Michigan Department of Transportation
RESEARCH Administration

RESEARCH SPOTLIGHT

Project Information

REPORT NAME: Developing Michigan Pedestrian and Bicycle Safety Models

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University Match**	$62,500
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**University of Michigan Transportation Research Institute (a University Transportation Center project).

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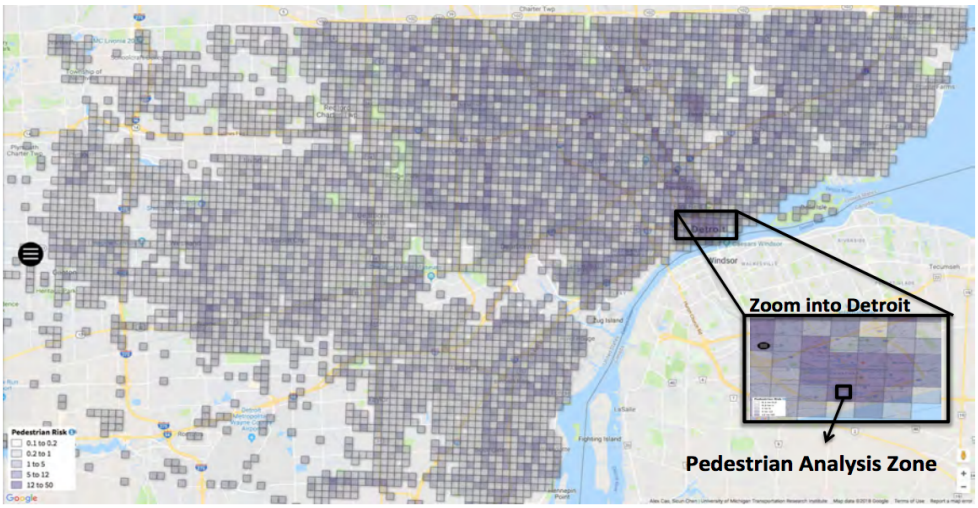
New safety tool highlights crash risks for pedestrians and bicyclists across the state

Walking and bicycling provide a variety of health and environmental benefits. However, these activities can also pose safety risks, as pedestrians and cyclists are more likely to be hurt or killed if they are involved in a crash with a motor vehicle. To improve safety for all travelers, the Michigan Department of Transportation (MDOT) developed new risk calculation formulas and an online tool that helps show where in the state there is a higher potential for these types of crashes. These resources will help MDOT better target its mitigation strategies to these locations.



An interactive map illustrates the risk scores for pedestrians in Wayne County (darker squares indicate greater risk).

PROBLEM

In Michigan and across the country, crashes involving pedestrians or bicyclists occur less frequently than other types of traffic collisions. But when they do happen, statistics show that these crashes can be more severe, causing injuries or death. In Michigan, State Police records from 2019 reveal that 1,129 bicyclists were injured in crashes with motor vehicles and 21 were killed. During the same year, 1,910 pedestrians were hurt on state roadways and 149 were killed.

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"This new risk model offers another tool in our toolbox for improving pedestrian and bicycle safety. Being able to display risk factors in an easy-to-see way helps our regions make informed decisions on where to focus their efforts for these vulnerable roadway users."

Carissa McQuiston, P.E.
Project Manager

To improve safety for all roadway users and reduce the likelihood of these crashes occurring, MDOT sought to identify the road features, circumstances and human factors that play a role in these events. If verifiable causes could be established, MDOT reasoned that crashes could be anticipated and possibly prevented.

Researchers set out to develop a risk assessment model, with the objective of determining the probability of crashes involving pedestrians and bicyclists anywhere in the state.

RESEARCH

The research team began by reviewing previously published studies on crash risks. They then compiled a list of factors that may affect the likelihood of a crash involving vehicles and pedestrians or bicyclists at a given location. These factors considered information in five categories:

- **Roadway attributes.** The width of the road, speed limit, number of travel lanes, presence or absence of sidewalks, traffic volume, and other features.
- **Land use.** The environment (residential or commercial, urban or rural, and other factors).
- **Socio-demographic characteristics.** The pedestrian's or bicyclist's age, gender, income, and use of alcohol, among other details.
- **Human behavior.** The direction the pedestrian or bicyclist is traveling relative to traffic, as well as information like roadway crossing behavior.
- **Historical crash data.** Previous crashes in the area, culled from state crash data over a 12-year period from 2004 to 2015.

Researchers assigned weights to each of the identified factors and chose six widely available and frequently updated sources from which to compile the necessary data. The team then evaluated a wealth of established statistical and data science methodologies used for estimating risk. Recognizing that the likelihood of a crash involving a pedestrian or bicyclist is dependent upon exposure, the researchers developed a new mathematical formula that incorporates the opportunity for these crashes and is tailored specifically to Michigan.

RESULTS

By applying the formula to each of Michigan's 83 counties, the team created exposure models and numeric risk scores for both pedestrians and bicyclists that indicate the theoretical probability of a crash at any location in the state. Higher scores signify a greater likelihood of a crash, allowing MDOT to effectively see where safety improvements are most needed.

This research project resulted in two new products: geographic information system (GIS) files and a web-based Pedestrian and Bicyclist Safety Risk Assessment Tool—an interactive format that gives users the ability to query the level of risk for pedestrians or bicyclists in any area of the state. This tool can be accessed via desktop or mobile device and allows for customized searches and targeted investigations. A user manual provides guidance for interacting with the tool and interpreting the results, as well as a sample case study that illustrates possible outcomes.

IMPLEMENTATION

With the ability to assess crash risks for pedestrians and bicyclists, MDOT has an unprecedented opportunity to focus its limited resources and strategically direct mitigation efforts to areas that would benefit the most.

Over time, as the accuracy and reliability of the risk scores is confirmed through validation and calibration against actual crash data, MDOT will be better equipped to implement appropriate countermeasures and improve safety for the state's most vulnerable roadway users.

Research Administration

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This final report is available online at
www.Michigan.gov/documents/mdot/SPR-1651_-_Final_Report_Developing_Michigan_Pedestrian_and_Bicycle_Safety_Models_626802_7.pdf.

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