VERMONT
AGENCY OF TRANSPORTATION

2017 Research Symposium & STIC Annual Meeting

FACT SHEET

The changing risk of extreme event impacts on Vermont transportation infrastructure

RESEARCH PROJECT TITLE
The changing risk of extreme event impacts on Vermont transportation infrastructure

STUDY TIMELINE
1/2015 – 8/2017

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MORE INFORMATION
Research will add link to the final report and other materials on VTrans website

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Fact sheets can be found for additional projects featured at the 2017 Symposium at http://vtrans.vermont.gov/planning/research/2017symposium

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 or What was the Problem?

The magnitudes of precipitation extremes are changing in Vermont, and these changes can affect flood behavior, leading to nonstationarity in stream flow. Standard engineering practice for culvert and bridge sizing assumes stream flow stationarity, so the observed nonstationarity may result in undersized structures rendering them vulnerable to future flooding. This research sought to quantify the change factors in design flows that should be applied in order to account for the changing precipitation climatology.

Methodology or What was done?

Because downscaled global climate model data is not validated for Vermont (model runs in hindcast fail to reproduce observed changes), we used a statistical approach based on a nonstationary Monte Carlo Markov Chain model trained with observed precipitation data to generate future precipitation realizations. The statistical weather generator was run 10,000 times for each scenario. These possible precipitation time series were combined with hydrological models, to quantify hydrological response and thereby arrive at a change factor useful for hydraulic design.

Conclusion or What are the next steps?

For the year 2050, the 100-year, 50-year, and 25-year flows may be as much as 1.5 times higher than they currently are. There is significant uncertainty in these estimates, and they assume that current trends in precipitation changes continue. The change factors presented in this research can be used as a factor of safety to account for climate change, but further research on the tradeoffs between making the upfront investment for potential future benefits versus saving the money and taking the risk of assuming stationarity should be considered.

What are potential impacts? What is the benefit to VTrans?

Benefits to VTrans include potential cost savings for bridges and culverts that are built to be more resilient to future floods. If current trends continue, larger structures built to accommodate higher floods magnitudes will result in a much more resilient transportation system.