MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 22-491 (project 619) | December 2022

Evaluating Nonlinear Methods to Generate Flood Hydrographs for Bridge Scour Applications

the **ISSUE**

The most common cause of bridge failure in the United States is the erosion of streambed material from around bridge substructure elements (scour). Improved methods of estimating stream flows during and between extreme precipitation events are needed to better understand bridge scour, enhance bridge design, and improve long-term safety and sustainability of the transportation system.

the **RESEARCH**

This research examined the effects of the nonlinear relationship between excess precipitation and peak stream flow on bridge scour evaluations. A hydrologic modeling system (HEC-HMS) model was developed to estimate peak discharges based on design storms from the regional extreme precipitation study. A river analysis system (HEC-RAS) model was then used to model stream hydraulics and to drive scour calculations for a case study on Cheyenne Creek in Colorado.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

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

Evaluating Nonlinear Methods for Flood Hydrograph Generation to Evaluate Bridge Scour

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the FINDINGS

The incorporation of a variable relationship between excess precipitation rate and Clark hydrograph parameters (i.e., nonlinearity) increased the peak discharges from all the design storms. The higher peak discharges caused substantial differences in the scour calculations for the case study.

the IMPACT

This research demonstrated that the estimation of peak stream flows, and nonlinearity in basin response in particular, can have a significant impact on scour estimations and thus the design and safety of bridges. While further research is needed, this study provides one case study of such an effect and is expected to prompt additional research in this area.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1112

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 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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