

Research Spotlight

Project Information

REPORT NAME: Costs and Benefits of MDOT Intelligent Transportation System Deployments

START DATE: June 2013

REPORT DATE: July 2015

RESEARCH REPORT NUMBER:
RC-1631

TOTAL COST: \$235,933

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

MDOT Project Manager Collin Castle, P.E.

Connected Vehicle Specialist
Michigan Department
of Transportation
8885 Ricks Road
Lansing, MI 48909
castlec@michigan.gov
517-636-0715



ITS technologies reduce delay, crashes and emissions, with significant returns on investment

Intelligent transportation systems (ITS) technologies have gained popularity in recent years as a method for relieving road congestion and improving safety through better traffic and incident management. Since 2006, MDOT has invested more than \$100 million in ITS. As of 2013, MDOT operated more than 800 devices throughout the state, covering more than 500 miles of highways. A user survey showed that Michigan motorists were satisfied with ITS, and a benefit-cost analysis suggested significant returns on investment.

Problem

Measuring the value and cost-effectiveness of MDOT's ITS investments was necessary to ensure these devices were enhancing traffic operations and safety. While MDOT has tracked extensive data about these costs and benefits, it needed to synthesize that information into an easy-to-understand benefit-cost analysis. The analysis will better inform future investment decisions and help MDOT respond to requests for information about the ITS system and its value.

Research

To quantify the benefits and costs of ITS in Michigan, researchers used performance



Dynamic message signs improve mobility by providing information that helps drivers respond to road conditions and incidents.

data collected by MDOT's transportation operations centers (TOCs). The following technologies and services were included in the benefit-cost analysis:

- **Closed-circuit television (CCTV)** cameras, which monitor real-time roadway conditions and provide information to first responders and the public.

“It was important to MDOT management to understand the costs and benefits of ITS technologies. The information will help us make wise investment decisions in the future.”

Collin Castle, P.E.
Project Manager

- **Microwave vehicle detection systems** (MVDS), which provide information about vehicle speeds, volumes, classification and occupancy that is useful for real-time incident identification and analysis of conditions over time.
- **Dynamic message signs** (DMS), which provide real-time information about road conditions to drivers.
- **Freeway Courtesy Patrol** (FCP), which provides several services to motorists involved in freeway incidents. Two of Michigan’s three TOCs operate FCP, and the third plans to implement it.
- **Mi Drive**, MDOT’s online traveler information website (www.michigan.gov/drive).

Researchers also created models of seven representative corridors using the Quadstone Paramics microsimulation software package. These simulations helped to determine the impact of DMS, CCTV and MVDS on collision rates.

A literature review, online survey of Michigan drivers and comparisons with comparable TOCs in other states helped to inform the researchers’ methods of quantifying benefits.

Results

Researchers calculated benefit-cost ratios statewide and in each of the three

TOCs. To offer increased detail and help address the difficulty of assigning dollar values to benefits that do not translate directly to monetary values, they calculated four levels of benefit-cost ratios:

- Level A includes only benefits from reductions in travel delay, fuel consumption and emissions, estimated from TOC data.
- Level B includes Level A benefits plus crash reduction benefits estimated by analyzing impacts of ITS on traffic crashes.
- Level C includes Level B benefits plus benefits from Mi Drive, based on the total amount of time drivers spend on the site.
- Level D includes all of the above plus benefits from FCP, based on an estimated average value of \$60.25 per assist found in a 2006 Georgia Department of Transportation study.

When all benefits are taken into account, ITS in Michigan was found to provide \$3.16 in benefits for every dollar invested. Benefits were greatest in the Southeast Michigan TOC, which includes Metro Detroit. The West Michigan TOC, which includes the Grand Rapids area, has the next highest benefit, even though it has not yet implemented FCP. The Statewide TOC, covering the rest of the state, has the lowest benefit-cost ratio. However, all three TOCs experienced greater benefits than costs from ITS devices, even if only Level A benefits were considered.

Researchers also calculated the benefits of the various types of devices. CCTV had the greatest benefit statewide, with a benefit-cost ratio of 3.95, although DMS and FCP were only slightly lower at 3.81 and 3.82, respectively. MVDS installations were significantly less beneficial, with a benefit-cost ratio of only 1.02, likely because of their relatively low utilization.

Value

This project confirmed that ITS implementation in Michigan offers a good return on investment that could be improved

even further. Researchers offer four recommendations to build on existing benefits of ITS in Michigan. First, further ITS investments, particularly in DMS and CCTV, warrant consideration. Second, the planned implementation of FCP in the West Michigan TOC is expected to produce benefits comparable to those currently realized in the Detroit area. Third, a consistent statewide incident database shared between the three TOCs would aid communication between agencies and make future cost and benefit estimation easier. Finally, there is a need for TV and radio outlets to share safety-related travel information, and Mi Drive information should be tailored based on seasonal trends.

Research Administration

Principal Investigator

Jun-Seok Oh, P.E., P.T.O.E.

Director, Transportation Research Center for Livable Communities
Western Michigan University
1903 W. Michigan Avenue
Kalamazoo, MI 49008
jun.oh@wmich.edu
269-276-3216

Contact Us

PHONE: 517-636-4555

E-MAIL: mdot-research@michigan.gov

WEB SITE: www.michigan.gov/mdotresearch

This final report is available online at

www.michigan.gov/documents/mdot/RC1631_495995_7.pdf.

Research Spotlight produced by CTC & Associates LLC, December 2015.