5.2.3 Evaluating Operational Resilience of a Highway Corridor in Wisconsin, using a GIS-based Freight Network

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Various transportation systems, including the corridors that support high volumes of freight and passenger travel, face unplanned emergencies, disruptions and disasters. On February 6, 2008, more than a thousand vehicles stranded due to severe winter storm on a 17-mile segment of I-90/94 highway between Hudson and Beloit, brought movement through the corridor to a standstill. Such disruptions affect the overall economy by constraining the free and efficient flow of commodities, and have a significant impact on travelers. This research provides decision makers with operational resilience information of transportation infrastructure that will help ensure reliable function of the Hudson to Beloit Interstate Highway Corridor while fortifying against vulnerabilities.

This research follows a framework for developing statewide freight system resiliency plan to identify the top 10 high-risk segments along the Corridor. GIS is used to model the freight flows obtained from the commodity flow database Transearch®. The GIS network model built uses ArcGIS Network Analyst® capabilities for finding alternative paths, and acts as a network framework for assessing operational resilience by considering the operational and service level impacts on travel distances and travel times. The vulnerabilities of the bridges, culverts, and road segments of each corridor segment are assessed for various failures using a frequent analysis method of FMEA (failure mode and effects analysis). The vulnerability ratings along with evaluation metrics and alternate route analysis are used to determine an overall resiliency rating for each corridor segment, thus resulting in a prioritization of the segments.

This research also presents computed freight resiliency measures reflecting the corridor's observed behavior during two weather events that affected the same corridor in 2008. The resiliency measures were calculated by GIS analysis of collected GPS data through the Freight Performance Measurements project of the FHWA.