

UTC Project Information	
Project Title	MPC-354 – Geotechnical Limit to Scour at Spill-through Abutments, Year 2
University	University of Wyoming
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Funding Agencies	USDOT, Research and Innovative Technology Administration
Agency ID or Contract Number	DTRT12-G-UTC08
Project Cost	\$157,745
Start and End Dates	January 1, 2012- December 31, 2013
Project Duration	2 Years
Brief Description of Research Project	<p>Research Needs: Most cases of abutment failure attributable to scour show a geotechnical failure of the spill slope of earthfill embankment associated with the abutment. The abutment column typically remains standing. Figure 1 illustrates two typical examples. Because spill-slope failure increases the flow area through a bridge waterway, and deposits material in the scour area, the maximum scour depth attainable at an abutment, and damage sustained by an abutment, appears to be limited by the geotechnical stability of an abutment's earthfill embankment. <i>However, the relationship between scour and geotechnical stability of a spill-slope or embankment has never been investigated.</i> The proposed study will be the first to investigate this relationship. <i>It will continue as the second year of the prior, but interrupted MPC project</i> (MPC 354). The MPC program was terminated in 2011 during the first year of the present project; the prior study, a two-year effort, was just getting started with producing early research findings when the MPC program ended abruptly. Appendix A of this proposal gives a brief summary of activities accomplished during the first year of work.</p>

	<p>The project addresses the research question that scour at spill-through abutments is best characterized as largely a geotechnical design concern and less of a hydraulics concern, because the geotechnical strength of the spill-slope limits the extent of scour. The actual depth of flow-induced scour leading to embankment failure can be unremarkable. Typically, scour depths at spill-through abutments are modest, at least when viewed after the flood event that caused the scour, and when other factors such as channel morphology effects are excluded. Though numerous illustrations of scour at spill-through abutments show failed embankment and channel bank, methods currently available for estimating scour do not address the geotechnical aspects of scour at spill-through abutments.</p> <p>When scour causes the spill-slope to become unstable, spill-slope soil slides into the scour region and the flow transports it away. Further deepening leads to more slope instability and erosion, until eventually, the erosion extends to the abutment column (Figure 2a, b). Still further erosion breaches the embankment, increasing the flow area, and relaxing flow velocities through the bridge waterway.</p> <p>The leading design guides, and bridge-monitoring guides, inadequately characterize scour at bridge abutments. For example, the recent FHWA publication NIH (2009) “Stream Instability, Bridge Scour and Countermeasures,” for instance inaccurately portrays an abutment structure and its flow field, and says nothing about how abutments actually are built, and possibly fail subject to scour. Figure 3 is taken from the publication. A similar comment can be made for the FHWA design guide HEC-18 (Richardson et al. 2001).</p> <p>Research Objectives:</p> <p>The overall project has the following principal objectives:</p> <ol style="list-style-type: none"> 1. Comprehensively define the essential geotechnical aspects associated with scour of spill-through abutments; 2. Show that the stability of an abutment’s spill-slope limits scour depth; and, 3. Formulate a practical method relating abutment scour depth to the shear strength of the abutment’s earthfill embankment. The relationship would provide a useful check on scour depth estimated using existing (and largely inadequate) methods for scour-depth prediction (e.g., as in HEC-18 recommended by the Federal Highway Administration). <p>The information and insights obtained from the project will significantly enhance understanding of abutment scour, and improve abutment design. Appendix A briefly indicates the work that had been accomplished during the first year of work.</p>
<p>Describe Implementation of Research Outcomes (or why not implemented)</p> <p>Place Any Photos Here</p>	
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	

<p>Web Links</p> <ul style="list-style-type: none">• Reports• Project Website	<p>https://www.ugpti.org/resources/reports/details.php?id=791</p>
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