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IMPLEMENTATION SUMMARY

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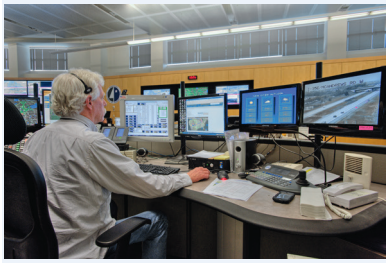
PROJECT COST:
$80,000



RTMC engineers monitor traffic volume and congestion patterns to help direct drivers to other routes.

Putting Research into Practice: New Software Models MnPASS HOT Lane Changes

Investigators used previous research to develop a tool to improve driver mobility and safety. When changes in traffic patterns and congestion occur, RTMC technicians use the software to model and design changes to MnPASS access.

What Was the Need?

In Minnesota, high-occupancy toll (HOT) lanes are used by buses, carpools and motorists with transponders that trigger payments for rush hour use. During rush hour, fees increase as congestion increases; at other times, the lanes are free for all users.

Closed-access lanes are separated from other lanes by continuous double white lines. Until recently, drivers could only enter or exit these lanes from select ramps and access points. Open-access MnPASS lanes are separated from other lanes by skipped double white lines that become solid only at certain points to limit movement from regular to HOT lanes.

MnDOT research in 2014 concluded that both closed and open HOT lane configurations effectively and safely improve traffic capacity. But researchers anticipated that roadway sections on an HOT lane corridor may eventually experience safety and mobility problems if toll prices are lowered or traffic volume increases. During heavy traffic, driving speeds often vary dramatically between HOT and general purpose lanes. Drivers moving into MnPASS lanes may force other drivers to brake suddenly to avoid collisions and trigger shockwaves of slowed or stopped traffic behind them. MnDOT prefers open-access designs for the increased options they offer road users, but it is not clear how best to manage access to reduce the incidence of shockwaves and the safety and mobility problems they create.

What Was Our Goal?

The goal of this implementation effort was to develop a software tool that the Regional Transportation Management Center (RTMC) could use to assess corridor operations and design. Based on design recommendations from earlier research, the tool would allow RTMC users to predict the safety and mobility impacts of a change from open to closed HOT lanes, and estimate where in the corridor such changes could be implemented safely and effectively.

What Did We Implement?

This effort leveraged findings from three previous MnDOT studies. Models and methods from "Evaluation of the Effect of MnPASS Lane Design on Mobility and Safety" (Report 2014-23) were used for the architecture of this new system. Investigators drew on "Expanding and Streamlining of RTMC Freeway Network Performance Reporting Methodologies and Tools" (Report 2014-05) to implement methods for retrieving historical data from RTMC's system, cleaning the data and integrating it into the new software package. The project team then incorporated data from "Safety Impacts of the I-35W Improvements Done Under Minnesota's Urban Partnership Agreement (UPA) Project" (Report 2017-22) to develop and calibrate the new tool for estimating traffic impacts and shockwaves. A car-following and lane-changing model developed in a 2013 University of Minnesota study provided effective methods for ensuring realistic vehicle modeling and shockwave generation.

continued

"Nothing like this has been developed anywhere else. There is a lot of debate around the country about high-occupancy designs. This tool helps us develop designs and monitor existing corridors."

—Brian Kary,
Director of Traffic Operations, MnDOT Regional Transportation Management Center

"This tool is calibrated for the Twin Cities. It takes real-time data and diagrams each location separately for lane changes and reaction time. It took theoretical ideas and made them usable."

—John Hourdos,
Director, Minnesota Traffic Observatory, University of Minnesota

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MnDOT has changed most of its MnPASS lane markings from double solid lines to skipped double lines to allow more open movement between general purpose and HOT lanes. A new software tool allows RTMC engineers to reassess MnPASS access to respond to changing traffic patterns.

How Did We Do It?

Investigators developed this system with links to MnDOT's database to draw on historical data to identify patterns of traffic demand over time and generate predictions of points in the MnPASS lanes at which shifts from open- to closed-access HOT lanes will offer the most benefit. The program's code integrates the various models, data sets and tools mentioned above into software that integrates smoothly with the RTMC's current software and capabilities for collecting speed and volume data, developing interfaces to model impacts of changing open designs at certain points in the freeway corridor to closed designs. The tool includes a module for access design, a module for generating data and a web application.

What Was the Impact?

After receiving training in using the new software, RTMC engineers have embraced the MnPASS design tool to regularly report MnPASS performance to the Federal Highway Administration and to generate quarterly and annual analyses and recommendations for changing specific locations from open access to closed access. Closing requires restriping and changing signage—operations that allow MnDOT to respond quickly and easily to shifts in traffic patterns and potential mobility and safety impacts.

The project also offers data for the broader transportation community in which experts debate the relative merits of open- and closed-access HOT designs. With MnPASS, MnDOT has emerged as a leader in open design; this software allows sophisticated modeling of design impacts for the national traffic operations community.

What's Next?

The MnPASS design tool effectively monitors corridor behavior and design changes. Improvements may yet be made to allow data calibration and validation for slower traffic speeds that represent mobility breakdowns, and to refine aspects of car-following and shockwave models. Increased density scenarios can also be further improved to better accommodate traffic density increases in regular lanes alongside HOT lanes.

In its current form, the tool will be used to analyze open- and closed-access designs on the Interstate 394 corridor to determine the best locations for changes to MnPASS lanes, and positions MnDOT and the RTMC to respond to traffic demand changes in the future.

This Implementation Summary pertains to Report 2018-11, "A Tool for Designing MnPASS Access Spacing," published March 2018. The full report can be accessed at mndot.gov/research/reports/2018/201811.pdf.