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OFFICE OF POLICY ANALYSIS, RESEARCH & INNOVATION

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Travelers tend to avoid sites of network disasters even after the sites have been restored. This finding is confirmed by patterns in the San Francisco Bay network after a disaster similar to the I-35W Bridge collapse.

# Responding to the Unexpected: Traveler Behavior and Network Performance in the Wake of the I-35W Bridge Collapse

*Researchers evaluated the traveler behavior and the performance of transportation networks in the wake of the I-35W Bridge collapse, advancing understanding of the impacts of full closure compared with staged construction on the safety, quality and cost of construction projects.*

## What Was the Need?

The collapse of the Minneapolis I-35W Bridge August 1, 2007, was a tragic disaster. However, it also provided a rare opportunity to evaluate the effects of a prolonged, unexpected disruption of a major transportation network as well as a unique window into the behavior and decision-making mechanisms of travelers responding to it.

## What Was Our Goal?

The objective of this study was to understand how travelers' behavior and transportation network performance evolve in response to a major, unexpected disruption. Researchers examined:

- Travelers' decisions about travel route, mode of transportation, destination, departure time and telecommuting with the closure and subsequent reopening of the I-35W Bridge.
- The accuracy of the current assumption of user equilibrium in travel demand models for such events, in this case, whether the restoration of capacity to one area of the Twin Cities network led to an even redistribution of traffic within the network as a whole, thus improving commute times on average to their predisruption state.

## What Did We Do?

Immediately after the I-35W Bridge collapse, researchers distributed mail-in questionnaires to drivers and transit users near major parking garages in downtown Minneapolis and the University of Minnesota. Following the reopening of the I-35W Bridge, researchers collected data on driver behavior using:

- GPS devices installed in commuters' vehicles to track travel times, routes and speeds for 13 weeks; participants in this study were also required to complete a series of surveys.
- A second round of the initial paper-based surveys, this time distributed both in hard copy and via the Web.

Researchers also obtained Mn/DOT loop-detector data concerning highway network traffic volumes and speeds before and after the bridge collapse. Finally, they combined, geocoded and analyzed all data to evaluate driver behavioral reactions to the bridge reopening, and to compare traffic dynamics and network performance before the bridge collapse, immediately after it and following the bridge reopening.

## What Did We Learn?

The bridge collapse did not disastrously disrupt the Twin Cities network. Traffic patterns restabilized in six weeks, and total travel demand did not change significantly. Travelers were very resourceful in dealing with altered traffic patterns—most frequently by changing routes and departure times, and less frequently by forgoing trips or

*continued*

*"Closing bridges and other links for construction may not have the dire effect a first analysis could imply. Mn/DOT should consider closing rather than trying to keep open network links during construction. Doing so will make projects faster, less expensive and safer."*

**–Rabinder Bains,**
Economic Policy Analyst,
Mn/DOT Office of
Investment Management

*"This project showed that travelers are resilient to adaptive transportation networks; there's a lot of latent capacity that can quickly be deployed to make up for disrupted transportation links."*

**–David Levinson,**
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Minnesota
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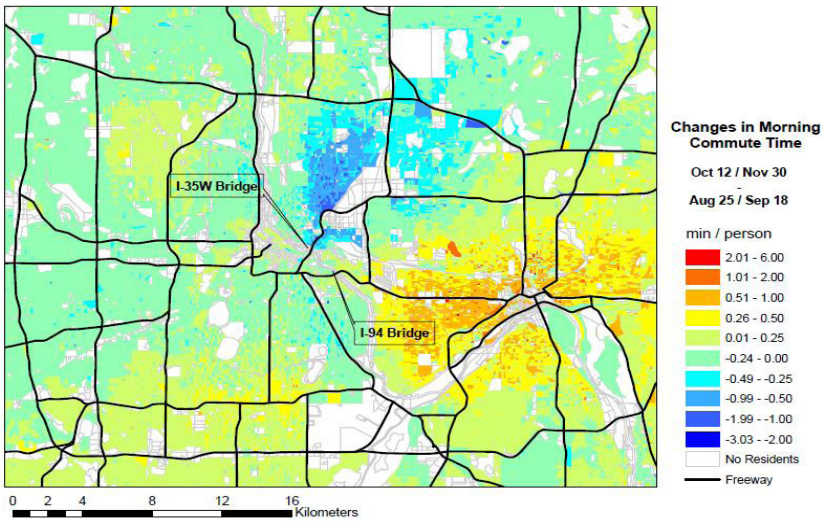


The removal of the fourth lane of I-94 increased average commute times more than the I-35W Bridge reopening decreased them. While residents closer to the I-35W Bridge benefited from its reopening (blue areas), residents to the east of the I-94 Bridge (red and yellow areas) did not.

finding alternative destinations. Adding a fourth lane to I-94 between I-35W and Highway 280 reduced commute times for many travelers.

The reopening of the I-35W Bridge did not restore the same traffic demand patterns as models predicted. Researchers concluded that driver route choice behavior differs between unexpected and preplanned disruptions. Drivers seem initially to avoid the site of an unexpected disruption as a perceived risk, and after its restoration do not re-establish predisruption routes either because of traumatic associations or habituation to new routes.

Consequently, the reopening of the I-35W Bridge's 10 lanes did not benefit all travelers and did not fully compensate for the loss of capacity caused by the subsequent removal of the fourth lane on I-94. While the new I-35W Bridge experienced no congestion, it failed to attract much traffic from the I-94 crossing, even after the latter's lane closure. Commuters living near I-35W were better off after the reopening, but travelers living farther away experienced longer commute times. After the I-94 lane removal, average travel times for the network as a whole significantly worsened.

## What's Next?

The study provides a baseline for future research in many traffic-related fields concerning driver behavior and traffic demand models. It will also help transportation officials improve network operational efficiency and safety by distributing resources based on more accurate models of network needs.

Finally, the project is a significant development in understanding the impacts of full closure versus staged construction contracting. Changing planning models would allow Mn/DOT to fully close a network link during construction, significantly speeding it and improving the safety of construction workers. Closure would also dramatically reduce construction costs by altering A & B contracting practices that offer heavy financial incentives for contractors to complete projects quickly.

Mn/DOT has several ongoing projects related to network closure, including the recently completed Report 2010-04, "TH-36 Full Closure Construction: Evaluation of Traffic Operations Alternatives," and a parallel study of the I-35W disruption, "Behavioral Response to the I-35W Disruption: Gauging Equilibration," sponsored by the National Science Foundation and expected to be completed in September 2010.

*This Technical Summary pertains to Report 2010-21, "Traffic Flow, Road User Impacts of the Collapse of the I-35W Bridge Over the Mississippi River," published June 2010. The full report can be accessed at* http://www.lrrb.org/PDF/201021.pdf.