

A Method of Identifying Critical Road Infrastructure for Maintaining Food Accessibility

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Issue

A key purpose of the transportation system is to provide access to critical services such as grocery stores. Maintaining food access during an emergency or other disruption is all the more important, particularly for vulnerable households. Most people in the United States rely on the use of private automobiles for grocery shopping. Thus, disruptions to road networks due to heavy precipitation, flooding, or even major maintenance and repair projects present notable threats to accessibility. Regional planning models that address food accessibility issues (not all do) typically do not consider households' familiarity with grocery locations. However, during a disruptive event, a household's familiarity with at least one available route to a retail grocery location becomes paramount. Identifying the roadways that are most critical to food access can help decision makers devise strategies to mitigate the risks of food insecurity for vulnerable households and populations.

Researchers at the University of Vermont developed a methodology that provides an ordinal measure of demand-side food access. It takes into account the spatial distribution of both the origin and destination, the topology of the road network, and the characteristics of the roadway network such as capacities, volumes, and travel speeds. The analysis considers household familiarity with retail grocery locations, destination weighting to account for retail grocery characteristics (square footage), and origin weighting to account for household vulnerability. The researchers demonstrated the methodology using the travel demand model for Chittenden County, Vermont.

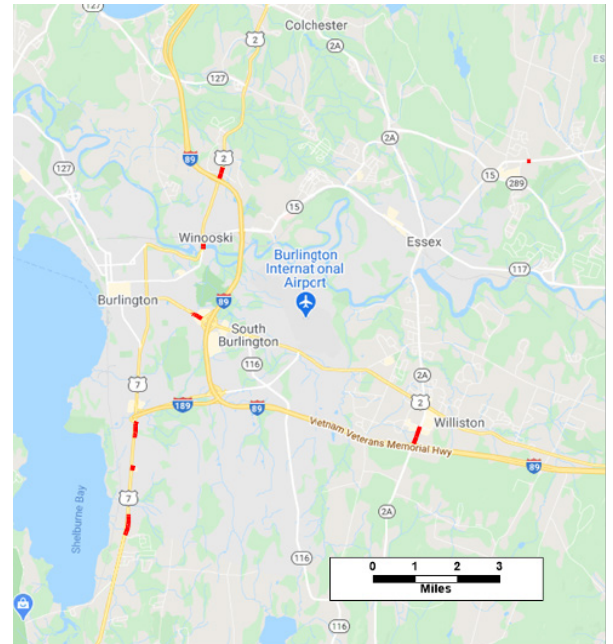


Figure 1. The most critical roadway links for maintaining food access in Chittenden County, VT, as identified by the Critical Closeness Accessibility measure

Key Research Findings

The researchers developed a modified Critical Closeness Accessibility performance measure to identify the roadway infrastructure components that are most critical for maintaining food access. The team developed an origin and destination weighting approach in which trip origins are weighted according to household vulnerability and destinations are weighted by retail-grocery square footage. The Critical Closeness Accessibility measure was further enhanced by employing actual grocery-shopping data from the National Household Travel Survey to incorporate realistic travel expectations for households' retail grocery familiarity.

The Critical Closeness Accessibility approach allows for a great deal of flexibility in modeling different types of locations. Quantitative measurements like grocery store square footage or household income can be used to model key road network links, or a decision maker’s qualitative assessment of the relative importance of particular nodes can be incorporated.

The researchers used the modified accessibility measure to identify the most critical 25 links in the Chittenden County road network (Figure 1). A high-resolution view of the five most critical roadway segments illustrates a corridor of US Route 7 in South Burlington that provides a non-redundant linkage between two neighborhoods with high residential density (including many vulnerable households) and nine retail grocery locations (Figure 2). The corridor carries high traffic volumes, meaning that a disruption would affect accessibility for a large number of households.

Policy Implications

The researchers used the TransCAD platform and coded the modified Critical Closeness Accessibility algorithm into the software via Caliperscript. To implement this methodology in a new jurisdiction, practitioners would need to do the same. Alternatively, researchers or practitioners interested in applying the methodology to different roadway networks may contact the research team to discuss a partnership.

More Information

This policy brief is drawn from “Targeted Investment for Food Access,” a report from the National Center for Sustainable Transportation, authored by David C. Novak, James L. Sullivan, and Meredith T. Niles of the University of Vermont. The full report can be found on the NCST website at <https://ncst.ucdavis.edu/project/targeted-investment-critical-food-access-rural-new-england>.

For more information about the findings presented in this brief, please contact David Novak at david.novak@uvm.edu.

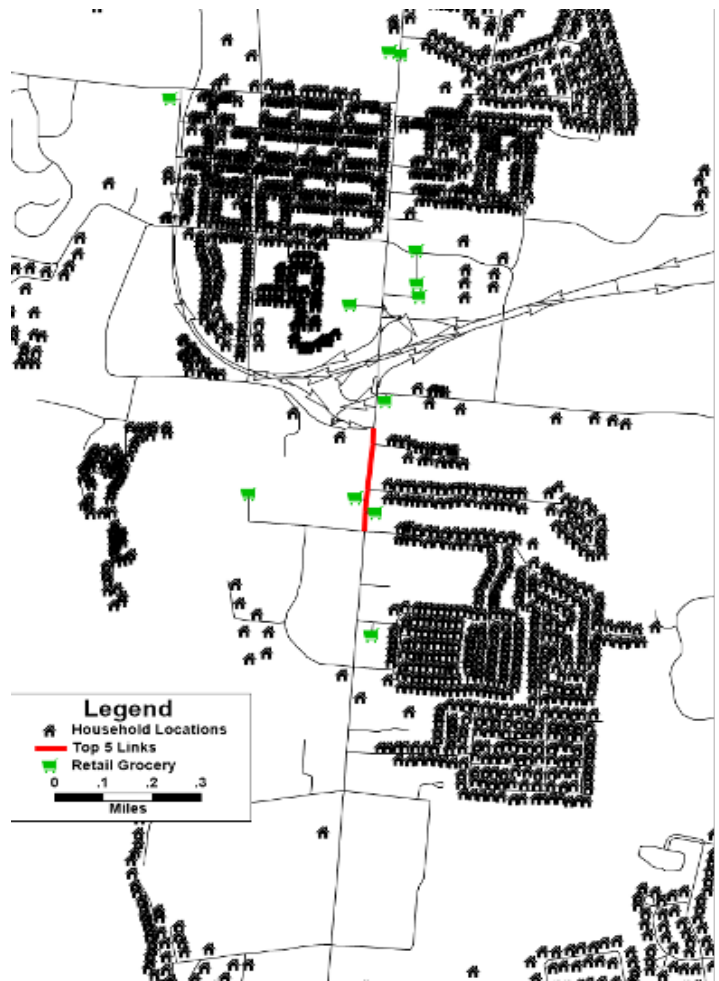


Figure 2. A high-resolution view of a neighborhood in South Burlington showing key roadway links along a stretch of US Route 7 connecting residential neighborhoods to food access

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