

# RESEARCH UPDATE

MAY 2011

## Roundabouts: Making a Safer Interchange

Not too long ago, encountering a roundabout on Michigan roadways was a rare occurrence. Not so today, with almost 100 roundabouts constructed and more planned or under way.

Increasingly, Michigan is turning to the roundabout as a safer alternative for some intersections than a traditional signal light or four-way stop. The roundabout's circular design, where entering traffic



One of the almost 100 roundabouts constructed in Michigan since 1996, this roundabout is near Bennett Woods Elementary School at the intersection of Bennett and Hulett roads in Okemos.

### In This Issue: Making a Safer Road

This issue of *Research Update* highlights research projects and new practices that bolster MDOT's robust traffic safety culture and advance its goal of making a safer road.

Roundabouts: Making a Safer Interchange	1
Education Key to Success of Clare Roundabout	2
More Rumble Strips on Rural Highways, Fewer Crashes	3
Making a Safer Driver	3
National Trends	4
Research in Progress	5
Program News	6



yields to vehicles traveling counterclockwise around a central island, has the effect of calming traffic and reducing congestion while decreasing the number of conflict points present in a typical signalized intersection.

Roundabouts improve safety for motorists, pedestrians and bicyclists alike, with these intersections tallying fewer and less severe crashes than other intersection types. And roundabouts save money by reducing the long-term operational and maintenance costs associated with traditional signalized intersections.

#### Identifying a need

While roundabouts are becoming more common in Michigan, they are still relatively new to many drivers and residents. Gaining public support for roundabouts and helping the traveling public learn new "rules of the road" is vitally important.

The Michigan Department of Transportation (MDOT) undertook a research project to understand roundabout driver behavior and effective educational countermeasures to improve safety. The result is educational materials for MDOT and local transportation agencies to help spread the word about roundabouts in Michigan—how to use them and why they are a safer alternative to traditional intersections.

#### Understanding the audience

An effective educational campaign speaks directly to its audience. With this in mind, researchers wanted to know more about the public perceptions of roundabouts, and for the drivers having difficulty navigating them, the driving behaviors in need of correction. Survey results and crash data gave researchers the information they needed to craft an effective message.

*continued*

## Roundabouts: Making a Safer Interchange

continued from page 1

Results of a survey of almost 12,000 road users, mostly from Michigan, indicate that many drivers and residents are skeptical of roundabouts during the planning stages, though over time their support for them grows. Exposure to roundabouts increases drivers' comfort and enhances their perceptions of roundabout safety.

An examination of recent crash data for Michigan roundabouts and crash data from previous studies identified factors commonly associated with roundabout crashes. Among them:

- Difficulty understanding yield signs.
- Excessive speed when entering a roundabout.
- Confusion about lane selection and lane changes in multilane roundabouts.
- Failure to recognize pedestrians and bicyclists.

### Delivering the message

Armed with knowledge of public perceptions and problematic driver behaviors, researchers developed a collection of educational materials.

- **Brochures** explain the advantages of roundabouts and offer step-by-step instructions for navigating a roundabout.
- **Animated videos** demonstrate the interaction of vehicles, pedestrians and bicyclists in roundabouts in real time.
- **Posters and PowerPoint presentations** describe the operational and safety benefits of roundabouts.

These carefully crafted materials provide the traveling public with a variety of ways to learn the roundabout "rules of the road." They also help MDOT and local transportation agencies advance the message that roundabouts are a safe and effective alternative to signalized intersections.

### For more information

Many of the educational materials developed in this project will be available on the MDOT Web site at [www.michigan.gov/roundabouts](http://www.michigan.gov/roundabouts).

## Education Key to Success of Clare Roundabout

In 2004, the leaders of Clare, a community of about 3,000 in central Michigan, had a decision to make as they prepared to reconstruct the interchange at U.S. 127 and Mission Road on the south side of the city. Among the four options under consideration: a roundabout.

Most community residents had not seen a roundabout and knew little about them. MDOT Bay Region staff stimulated interest within the community by providing sketches and information about the design, operation and safety effects of roundabouts well in advance of the expected construction date. Almost four years before, in fact.

After more than a year of public meetings, one-on-one educational ses-

sions with city leaders, and a public comment period facilitated by MDOT Bay Region staff, the community was ready to move forward with construction of its first roundabout.

Education continued to play a role when the roundabout opened in June 2009, with police opting for education over tickets for drivers having problems navigating the roundabout on opening day.

Local law enforcement has noted fewer crashes than expected at the roundabout, and community feedback has been positive. Today, the landscaped roundabout, maintained with city resources and the help of local volunteers, serves as a pleasing gateway to Clare's south side.

*"The Clare roundabout has been an overwhelming success. It has changed the dynamics of the community."*



—Jack Hofweber, Mt. Pleasant Transportation Service Center Manager, MDOT Bay Region



This dual roundabout in Brighton is located at Lee and Whitmore Lake roads and Lee Road and southbound U.S. Highway 23.

[michigan.gov/roundabouts](http://www.michigan.gov/roundabouts). Read more about this research project—"Educating the Public to Navigate Roundabouts"—in the *Research Spotlight* available at [www.michigan.gov/mdot/0,1607,7-151-](http://www.michigan.gov/mdot/0,1607,7-151-)

[9623\\_10724\\_48681\\_51213\\_51738---,00.html](http://www.michigan.gov/mdot/0,1607,7-151-9623_10724_48681_51213_51738---,00.html). The research report will be available online soon at [www.michigan.gov/mdot/0,1607,7-151-9622\\_11045\\_24249---,00.html](http://www.michigan.gov/mdot/0,1607,7-151-9622_11045_24249---,00.html).

# More Rumble Strips on Rural Highways, Fewer Crashes

Lane departures—where vehicles cross over the centerline or leave the pavement edge—can lead to head-on or run-off-the-road collisions that are among the most severe crashes on rural highways in Michigan. Many of these crashes involve distracted or drowsy drivers.



Centerline rumble strips have been shown to reduce cross-centerline crashes.

## An ambitious initiative

Rumble strips provide an audible warning and a physical vibration that warns drivers they are leaving the driving lane. Studies show that rumble strips reduce lane departure crashes, which translates to fewer injuries and deaths.

In 2008, MDOT began installing shoulder and centerline rumble strips on existing pavements on two- and four-lane rural highways in Michigan. It was the largest initiative of its kind. A two-part research project—“Impact of Non-Freeway Rumble Strips”—will evaluate this significant safety investment. In addition to analyzing crash data, researchers will examine alternative installation methods, preventive maintenance treatments, impacts on bicyclists, and the impact of road noise.

## Data gathering in Phase I, results in Phase II

The first phase of the project began last summer with researchers gathering “before” data on road segments scheduled for rumble strip installation. Researchers used video cameras temporarily mounted on road signs to gather field data on driver behavior; MDOT’s pavement management system video logs provide data on pavement condition. Research will document bicycle-related safety concerns and make recommendations on how to address them so motorists and bicycles can safely share

the road. Research results on pavement condition and bicycle safety will be available after Phase I concludes in June 2012.

In Phase II, researchers could produce a database of before-and-after crash data. If significant crash reductions are found, this project could serve as a benchmark for future rumble strip installations in Michigan and other states.

Contact Project Manager Jill Morena at [morenaj@michigan.gov](mailto:morenaj@michigan.gov) to learn more about this ongoing project.



This camera, temporarily mounted on a road sign on a horizontal curve, monitors vehicle position within the lane of traffic and encroachments into the adjacent lane or shoulder.

# Making a Safer Driver

Putting safer drivers on safer roads will continue to reduce traffic fatalities and injuries on Michigan roadways. Changing the driver behavior that results in crashes is one way to put safer drivers on the road. The practices designed to change driver behavior are called behavioral countermeasures, and they can take the form of new legislation, enhanced enforcement, public education, engineering measures or other actions.

## Countermeasures with potential

While all are well intentioned, research has shown that behavioral countermeasures vary widely in their effectiveness. What makes sense in theory may not translate well into practice. And ensuring success can require more than simply implementing the countermeasure itself. Sometimes a companion marketing campaign or an enhanced enforcement program is required. Michigan’s success with increasing seat belt use is an example of such a coordinated effort.



The driving simulator at Central Michigan University’s Center for Driving Evaluation, Education & Research will be used to gather data for the drum spacing project.

A research project that began in the fall of 2009, “Improving Driver Safety with Behavioral Countermeasures,”

## Making a Safer Driver

*continued from page 3*

is examining behavioral countermeasures used nationwide with the potential for success in Michigan. The project panel selected two countermeasures for further investigation: (1) increased law enforcement, or threat of increased law enforcement, in construction zones; and (2) the

effects of drum spacing in construction zones on speed and driver behavior.

### A historical perspective

In the past, Michigan provided increased law enforcement in construction zones as an informal practice. Historical data from these periods will supplement data gathered from current pilot tests of driver behavior. The accumulated data, and an

examination of other states' practices, will help researchers determine whether increased law enforcement in construction zones is likely to improve safety.

Research results will be available after the project concludes in September 2011. Contact Project Manager Kim Lariviere at [larivierek@michigan.gov](mailto:larivierek@michigan.gov) to learn more about this ongoing project.

---

---

# National Trends

---

---

## 'Safety Edge' on Rural Highways

An inattentive driver drifts off a rural roadway. A quick turn of the steering wheel and the car's tires start to rub up against the vertical edge of the pavement, making it difficult for the driver to make a smooth return to the lane of traffic. Some drivers can make the correction and return safely to the pavement, but this scenario could end in a crash.

### A safety issue

Pavement-edge drop-offs occur where the paved edge of the roadway meets the unpaved shoulder. Sometimes the shoulder material has settled, creating a more dramatic drop-off than intended, or pavement edges lack durability and start to ravel.

These drop-offs can have a significant impact on safety. At least one state has

found that drop-off crashes are four times as likely to include a fatality as other types of crashes on similar roads.

### A simple solution

The Safety Edge is a simple but effective solution that the Federal Highway Administration (FHWA) is promoting for reducing crashes related to pavement-edge drop-offs on asphalt and concrete pavements. On asphalt pavements a commercially available shoe that attaches to standard paving equipment shapes the edge of the pavement to 30 degrees during paving, minimizing vertical edges. Easy to install and shown to reduce total crashes by more than 5 percent, the Safety Edge also requires little extra cost to implement.

### Testing the technology

FHWA's strong interest in the Safety Edge is shared by MDOT's top management. Working with FHWA, MDOT will install the Safety Edge on two repaving projects this summer, one using hot-mix asphalt and one using concrete. Together, MDOT and FHWA will monitor the test sections.

MDOT is not the only Michigan agency to benefit from tests of the Safety Edge. Rural two-lane highways managed by local agencies often lack the minimum 3-foot paved shoulder MDOT requires on its rural roadways, creating an environment where pavement-edge drop-offs are closer to the drive lane. MDOT's tests of the Safety Edge can serve as a model for local agencies in applying this simple, low-cost safety improvement.



*"This summer's tests of the Safety Edge have multiple benefits. Installations in the field will help us assess the balance between safety and constructability. And the projects can serve as a model for local agencies interested in using this new technology."*

—Mark W. Bott, P.E., MDOT Traffic Operations Engineer and Traffic and Safety Focus Area Manager



*An engineer measures a fresh 30-degree Safety Edge during construction. (Courtesy of FHWA.)*

### For more information

FHWA's Every Day Counts program is working with transportation agencies around the country to accelerate deployment of the Safety Edge and other innovative technologies. Learn more about the Safety Edge at the Every Day Counts Web site at [www.fhwa.dot.gov/everydaycounts/technology/safetyedge/](http://www.fhwa.dot.gov/everydaycounts/technology/safetyedge/).

# Research in Progress

## Current MDOT Safety Research

Researchers are exploring ways to make a safer road in 13 MDOT projects under way or scheduled to begin soon. Through projects ranging from an evaluation of passing relief lanes to an assessment of pedestrian safety improvements, the Office of Research and Best Practices (ORBP) is actively supporting MDOT's traffic safety culture.

Read about the first two projects below on pages 3 and 4 of this issue, and see the sidebar on this page to learn more about a project getting under way this fall—"Study of High-Tension Cable Barrier on Michigan Roadways."

Project Title	Start Date	End Date
Improving Driver Safety with Behavioral Countermeasures	Fall 2009	Fall 2011
Impact of Non-Freeway Rumble Strips – Phase I	Summer 2010	Summer 2012
Evaluating the Performance and Effectiveness of Roundabouts	Fall 2010	Fall 2011
Evaluating the Performance and Making Best Use of Passing Relief Lanes	Fall 2010	Fall 2011
Safety Analysis of 4-Lane to 3-Lane Conversions (Road Diets) in Michigan	Fall 2010	Fall 2011
Transportation Needs of Michigan's Aging Population	Fall 2010	Fall 2011
Sharing the Road: Optimizing Pedestrian and Bicycle Safety and Vehicle Mobility	Fall 2010	Spring 2012
Evaluating Pedestrian Safety Improvements	Fall 2010	Fall 2012
Implementing Quick Clearance in Michigan	Summer 2011	Summer 2012
Best Practices for Emergency Rerouting	Fall 2011	Fall 2012
Transportation Patterns for Older Drivers in Michigan	Fall 2011	Fall 2012
Study of High-Tension Cable Barrier on Michigan Roadways	Fall 2011	Fall 2014
Development of Performance Measures for Non-Motorized Dynamics	Fall 2012	Fall 2013



Researchers are identifying opportunities to improve pedestrian and bicycle safety through innovative countermeasures in the in-progress project "Sharing the Road: Optimizing Pedestrian and Bicycle Safety and Vehicle Mobility." (Courtesy of The Greenway Collaborative.)

## Reducing Cross-over Crashes with Cable Barrier



This straight-line design is one of five high-tension cable barrier systems approved for use in Michigan.

Median crossover crashes are among the most dangerous crashes on the nation's highways, often resulting in fatalities or severe injuries.

In 2008, MDOT began installing 280 miles of high-tension cable median barrier on roadway sections with a history of cross-median crashes, in order to reduce the frequency and severity of these crashes.

Nearly 95 percent effective in redirecting impacting vehicles, cheaper to install than concrete barriers or metal beam guardrail, and easy to maintain, high-tension cable barrier is a logical choice for MDOT.

This fall, researchers will begin an examination of cable barrier installations in Michigan. In addition to considering the effectiveness of cable barrier, researchers will analyze life-cycle costs, location considerations, and the effects of cable barrier on different types of road users (for example, motorcycles). The research project will produce guidelines for future cable barrier installations in Michigan.

# Program News

**Research and Implementation Manual:** Draft and final revisions to ORBP's *Research and Implementation Manual* will be posted on the ORBP Web site at [www.michigan.gov/mdot/0,1607,7-151-9623\\_10724\\_48681-201471--,00.html](http://www.michigan.gov/mdot/0,1607,7-151-9623_10724_48681-201471--,00.html) as they become available. The manual includes forms and guidance for MDOT staff involved in research and principal investigators.

**Research reports online:** Links to recently completed and past research reports can be found at [www.michigan.gov/mdot/0,1607,7-151-9622\\_11045\\_24249---,00.html](http://www.michigan.gov/mdot/0,1607,7-151-9622_11045_24249---,00.html). Two reports completed this year are now available:

- *A Critical Evaluation of Bridge Scour for Michigan Specific Conditions* by Donald Carpenter (Lawrence Technical University) and Carol Miller (Wayne State University)
- *Efficient Use of Recycled Concrete in Transportation Infrastructure* by Jacob E. Hiller, Yogini S. Deshpande, Yinghong Qin and Cory J. Shorkey (Michigan Technological University)

**Region visits:** ORBP will be coming to an MDOT region office near you this spring. We would like to hear innovative ideas from our experts in the field. What should we be researching? How can ORBP help? The first meeting will be with the Superior Region on May 24, 2011.



**VISION:** *To be a recognized leader in coordinating applied research and implementing results by identifying cutting-edge research topics, implementing research results and coordinating development of research projects. Our core strength results from a highly integrated network of dynamic partnerships among transportation professionals.*

## The ORBP Team

### Main ORBP Office

VACANT, Engineer of ORBP  
Trudy Schutte, Executive Secretary  
Wen-Hou Kuo, Statistician  
Angela Nelson, Department Analyst

### MDOT Statewide Library

Alexandra Briseno, Librarian

### Best Practices/Legislative Initiatives

André Clover, Administrative Engineer

### Transportation Research Program

Michael Townley, Section Manager  
Annette Nealey, Administrative Assistant  
VACANT, Research Analyst  
Homer Sprague, Statistician

## Contact Us

Phone: 517-241-2780

E-mail: [mdot-research@michigan.gov](mailto:mdot-research@michigan.gov)

Web site: [www.michigan.gov/mdotresearch](http://www.michigan.gov/mdotresearch)