Michigan Department of Transportation
RESEARCH Administration

RESEARCH SPOTLIGHT

Project Information

REPORT NAME: Identify Best Locations for New Flex-Route Projects Throughout the State of Michigan

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MDOT Project Manager

Jason Firman, P.E.

ITS Operations Program Engineer
Transportation Systems Management and Operations

FirmanJ@Michigan.gov
517-388-3378

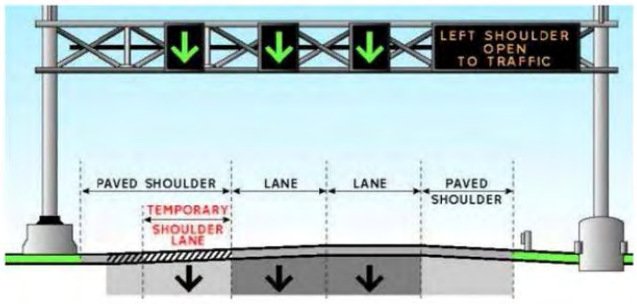
RESEARCH ADVISORY PANEL MEMBERS:

André Clover, Joe Gorman, Rob Maffeo, Rob Marz, Stephanie Palmer, Nathan Schilling, Ben Schimberg and Brad Sharlow.

Prioritizing locations for flex routes to ease traffic congestion

Part-time shoulder use (PTSU) on Michigan's highways is an effective flex-route strategy to ease congestion during peak traffic times. Comprehensive assessments of 16 highway corridors illustrated potential flex-route benefits and important corridor variables. A new ranking tool will help the Michigan Department of Transportation (MDOT) identify the best locations for future flex-route projects.

PROBLEM



A widened left shoulder can become a temporary travel lane – or flex route – during peak travel times, easing congestion and creating safer driving conditions.

Adding highway capacity is resource-intensive and not always the best solution to traffic congestion. Strategies to provide temporary additional lanes, however, are gaining popularity. In 2017, MDOT tested this strategy with the US-23 Flex Route, which used highway shoulders as travel lanes during peak traffic hours. Subsequent research found that these changes have reduced congestion. As a result, design and operational lessons learned are informing MDOT decisions on potential expansion of PTSU.

Implementing PTSU requires widening shoulders and installing cameras and message boards to communicate with motorists. In addition to existing traffic congestion, designers and planners must consider safety, roadway design, costs and benefits when choosing highway segments for flex routes. To maximize roadway investments, MDOT was interested in methods to identify and prioritize additional PTSU candidate locations to mitigate traffic congestion safely and cost-effectively.

RESEARCH

A comprehensive literature review and state DOT surveys on flex-route practices and strategies preceded an initial screening of Michigan's freeway network to identify congested areas. Researchers examined

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"The ranking tool produced in this research helps MDOT understand where flex routes could alleviate congestion. The tool's flexibility will allow us to focus on different criteria to maximize road investments."

Jason Firman, P.E.
Project Manager

crash data, roadway geometries, and segment-specific data on vehicle speeds, travel times and traffic volumes across times of day.

The project's Research Advisory Panel and regional staff helped to identify 16 freeway segments that experience traffic congestion for further evaluation as potential PTSU candidates. The evaluation included a review of crash data from 2021 to 2023 and traffic volume data from MDOT. Operational and safety analyses on the 16 corridors compared the percent of hours each corridor was congested, and heat maps illustrated variations in delay trends across the corridors.

Using Highway Capacity Software that simulates freeway operations under different scenarios, researchers analyzed the impacts of implementing PTSU along the corridors. Comparisons were made between existing conditions, adding flex lanes with similar traffic levels and adding flex lanes combined with a 10 percent increase in volume assumed to occur with the added capacity. Based on design assumptions developed by MDOT, researchers estimated the effectiveness of each corridor over a 24-hour period and during morning and afternoon peak travel periods using average travel time, vehicle hours of delay above free-flow travel time and total user delay cost.

RESULTS

The investigation showed that current morning and afternoon congestion levels in both directions on each of the 16 corridors could be significantly reduced with PTSU. Reductions in delay and travel times illustrated for each corridor were only slightly offset by an assumed 10 percent increase in traffic volume. While safety analyses showed that crash rates on each corridor varied with direction and time of day, safety was generally enhanced and congestion reduced.

Researchers used the measures of effectiveness to develop a corridor ranking scheme that helped identify the best locations for new PTSU projects. A simple spreadsheet tool described each corridor using parameters such as:

- **Operational measures**, including speed indicators, travel times, total vehicle miles traveled and total delay costs.
- **Safety**, represented by crash rates at different time periods.
- **Geometric characteristics**, such as median and shoulder widths, presence of bridges and on/off ramps, and other highway features.
- **Traffic descriptors**, including average daily traffic and proportion of trucks.

Scaling, normalizing and weighting parameter values allowed a ranked scoring of corridors by need to reduce congestion and feasibility of PTSU implementation. Researchers assigned higher weights to vehicle hour delay and crash rate, though weighting is flexible for varying priorities or unique local conditions. The final ranking prioritized corridors where PTSU would be most beneficial, balancing operational improvements with safety and feasibility concerns.

IMPLEMENTATION

The new methodology provides a data-driven approach for MDOT to choose the best locations for new flex routes based on safety and corridor-specific factors.

Operation and maintenance costs associated with PTSU locations, including signs and other intelligent transportation system components, are an ongoing consideration. While public response to PTSU has been positive, the agency will continue to balance adding temporary versus permanent highway capacity.

Research Administration

Principal Investigator

Peter Savolainen
MSU Foundation Professor and Chairperson, Civil and Environmental Engineering
Michigan State University
428 S. Shaw Lane, Room 3546C
East Lansing, MI 48824

pete@msu.edu
517-432-1825

Contact Us

PHONE: 517-281-4004

E-MAIL: MDOT-Research@Michigan.gov

WEBSITE: Michigan.gov/MDOTResearch

The final report is available online at
MDOTjboss.state.mi.us/TSSD/tssdResearchAdminDetails.htm?keyword=SPR-1751.

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