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VTrans Research

Presentation to Senate Transportation Committee
February 27, 2018

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Policy, Planning & Research Bureau
Vermont Agency of Transportation (VTrans)

1

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Research Section Activities

- Manages the States Research Program, supported by 25% of SPR funds
- Contributes for the State's participation in TRB, NCHRP, AASHTO TSPs, NETC
- External Research Projects: UVM, and expanding to include VTC, Norwich, and St. Michael's
- Internal Research Projects, Experimental Features, participation on various VTrans Committees and Working Groups

2

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2019 Research Problem Statements

- Quantifying Nutrient Pollution Reductions Achieved by Erosion Remediation Projects
- Drift Fencing for Small to Medium-Sized Wildlife; Identifying the Most Cost-Effective Approach for Guiding Small to Medium Sized Wildlife into Crossing Structures
- The Effect of Agricultural Biproduct Brine vs. Rock Salt Brine on Vermont Roads
- Vermont Stream Geomorphic Assessment: Vermont Regional Hydraulic Geometry Curves
- Maximizing Wetlands for Water Quality Enhancements
- Utilization of Ground Penetrating Radar (GPR) and Sensing Technologies to Detect Voids and Sinkholes Beneath Roadways and Structures
- Reclaimed Stabilized Base—Stabilizing Agent Selection and Design
- Microsimulation Model Validation and Calibration for Intersections in Vermont
- Evaluation of Commercially Available Probe Data for Vermont
- The Feasibility of Design-Build Method for Smaller Project Procurements
- Railroad Crossing Concrete Panel Durability Study
- Hydraulic Inspection Vehicle Explorer (HIVE) Culvert Upgrade

3

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Internal Research

Experimental Features

- Culvert Liners
- Porous Asphalt Park and Ride - Randolph
- Vist-A-Wall and Super Cor Arch Bridge
- Jahn Permeable Mortar System in a Historic Bridge Abutment Application
- Composite Arch Bridge
- Super-Slab, a Precast Concrete Bridge Approach Slab
- Bridge Preservation LLC's BDM Waterproofing Membrane System
- Poly-Carb Flexogrid Bridge Deck Overlay System
- Fiber Reinforced Polymer (FRP) Strips for Bridge Rehabilitation

Internal Projects

- Recycled Materials – RAS, Glass, Tires, Compost
- Pavement Life Study – Tracking the lifecycle performance of new pavement technologies
- Pavement Marking Study – Tracking lifecycle performance of tape and liquid pavement markings

4

External Research—New Process

- 325,000 (2-4 up to two year projects)
- Qualified Researcher List (4 VIHE)
- Online Research Idea Submission (~30)
- Matched with enthusiastic VTrans Champions (12)
- Solicited 2 page Letters of Interest (15 letters on 11 projects)
- Champions helped select who submits full proposals
- Champions present in front of VTrans Bureau Directors

5

Champions and TACs

- Want projects with enthusiastic staff support
- Need a VTrans Technical Champion
- Need Supporting Section/Bureau
- Need diverse Technical Advisory Committees
- Meet 2-4 times/year
- Guide the research/comment on deliverables/help with implementation

6

External Research (Examples)

- Quantifying the Vulnerability of Vermont Bridges to Seismic Loading
- Acoustic Emission Monitoring of Prefabricated and Prestressed Reinforced Concrete Bridge Elements and Structures
- Snow and Ice Control (SIC) Performance Measurement: Comparing "Grip," Traffic Speed Distributions, and Safety Outcomes During Winter Storms
- Bridge-Stream Network Assessment to Identify Sensitive Structural and Hydraulic Parameters for Planning Flood Migration
- Implementation of Intelligent Compaction for Pavement Construction in Vermont
- Evaluating Effectiveness of Floodplain Reconnection Sites along the Lamoille Valley Rail Trail: A Blueprint for Rail/River Projects
- Calibration of the Highway Safety Manual Predictive Models for Rural Two-Lane Roads for Vermont
- Radio Frequency Identification (RFID) Technology for Transportation Asset Management
- [The Nature Conservancy] Reducing Wildlife Mortality on Roads in Vermont: Determining Relationships Between Structure Attributes and Wildlife Movement Frequency Through Bridges and Culverts to Improve Related Conservation Investments

7

17-3 Bridge-Stream Network

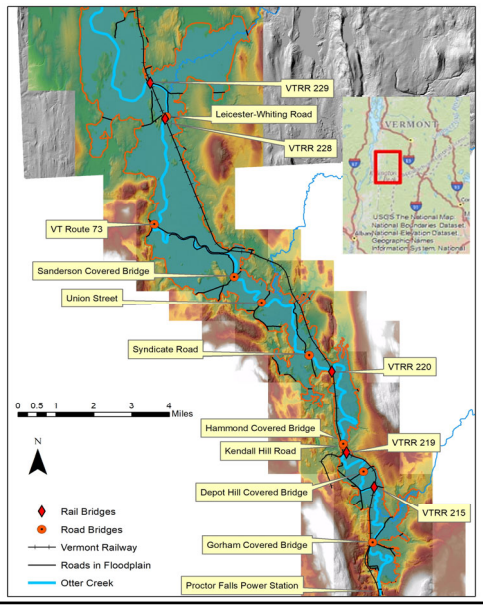
UVM CEE – Matt Trueheart, Dr. Dewoolkar, Dr. Rizzo, Dr. Bomblies, Dr. Huston.

PROJECT OBJECTIVES

1. Develop a model that performs transient analyses of a hydraulic bridge network on a stream reach to assess the impacts of coupled bridge-stream interactions over a range of design flows.
2. Perform a sensitivity analysis to examine how localized perturbations to bridge and/or stream features affect up- and down-stream bridges and river corridors for the purposes of identifying and ranking structural and hydrogeological features of importance.

OTTER CREEK MODEL

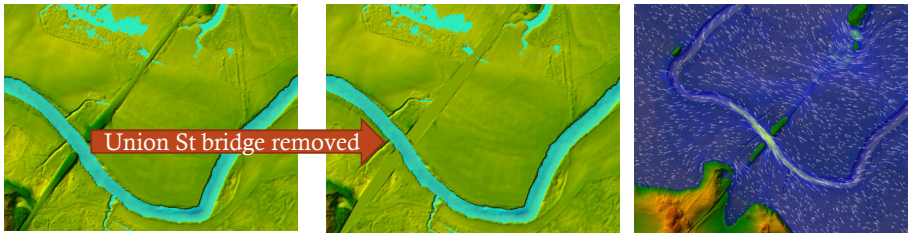
- Modeled flows over Proctor Falls used as inflow boundary condition on smaller domain (Proctor → Middlebury)
- Bridges: 10 road; 7 railroad
- ~70 hydraulically connected culverts & overflow bridges



8

17-3 Bridge-Stream Network

Modelled bridge and approach embankment removal

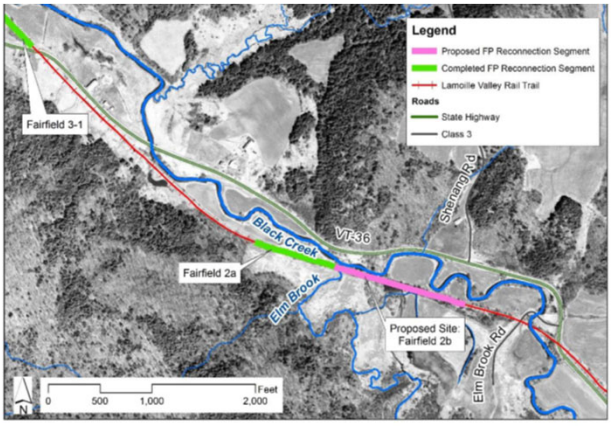


Δ Peak Velocity Q100 (fps)		Impact on Bridge													
		Gorham	RR 215	Depot	RR 219	Kendall	Hammond	RR 220	Syndicate	Union	Sanderson	Rt 73	RR 228	LW	RR 229
Existing		4.994	4.836	1.857	5.191	7.458	6.073	6.464	2.697	4.198	5.296	3.710	4.779	5.337	3.579
Removed Bridge	Gorham	-0.758	-0.003	0.005	-0.002	0.001	0.006	-0.001	0.003	0.001	0.003	-0.002	0.001	0.002	0.002
	RR 215	0.223	-2.689	-0.019	-0.031	-0.045	-0.033	-0.030	-0.001	-0.012	-0.013	-0.006	-0.012	-0.017	-0.001
	Depot	0.013	0.025	-0.269	-0.003	-0.001	0.004	-0.003	0.004	0.000	0.003	-0.002	-0.001	0.000	0.001
	RR 219	0.019	0.069	0.031	-0.602	0.028	0.052	0.031	0.007	0.015	0.022	0.000	0.014	0.021	0.006
	Kendall	-0.001	0.000	0.006	0.017	-0.584	-0.023	0.003	0.003	0.003	0.006	-0.002	0.002	0.004	0.002
	Hammond	0.000	0.004	0.007	0.010	0.015	-0.690	0.000	0.004	0.002	0.005	-0.002	0.001	0.003	0.002
	RR 220	-0.001	0.000	0.006	0.053	0.094	0.087	-2.246	-0.099	0.018	0.025	-0.001	0.017	0.026	0.008
	Syndicate	0.005	-0.001	0.008	0.004	0.010	0.013	0.010	-0.146	0.000	0.002	-0.005	0.000	0.001	0.002
	Union	0.005	0.000	0.011	0.001	0.005	0.009	0.004	0.103	-1.325	0.003	-0.015	-0.004	-0.005	0.000
	Sanderson	0.004	-0.001	0.007	0.000	0.003	0.008	0.009	0.034	0.129	-1.049	0.003	-0.004	-0.005	0.002
	Rt 73	0.005	0.001	0.012	-0.001	0.003	0.007	0.002	0.104	0.042	0.123	-2.086	-0.028	-0.037	-0.009
	RR 228	0.004	-0.002	0.005	-0.002	0.001	0.006	-0.001	0.003	0.001	0.004	0.001	-1.560	0.014	0.125
	LW	0.004	-0.002	0.005	-0.002	0.001	0.006	-0.001	0.004	0.002	0.008	0.024	-0.278	-1.785	-0.282
	RR 229	0.004	-0.002	0.005	-0.002	0.001	0.006	-0.001	0.004	0.001	0.004	0.008	-0.016	0.111	-1.385

9

18-2 LVRT Floodplain Reconnection

UVM CEE – Dr. Kristen Underwood, Dr. Dewoolkar, Dr. Rizzo, Dr. Bomblies, Dr. Wemple



Objectives:

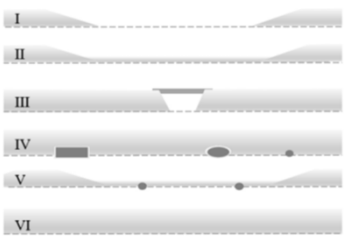
1. Analyze floodplain reconnection at Fairfield 2b
2. Develop desktop protocol for site prioritization

Optimize River / Rail Corridor

Functions and Values

- Recreation (Lamoille Valley Rail Trail)
- Transportation (VT Rt 36, town roads, driveways)
- Residential properties
- Agricultural uses
- Flood attenuation
- Sediment and nutrient attenuation
- Habitat

Alternatives Analysis



10

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18-2 LVRT Floodplain Reconnection

22 December 2018, view to SSE from Shenang Rd Jct with VT Route 36

11

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18-2 LVRT Floodplain Reconnection

Desktop Protocol Outline

Technical Feasibility

Proximity

1. River reach shares valley with inactive rail line

Geomorphic Setting - *identify river reaches with potential to inundate the floodplain*

2. Reach is Unconfined (VC is ≥ 4)
3. Channel slope is < 2%
4. Stream Order is ≥ 5 (maybe 4?)
5. Entrenchment Ratio is > 2.2
6. Incision Ratio is ≤ 1.3

Effectiveness

Reach Scale

7. Floodplain area gained by rail bed modification (acres, percentage)

Watershed Scale

8. Stream network location (upstream/downstream impacts)
9. Distance upstream from village center or infrastructure
10. % agriculture/ %developed in upstream catchment (i.e., as proxy for nutrient attenuation potential)

12

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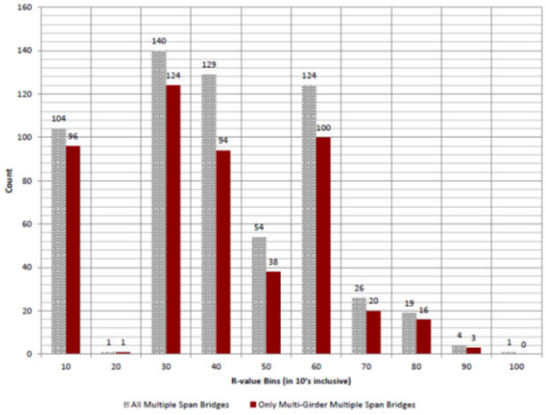
Quantifying the Vulnerability of Vermont Bridges to Seismic Loading, UVM John Lens

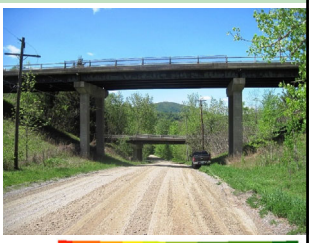
Project included:

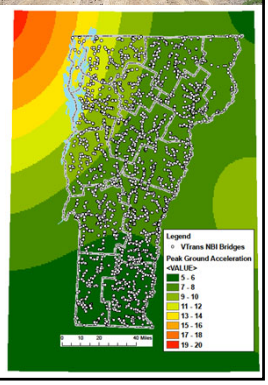
- Survey of other State's methods
- Non-linear finite element modeling of multi-span bridges
- Developed Rapid Seismic Screening Algorithm bases on NBI data



Project found:

- Susceptibility varies with location, foundation, bridge feature, skew
- Produces a moderately conservative screening vulnerability rating
- Can be refined with additional data on foundations, soils, and plan review of dimensions and support features
- Provides a tool for prioritization following an earthquake





13

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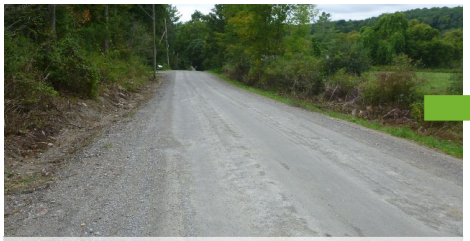
RAS in Gravel Roads – Pownal and Shaftsbury

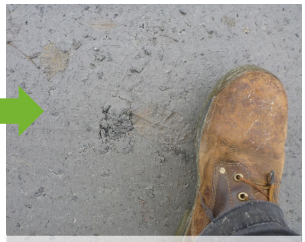

Shingles piled up at Myers Recycling


Ground RAS at Whitcomb


RAS stockpile at Pownal


Precondition of Shaftsbury Test Section


Reconstruction of Shaftsbury Test Section


New Gravel/RAS Surface

14

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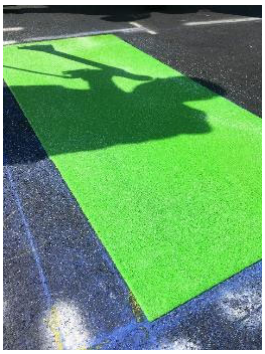
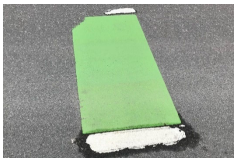
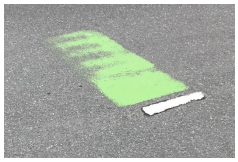
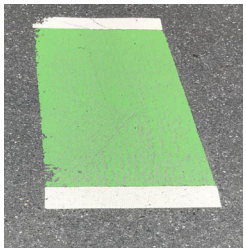
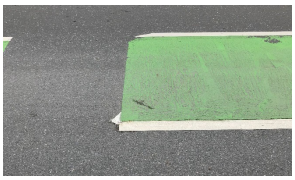
Bike Lanes – US302 Berlin

15

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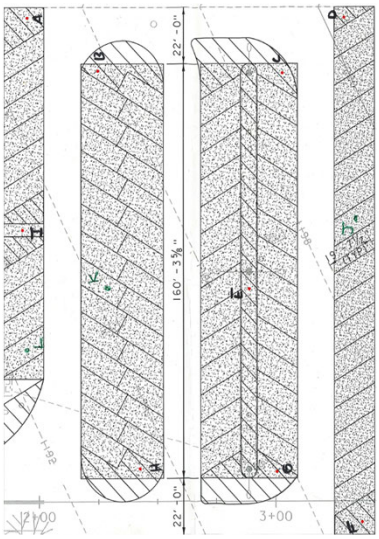
Porous Asphalt – Randolph Park and Ride






16

Research Symposiums

- September 28, 2017 and September 13, 2018
- http://vtrans.vermont.gov/planning/research/2018symposium
- Posters, Fact Sheets, available reports, 90 second videos
- ~30 projects: External research (largely UVM), NETC, VTrans innovations, a few internal research projects
- In conjunction with State Transportation Innovation Council (STIC)

17

Quarterly Research and Innovation e-Newsletter

August, November, February, May


Volume 02 | November 13, 2018 View as Webpage

RESEARCH & INNOVATION

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SUBMIT YOUR RESEARCH IDEA NOW!

Vermont Agency of Transportation | 2019 External Research Program

Do you have an idea for a research topic you think the Vermont Agency of Transportation (VTrans) should consider? Each year, VTrans sponsors 2-4 research projects in partnership with external re searche rs and we are now seeking project ideas for VTrans' 2019 External Research Program!

Project ideas must be submitted by December 14th to be considered for the 2019 program. Simply **complete the research idea submission form** on our website .

For questions regarding project submissions, please contact Emily.Parkany@vermont.gov or Ian.Anderson@vermont.gov .

Link

18