Michigan Department of Transportation
RESEARCH Administration

RESEARCH SPOTLIGHT

Project Information

REPORT NAME: Signal Performance Measures Pilot Implementation

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TOTAL COST: $242,757

COST SHARING: 20% MDOT, 80% FHWA through the SPR, Part II, Program

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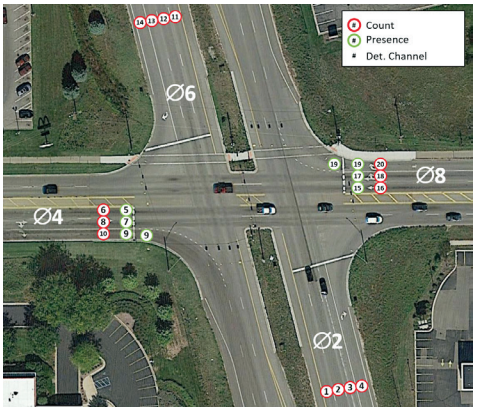
Pilot signal performance software improves driver travel times and traffic engineering efficiency

Automated Traffic Signal Performance Measures (ATSPM) software developed by the Utah Department of Transportation (UDOT) has been implemented by numerous agencies and used to more actively manage traffic signal operations and maintenance. Researchers implemented a pilot project on two traffic corridors with data-logging equipment and traffic signal performance-measuring software to analyze activity at traffic signals, identify patterns and optimize signal timing to improve traffic flow. Cost-benefit analysis identified a potential 25-to-1 benefit-to-cost ratio from the implementation on the two pilot corridors, benefiting drivers, traffic engineers and maintenance staff. Researchers provided a tool to estimate the cost of implementing various levels of more active signal management.

PROBLEM

Seven MDOT signal engineers oversee planning, design, construction, operation and maintenance of 1,645 signals throughout the state, as well as another 1,498 state-owned signals managed by local road agencies. MDOT lacks dedicated resources and systems to actively manage traffic signal operations and maintenance, and often relies on public complaints to identify poor signal operations. This reactive mode of addressing signal operations issues leads to increased delay and safety concerns. Existing methods and resources for optimizing traffic signal performance are based on limited data, and the optimization



Researchers implemented signal performance measures at this intersection of US-31 and Riley Street in Holland, Michigan, as well as at 11 other intersections.

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"With this ATSPM system, we can visually see platoons of vehicles approaching a traffic signal and whether the signal is green or red as the vehicles are arriving. The system reports what percentage of vehicles are arriving while the signal is green. When we make a timing change, we can see how it affects traffic within 20 minutes. Although not every intersection needs to be monitored at this level of detail, this project shows there are very compelling benefits to be gained by moving toward more active signal management."

Douglas Adelman
Project Manager

is done much less frequently than the federally recommended three to five years. In order to justify additional resources to actively manage traffic signal operations and maintenance, the anticipated benefit and cost must be known.

RESEARCH

Two Michigan corridors were equipped with advanced detection, communication and high-resolution traffic controllers required to implement the Utah ATSPM software. The intersections chosen included nine signals along the US-31 corridor in Holland and three signals along the US-31 corridor in Traverse City. The UDOT ATSPM dashboard provided the ability to monitor and measure the performance of signalized intersections remotely. This tool was used to identify signal operations issues on the corridors. The ATSPM data were used to monitor and optimize traffic signal timings over many months. The travel times along the corridors were compared before and after signal optimization, and user delay benefits were derived.

RESULTS

This research validates that investment in equipment and resources to monitor and adjust traffic signal timing can pay significant dividends in Michigan, reducing congestion and improving safety. The tools can help both maintenance staff and engineers proactively identify and resolve issues. Performance-based decision tools and data can equip MDOT to develop its own long-term performance-monitoring approach. The traveling public will save vehicle operating costs and travel time through signalized corridors, improving MDOT's reputation in the public eye. This research provides valuable cost and benefit information for MDOT and other agencies that are considering more active management of their traffic signal systems to improve safety and mobility along arterial roadways. This pilot implementation of ATSPMs cost $371,000 and provided an estimated annualized user delay benefit of $1.05 million. The quantified benefits of this project can help provide justification for implementation of ATSPMs. The cost-estimating spreadsheet can assist agencies in providing resource estimates (equipment, maintenance and operations) required for discrete levels of active signal management.

IMPLEMENTATION

Researchers presented a conceptual plan for statewide deployment of an ATSPM system. The plan includes both internal and contracted staffing estimates required to operate and maintain an ATSPM system. The initial cost to equip one existing signalized intersection with side-street and advanced mainline detection and communication, and a data-logging controller, and to initially deploy ATSPMs is approximately $48,000 per signal. The controllers being deployed for connected vehicle applications and central system integration are ATSPM capable, and thus will help to reduce this initial cost. Researchers recommend a phased deployment of the ATSPM system, prioritized for intersections with high traffic volumes that will benefit most from optimized signal timing. MDOT is currently using the results of this study to provide justification for more active management of traffic signal operations and maintenance. The cost-estimating tool is being used to assist with prioritizing signal monitoring strategies across the state and to estimate the resources required to support these strategies.

Research Administration

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This final report is available online at
www.Michigan.gov/documents/mdot/MDOT-Signal-Performance-Measures-Pilot-Implementation_645942_7.pdf.

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