

MOUNTAIN-PLAINS CONSORTIUM

PROJECT BRIEF | March 2015

Building a Framework for Transportation Resiliency and Evaluating the Resiliency Benefits of Light Rail Transit in Denver, Colorado



the **ISSUE**

You spend your life seeing white swans, but a single black swan proves that not all swans are white. Nassim Tale's "Black swan theory" explains how extreme outliers often have disproportionate impacts. Researchers evaluate transportation resiliency of cities in the wake of a "black swan" event such as a major shift in gas prices. Their work will evaluate the need for investments in transit and other transportation infrastructure.

the **RESEARCH**

This report presents a three-part research program examining transportation resiliency and the ability for a transportation system to maintain or return to a previous level of service after a disruptive, black swan event such a drastic gas price shock. The first part uses a multinomial logistic regression mode choice model to derive resiliency scenarios of various driving cost increases. Modal shifts are based on the supposition that travel behavior will adapt with increased fuel costs to be more like households with a similar percentage of household income being dedicated to transportation. We assess the influence that transit infrastructure, active transportation, the built environment, land uses, and socio-economic status. The second part focuses in on city-scale resiliency by accounting for active transportation infrastructure in a detailed manner not feasible at the regional scale. The research applies a "level of traffic stress" methodology that accounts for both the presence and quality of bicycling, walking, and transit modal options as well as the presence of barrier roads and highways. We measure the resiliency value of these multi-modal transportation infrastructures - even if few people are using those facilities today. The third part develops a Transportation Economic Resilience (TER) rating system.



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North Dakota State University
South Dakota State University

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University of Utah

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Project Title

Building a Framework for
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the FINDINGS

While high income represents one path to resilience, our results suggest that higher resilience can be found with proximity to high levels of employment, with more compact and connected street networks, or with better transit infrastructure. Current transit usage does not make as big of a difference as living in the vicinity of good transit infrastructure. In other words, there is a significant option value to transit. Results at the city scale suggest proximity to downtown and the availability of multi-modal transportation options helps increase resilience. There is also a cumulative effect. For instance, lower-income suburban areas tend to spend more of their household budget on transportation than higher-income urban areas, thus increasing their vulnerability. TER scores range from zero to 100; when fuel price doubles, the average TER score is 80.6, which equates to a 1.94% increase in the percent of household income consumed by transportation to work.

the IMPACT

The results illustrate that transportation choice helps create network redundancy and facilitates adaptability under extreme conditions; alternatively, more suburban locations with fewer transportation options are far more vulnerable. While alternative fuels and improvements to the fuel economy of vehicles would help reduce the long-term impacts, the most vulnerable households are already spending more than 30% of their income solely on transportation costs and would be the least likely to benefit from technological improvements. Should a “black swan” event occur, the most resilient households will live in cities and regions that plan for and invest in diversifying and expanding transportation choice.

For more information on this project, download the entire report at <http://www.ugpti.org/resources/reports/details.php?id=788>

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7938 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.



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