Using The Transportation Resiliency Planning Tool (TRPT) To Strengthen Hazard Mitigation Planning
Definitions

**Vulnerability:** The extent that a transportation asset is exposed to a threat from inundation, erosion, or deposition.

**Probability:** The likelihood that a threat will damage a transportation asset, as linked to storms of different sizes.

**Criticality:** How important is the transportation asset that dictates the consequence of the disruption to mobility due to damage? How close is it to essential facilities?

**Risk:** The combination of the probability of vulnerability and criticality.
PROJECT

VULNERABILITY
- Watershed and River Corridor Analysis
- 10-year, 50-year, and 100-year floods
- Road, Bridges, and Culverts
- Failure Mode

CRITICALITY
- State and Local Roads
- Novel Consideration of Vulnerability
- 1,000 Simulations of Network Disruption
- Failures and Delays

RISK

Mitigation
- Resiliency App
- VTrans Prioritization Updates
- Watershed Resiliency Plans
- Project Guide Book
GOALS

1. Develop flood risk identification methods and tools.
2. Systematically identify high risk road segments and crossing structures.
3. Incorporate vulnerability and risk into planning process.
VULNERABILITY PROCESSES

Deposition
Little Otter Creek
North Street, New Haven, VT (2004)
Photo taken by ACRPC Staff

Inundation
Otter Creek Flooding
Swamp Road, Cornwall VT (2007)
Photo taken by ACRPC Staff

Erosion
North Branch Middlebury River
Dugway Road, Ripton, VT (2008)
Photo taken by ACRPC Staff

Erosion
New Haven River
W River Road, Lincoln, VT (1998)
Photo taken by ACRPC Staff
Vulnerability

- Vulnerability estimated at road embankments, bridges, and culverts.
- Assigned maximum from inundation, erosion, and deposition.
Vulnerability - Combined 50 Year Flood

Legend

<table>
<thead>
<tr>
<th>Bridge Vulnerability</th>
<th>Road Vulnerability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1 - 3)</td>
<td>None (0)</td>
</tr>
<tr>
<td>Medium (4 - 8)</td>
<td>Low (1 - 3)</td>
</tr>
<tr>
<td>High (9 - 10)</td>
<td>Medium (4 - 6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Culvert Vulnerability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1 - 3)</td>
</tr>
<tr>
<td>Medium (4 - 6)</td>
</tr>
<tr>
<td>High (9 - 10)</td>
</tr>
</tbody>
</table>

Streams: Rivers, Lake, and Ponds
Stevens Branch Watershed
Town Boundary

Map created by CVRPC 11/2016
This map is for planning purposes only.
Data is only as accurate as the original sources.
The map may contain errors and/or omissions.
Vulnerability - Barre City Combined 50 Year Flood

Transportation Resilience Planning Tool
Stevens Branch Watershed
50 Year Flood Vulnerability

Legend
Bridge Vulnerability
- Law (1 - 3)
- Moderate (4 - 8)
- High (9 - 10)
Culvert Vulnerability
- Law (1 - 3)
- Moderate (4 - 8)
- High (9 - 10)
Road Vulnerability
- Law (1 - 3)
- Moderate (4 - 8)
- High (9 - 10)
Streams
- Rivers, Lake, and Ponds
- 100 Year Flood Plain
- Stevens Branch Watershed
- Town Boundary

Map created by CVRIPC 11/2019; updated 9/2020
This map is for planning purposes only.
Data is only as accurate as the original sources.
This map may contain errors and/or omissions.

CVRPC

Transportation Resilience Public Meeting 16 x 36 BC
Local Road Importance – Northfield & Williamstown
Criticality – Critical Closeness Accessibility

Fig. 1. Illustration of an isolating link and an isolated sub-network.

(Novak and Sullivan, 2014)
<table>
<thead>
<tr>
<th>SCORE</th>
<th>Key Link in Network</th>
<th>Critical Closeness Accessibility (UVM)</th>
<th>Locally Important for daily regular function or for detour*</th>
<th>Combined Score for Map Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>10=</td>
<td>High or Medium</td>
<td>AND High</td>
<td>AND y</td>
<td>HIGH (RED)</td>
</tr>
<tr>
<td>9=</td>
<td>High or Medium</td>
<td>AND Medium</td>
<td>AND y</td>
<td></td>
</tr>
<tr>
<td>8=</td>
<td>High or Medium</td>
<td>AND High or Medium</td>
<td>AND n</td>
<td></td>
</tr>
<tr>
<td>7=</td>
<td>High or Medium</td>
<td>AND Low</td>
<td>AND y</td>
<td></td>
</tr>
<tr>
<td>6=</td>
<td>Low</td>
<td>AND High</td>
<td>AND y</td>
<td></td>
</tr>
<tr>
<td>5=</td>
<td>Low</td>
<td>AND Medium</td>
<td>AND y</td>
<td></td>
</tr>
<tr>
<td>4=</td>
<td>High or Medium</td>
<td>AND Low</td>
<td>AND n</td>
<td>MEDIUM (YELLOW)</td>
</tr>
<tr>
<td>3=</td>
<td>Low</td>
<td>AND High or Medium</td>
<td>AND n</td>
<td></td>
</tr>
<tr>
<td>2=</td>
<td>Low</td>
<td>AND Low</td>
<td>AND y</td>
<td></td>
</tr>
<tr>
<td>1=</td>
<td>Low</td>
<td>AND Low</td>
<td>AND n</td>
<td>LOW (GREEN)</td>
</tr>
</tbody>
</table>
Criticality – Watershed Wide

- **Network criticality index** - based on simulations of failure – if there are secondary routes and no vulnerability = low, if no secondary and vulnerable or both routes vulnerable = high.

- **Criticality closeness accessibility index** = indicates closeness to critical facilities such as hospitals, police departments, ambulance dispatch, fire stations.

- Then a tool is run to factor these things in with the local road importance to come up with a criticality score.
Criticality Scores – Barre City

Transportation Resilience Planning Tool
Stevens Branch Watershed
Barre City
Criticality Score

Legend
Road Criticality Score
- Low (1)
- Medium (2-4)
- High (5-9)
- Streams
  - Rivers, Lake, and Ponds
  - VT_Road_Centerline
  - 100 Year Flood Plain
  - Stevens Branch Watershed
  - Town Boundary

Map created by CVRPC 5/2020; Updated 6/2020
This map is for planning purposes only.
Data is only as accurate as the original sources.
This map may contain errors and omissions.

CVRPC
N\RegionalTransportationResiliencePlanningTool_OutreachRound2\Maps\TransportationResilienceCriticality_36x36_8C
Next Steps

**VULNERABILITY**
- Watershed and River Corridor Analysis
- 10-year, 50-year, and 100-year floods
- Road, Bridges, and Culverts
- Failure Mode

**CRITICALITY**
- State and Local Roads
- Novel Consideration of Vulnerability
- 1,000 Simulations of Network Disruption
- Failures and Delays

**RISK**
- Mitigation

**Mitigation**
- Resiliency App
- VTrans Prioritization Updates
- Watershed Resiliency Plans
- Project Guide Book
Risk

Risk is equal to the average of Vulnerability and Criticality.
Mitigation Planning

Mitigation Options

- Infrastructure Improvements (Revised alternatives analysis and design standards)
- River Management
- Alternative Routes
- Roadway Relocation
- Conservation
- Land Use Regulation
Explore TRPT Websites

Direct link to TRPT
https://roadfloodresilience.vermont.gov/#/map

Link to VTrans TRPT Website
https://vtrans.vermont.gov/planning/transportation-resilience

Link to statewide Vulnerability, Criticality & Risk Assessment
https://vtrans.vermont.gov/planning/transportation-resilience/statewide
Questions?