

UTC Project Information	
Project Title	MPC-537 – Quantifying Mountain Basin Runoff Mechanisms for Better Hydrologic Design of Bridges and Culverts
University	Colorado State University
Principal Investigator	Jeffrey D. Niemann
PI Contact Information	Associate Professor Colorado State University Phone: (970) 491-3517 Email: jniemann@engr.colostate.edu ORCID: 0000-0002-2988-0879
Funding Source(s) and Amounts Provided (by each agency or organization)	USDOT, Research and Innovative Technology Administration \$50,000 “Mountain Basin Hydrologic Response Study,” Colorado Water Conservation Board (CWCB), State of Colorado, \$50,000. Project was approved at the 3/22/2017 CWCB meeting. Project duration is July 1, 2017 to June 30, 2018. \$50,000
Total Project Cost	\$100,000
Agency ID or Contract Number	69A3551747108
Start and End Dates	November 2, 2017 to July 31, 2022
Brief Description of Research Project	<p>The objectives of this MPC research project are: (1) to determine the importance of saturation-excess runoff production for large storms that affect the design and performance of key surface transportation infrastructure and (2) to develop a generalized model for runoff production in mountainous basins that can be used by consultants to perform hydrologic analysis of transportation infrastructure. This project would allow expansion of a one-year research project that was recently awarded by CWCB to the PI and collaborators in Colorado Dam Safety into a two-year effort.</p> <p>To achieve the project goals, a physically-based model that allows production of both infiltration-excess and saturation-excess runoff will be implemented and used to examine the mechanisms that have been active for three large historical rainfall events that occurred in the Colorado Front Range. Future phases of this research will consider mountain basins outside of the Front Range. The model used in this study must fulfill several key requirements. First, it must be physically-based to maximize the reliability of its results. Second, it must simulate both infiltration-excess and saturation-excess runoff so the appropriate runoff production mechanism(s) can be identified and simulated. Third, the model must not require calibration because most basins above bridges and culverts are ungauged. Fourth, it must be implemented in a simple and low-cost framework and utilize existing Natural Resources Conservation Services (NRCS) or United States</p>

	Forest Service (USFS) soil survey data to allow possible future adoption by consultants who perform hydrologic analysis of transportation infrastructure.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	The research outcomes were implemented in a journal publication that (1) thoroughly describes the basis for the study's conclusions and (2) implements modeling methods that can be used by consultants in future hydrologic studies for design evaluation. Specifically, the soil moisture accounting method in HEC-HMS can be used to simulate infiltration-excess runoff, saturation-excess runoff, and subsurface stormflow. Ongoing work (supported by a different sponsor) aims to develop more specific guidance for parameter estimation when implementing this modeling method.
Impacts/Benefits of Implementation (actual, not anticipated)	The study identified a key limitation in some current hydrologic guidelines. It also suggested an avenue by which this limitation can be overcome. Thus, the study is expected to produce more accurate estimates of runoff and streamflow from design storms and improved hydrologic analysis and design.
Web Links <ul style="list-style-type: none"> • Reports • Project Website 	https://www.ugpti.org/resources/reports/details.php?id=994