

Semi-Annual Progress Report

Project Number and Title: 4.4: Bridge-stream Network Assessments to Identify Sensitive Structural, Hydraulic, and Landscape Parameters for Planning Flood Mitigation

Research Area: Thrust 4 Connectivity for Enhanced Asset and Performance Management

PI: *Mandar Dewoolkar, University of Vermont*

Co-PI(s): *Donna Rizzo and Arne Bomblies, University of Vermont*

Reporting Period: *First semi-annual report*

Date: *March 28, 2019*

Overview:

A 2D hydrologic transient HECRAS model of a low-gradient ~35 mile river corridor (Otter Creek between Rutland and Middlebury, VT) with 12 road and 8 rail bridges, 75 miles of road, 30 miles of rail and ~100 culverts was developed. The model was built using LiDAR terrain model and sonar-derived bathymetry of the river channel. Perturbations were then 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 to assess sensitive features of the network.

A new framework and methodological development is needed to enable New England transportation agencies to perform a network-level resiliency analysis over a wide range of design flows including flows equivalent to extreme events beyond detailed characterization of the heterogeneity associated with site-specific conditions. The above mentioned activities serve as a proof-of-concept study to work towards achieving this overarching goal. In coming months, two additional river corridors will be selected and studied in a similar fashion. The results from the three river corridors will allow examination of generalizability of the results across low- to high-gradient river corridors with significant surrounding infrastructure. A probabilistic network model will then be developed and calibrated for application to similar geographic and climatic conditions.

The results to date have been presented to personnel from the Vermont Agency of Transportation (VTrans) and Vermont Agency of Natural Resources (VTANR). The project team also met with the project's Technical Advisory Committee comprised of personnel from VTrans and VTANR.

The following report has been submitted to VTrans:

1) Trueheart, M., Bomblies, A., Rizzo, D., Huston, D., Dewoolkar, M. (2019), "Identifying sensitive structural and hydraulic parameters in a bridge-stream network under flood conditions", submitted to Vermont Agency of Transportation, Report No. VTRC017-003,
https://vtrans.vermont.gov/sites/aot/files/planning/documents/research/publishedreports/2019-02_BridgeStream.pdf

2) A manuscript is under preparation to be submitted to the journal of Science of Total Environment.

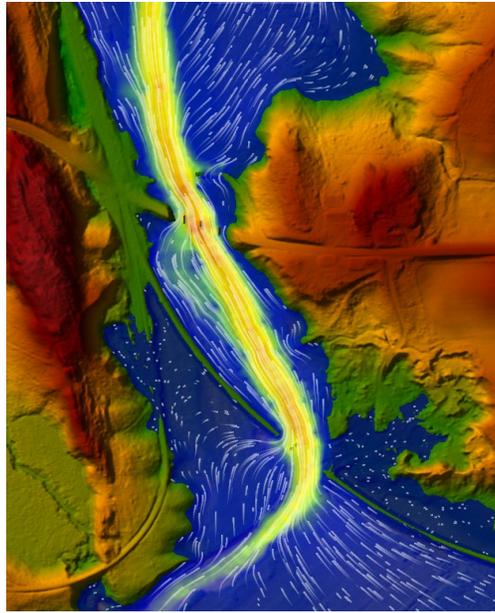


Figure 1: *Part of the developed 3D hydraulic model*

Participants and Collaborators:

Prof. Mandar Dewoolkar, Civil & Environmental Engineering, University of Vermont, Project PI
Prof. Donna Rizzo, Civil & Environmental Engineering, University of Vermont, Project co-PI
Prof. Arne Bomblies, Civil & Environmental Engineering, University of Vermont, Project co-PI
Prof. Dryver Huston, Mechanical Engineering, University of Vermont, Collaborator

M.S. student Matthew Trueheart, Civil & Environmental Engineering, University of Vermont, graduating May 2019

Vermont Agency of Transportation:

Cassidy Cote

Nick Wark

Dr. Emily Parkany

Dr. Ian Anderson

Vermont Agency of Natural Resources:

Jaron Borg

Changes:

The Master's student is graduating and the new student will start in June.

Planned Activities:

Select two additional sites, and develop transient hydrologic models (HECRAS 2D) using existing LiDAR data and supplemental bathymetry data.