VERMONT
AGENCY OF TRANSPORTATION

FACT SHEET

2018 Research Symposium & STIC Annual Meeting

Identifying Sensitive Structural and Hydraulic Parameters in a Bridge-Stream Network for Flood Mitigation Planning

RESEARCH PROJECT TITLE

VTRC017-003: Bridge-stream network assessment to identify sensitive structural and hydraulic parameters for flood mitigation planning

STUDY TIMELINE

January 2018 – January 2019

INVESTIGATORS

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Fact sheets can be found for additional projects featured at the 2018 Symposium at http://vtrans.vermont.gov/planning/research/2018symposium

Additional information about the **VTrans Research Program** can be found at http://vtrans.vermont.gov/planning/research

Additional information about the **VTrans STIC Program** can be found at http://vtrans.vermont.gov/boards-councils/stic

Introduction

Vermont is experiencing a trend of more frequent precipitation events of longer duration. Consequently, infrastructure must withstand more frequent extreme flood events of greater magnitude. Satisfying the rigorous hydraulic demands these floods impose upon all bridges and structures is not feasible, so prioritizing resources to maximize flood hazard mitigation in a watershed is critical for efficient rehabilitation projects. Studies are generally limited in scope to steady-state analyses in the immediate vicinity of a specific structure or feature, and far-reaching impacts up-and-downstream are often not considered. Specific structural or hydrogeological features may attenuate and/or intensify hazards on the network scale; by quantifying the dynamic interactions between a river and its surrounding infrastructure under high-risk, transient conditions, we may improve the efficiency of flood mitigation strategies.

Methodology

A two-dimensional HEC-RAS hydrologic model was developed of the Otter Creek between the USGS flow gauges at Rutland and Middlebury on a LiDAR terrain model, incorporating sonar-derived bathymetry of the river channel. The model is calibrated to Tropical Storm Irene flows and surveyed high-water marks. In the domain are over 100 culverts, 12 road and eight rail bridges, and the Proctor Falls hydropower station.

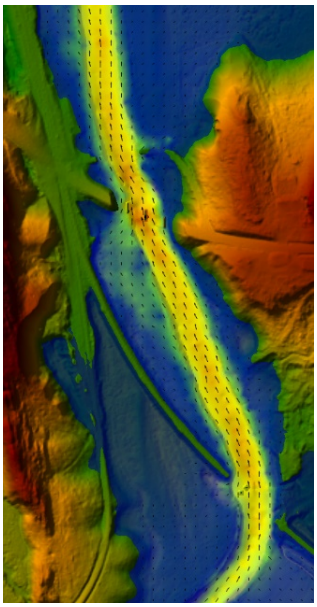

Fig. 1: Plot of TS Irene peak velocity through 3 consecutive bridge crossings at Florence Junction.

Next Steps

Perturbations will be applied to various features by terrain manipulation, including increased bridge span lengths, removal of berms, grade elevation, addition of relief structures, and recreation of natural conditions. Sensitivity to each of these will be analyzed for several events with annual exceedance probabilities (AEP) from 4% to 0.2%. Preliminary analyses show that the effects of localized adjustments can propagate throughout the entire domain.

Potential Impacts and VTrans Benefits

By identifying critical structural and hydrogeological features in a bridge-stream network, a network-level infrastructure resiliency analysis is possible. This may help prioritize limited resources available for bridge and river rehabilitations, holistic design of bridges, and address stakeholder concerns raised in response to planned bridge and infrastructure alterations.