Examining the Potential Impacts of Maintenance Investment and Capital Reinvestment in Vermont's Roadway Infrastructure Network

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Introducing Strategic Disinvestment

Strategic disinvestment is a deliberate effort to prioritize transportation infrastructure assets or programs with respect to their strategic importance, or lack thereof, in a system. Essentially, strategic disinvestment shifts investment away from the least critical or essential assets towards the most critical or essential assets. The current state of the practice includes disinvestment strategies as outlined in Figure 1.

The aim of this research was to demonstrate quantitative methods to aid in meeting the challenge of disinvestment decision-making. One of the strategic VAOT goals is to provide equitable access and mobility throughout the state, therefore disinvestment decisions should not have disproportionately adverse impacts on disadvantaged populations. This required the development of a new tool, the **Vermont Vulnerability Index** (VVI), to use alongside improvements in the **Network Robustness Index** (NRI) and **Critical Closeness Accessibility** (CCA) to identify candidate disinvestment corridors and assess their impact on vulnerable populations.

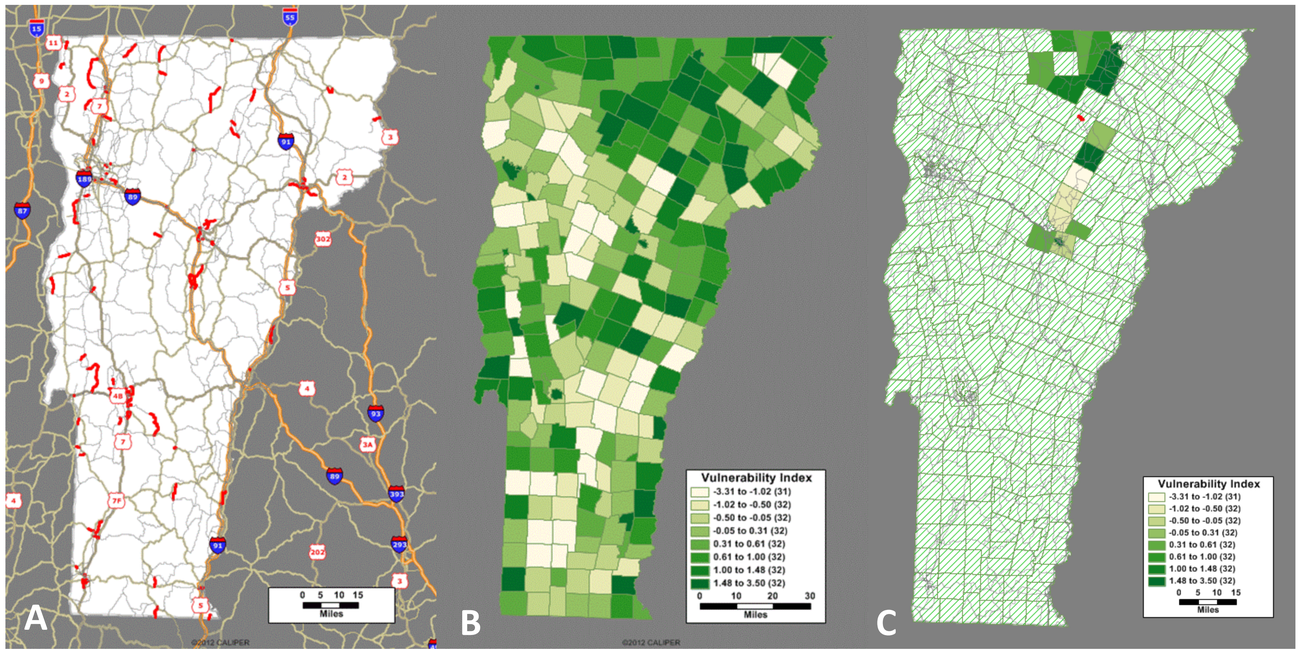

Figure 2. A) Selection of candidate corridors for disinvestment based on low NRI and low CCA. B) VVI for each town in Vermont. C) Set of towns affected by example disinvestment corridor.

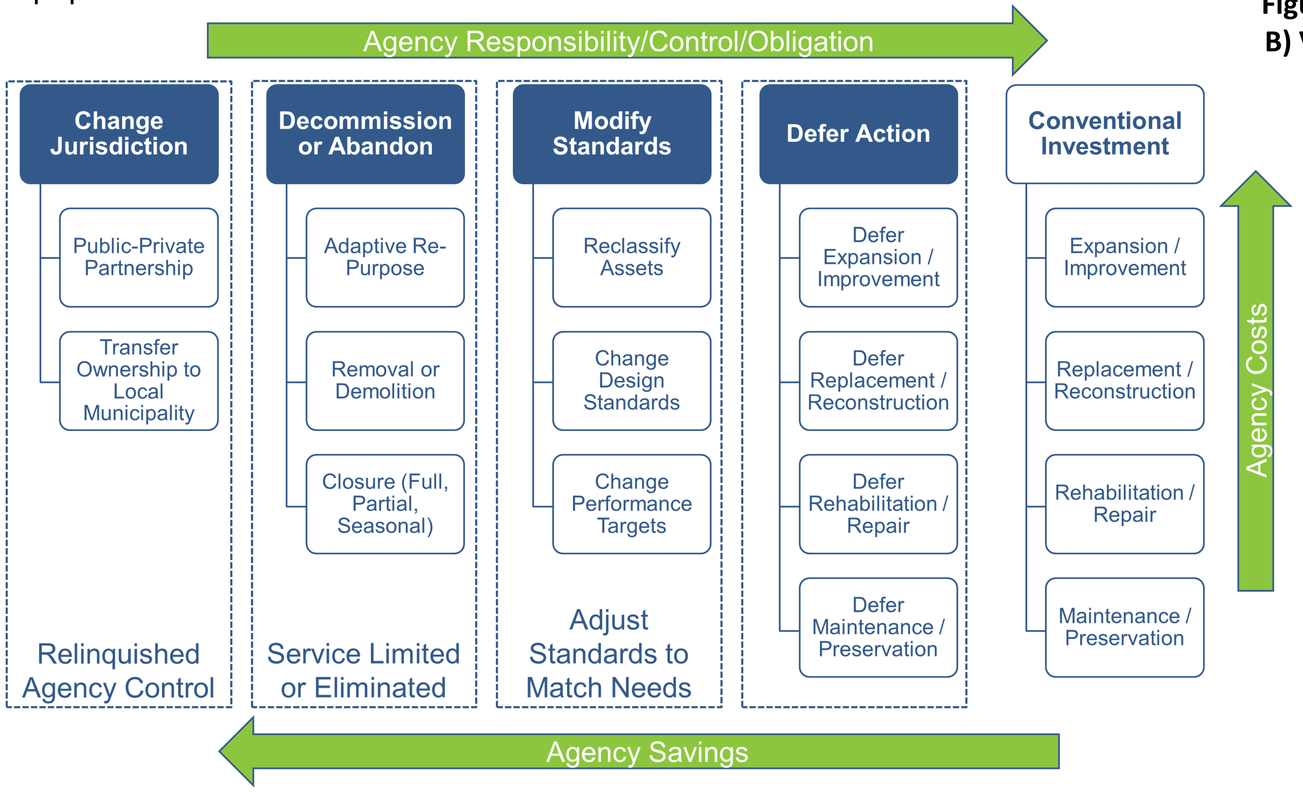

Figure 1. Disinvestment framework.

Disinvestment Decision Tools

NRI: link-based performance measure that quantifies the relative importance of each link in road network based on the link's contribution to the overall travel time for entire network (low NRI implies the corridor is not critical to the performance of the network)

CCA: link-based performance measure that quantifies access to critical services in the network (low CCA implies that the corridor is not important in gaining access to emergency services including police, fire, and medical)

VVI: town-based metric that quantifies vulnerability of the population with respect to transportation and mobility and specific to the range of vulnerabilities encountered in Vermont

Vermont Vulnerability Index

vulnerability at town level

$$VVI_i = \sum_a \left(\frac{f_{ia} - \tilde{f}_a}{\max f_a - \tilde{f}_a} \right)$$

binary indicator (I_{VVI}) based on all towns

$$VVI_i \geq \tilde{VVI} \rightarrow I_{VVI_i} = 1$$

$$VVI_i < \tilde{VVI} \rightarrow I_{VVI_i} = 0$$

select link analyses to identify set of towns (X_c) most affected by corridor

$$\frac{Q_{c_{jk}}}{\sum_{jk} Q_c} \geq 0.005 * Q_c \rightarrow X_c \cup \{x_j, x_k\}$$

assess disproportionate effect (E_c) on vulnerable populations

$$E_c = \frac{\sum_i I_{VVI}}{|X_c|}$$

Vulnerability Metrics (f_{ia})
Income Per Capita
People Living in Poverty
17 Years and Under
65 Years and Over
Housing Value
Mobile Homes
Renter-occupied Homes
Households without Access to Vehicle
Cognitive Difficulty
Ambulatory Difficulty
Employed in Extractive Industries
Employed in Transportation & Warehousing, and Utilities
Limited English Proficiency
Black or African American
Black or African American Female Householder

Acknowledgments | **This work was funded by the Vermont Agency of Transportation.**