Spill-through Bridge Abutments: Laboratory Investigation



the **ISSUE**

Although abutment scour has been extensively studied, the question of how spill-through abutments actually fail during scour has remained largely unaddressed. Prior studies focus largely on the depth and location of a scour hole formed near the toe of an abutment, but do not relate scour to abutment failure.

the **RESEARCH**

The research entails a series of laboratory flume experiments completed at the University of Wyoming using erodible 1:30 scale model abutments that simulate a standard two-lane road. To consider geotechnical factors in scour-depth measurements during the flume experiments, controlled soil compaction was performed and detailed soil shear strengths were measured. Flume observations and data regarding abutment failure were summarized. The experimental results show that a prevalent failure mode has been largely overlooked: spill slope erosion along the abutments waterline, beginning at the upstream corner. It is also shown that abutment failure involves a combination of hydraulic and geotechnical processes that cause spill slope erosion and abutment scour to be influenced by the shear strength of the compacted earth fill forming the spill slope.

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A University Transportation Center sponsored by the U.S. Department of Transportation serving the Mountain-Plains Region. Consortium members:

Colorado State University
North Dakota State University
South Dakota State University
University of Colorado Denver
University of Denver
University of Utah
Utah State University
University of Wyoming

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Project Title

Geotechnical Limit to Scour at Spill-through Bridge Abutments: Laboratory Investigation

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the **FINDINGS**

This study shows that scour at spill-through abutments involves geotechnical and hydraulics erosion processes, and confirms that geotechnical failure of abutment spill-slope limits scour depth. Observations of failed abutments commonly reveal that the geotechnical failure of the compacted earth spill-slope, and thus the geotechnical strength of the spill-slope, influence the extent, depth, and rate of abutment scour. Abutment failure directly influences scour depths at abutments by increasing the flow area through a bridge opening, reducing flow velocities, and producing scour depths less than reported in laboratory studies reported in the literature on scour.

the **IMPACT**

The practical outcome of this study is substantially improved understanding of scour at spill-through abutments, including new insight into how abutments fail. This information is needed for efficient and safe abutment design and maintenance. As embankment failure is a common aspect of bridge failure at bridge waterways, the study's findings will help enhance the stability of bridge abutments for the smooth operation of traffic.

For more information on this project, download the entire report at http://www.ugpti.org/resources/reports/details.php?id=791

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7938 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.

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