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Digitizing for Better Decisionmaking

by Clark Merrefield, Susan Smichenko, Gerry Flood, and Melonie Barrington

Michigan has established a successful government-academia partnership to help local agencies make data-driven decisions on road safety.

Flashing beacons on span wires, advance signage, and dedicated lanes are among the safety infrastructure improvements identified and analyzed using Roadsoft software on this stretch of road in Van Buren County, MI.

If you worked in road safety for a local transportation agency before the advent of the Internet, you might remember desks piled high with stacks of paper reports detailing crash data. For that data to even reach your desk might have taken weeks, months, or even years. You might also remember sticking pushpins on maps and the tedious, manual process of recording and organizing crash data.

Even before the digitization of crash reporting data became possible, some local agencies in Michigan had the resources to analyze and use data about crashes to make targeted decisions on roadway safety

improvements. Many, however, did not. These agencies simply lacked the technical capacity to use data in decisionmaking effectively. On top of this, access to crash data often was hampered by a slow-moving paper trail.

But the picture in Michigan has changed dramatically over the past 20-plus years. Through a combination of forward-thinking leadership, partnership with law enforcement, and technological advances, crash data in Michigan today is exchanged, accessed, and analyzed in hours and days rather than months or years.

Local agencies in Michigan now have easy access to crash, roadway, and traffic data through an application called Roadsoft®. A desktop software application developed by Michigan Technological University (Michigan Tech) with funding from the Michigan Department of Transportation (MDOT), Roadsoft provides local agencies with data and tools that help them manage roadway assets, collect field data, oversee maintenance jobs, and analyze safety needs.

The software is complemented by MDOT's Local Safety Initiative (LSI), a hands-on, collaborative technical assistance program that provides technical resources for Roadsoft users, on-the-road discussions about safety, and other kinds of guidance. Through Roadsoft and LSI, local and State agencies are now able to make roadway safety improvements based on accessible, actionable information.

How Roadsoft Came To Be

Michigan has approximately 122,000 miles (196,340 kilometers) of roads, 92 percent of which are under local jurisdiction. In the early 1990s, MDOT realized that if it was going to reduce serious crashes, it would have to bring robust data analysis to the local level.
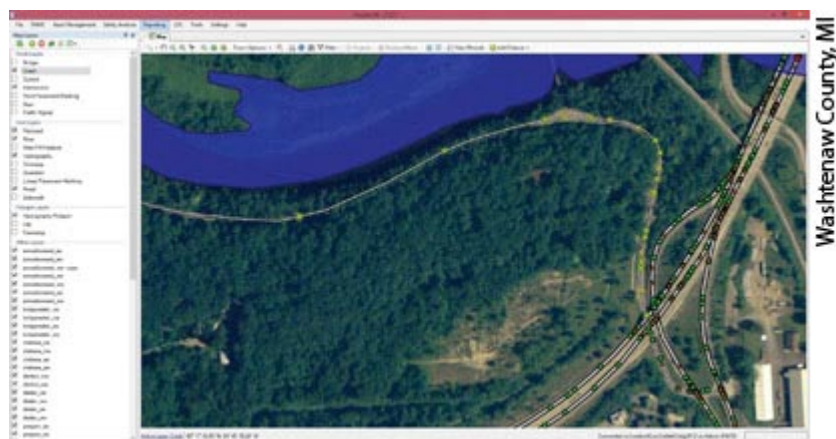
A screen capture from the Roadsoft interface shows crashes in Washtenaw County, MI. Green dots indicate crashes during which there was property damage only, orange triangles indicate crashes that resulted in injury, and the red X (top right) indicates a fatal crash.

That safety imperative led MDOT and Michigan Tech to collaborate on developing Roadsoft through a public-academia partnership. With local agencies in mind, MDOT and Michigan Tech designed Roadsoft as a free tool for managing roadway assets, such as knowing when signs need to be replaced and roads need to be repaved.

Since the release of Roadsoft in November 1993, Michigan Tech has produced seven versions to keep the software current and address the ever-changing needs of transportation agencies. Today, Roadsoft is
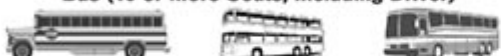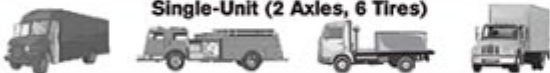
the software of choice for road asset management and safety data analysis for many local agencies in Michigan.

Roadsoft was developed as a pavement management application; however, shortly after its initial release, safety analysts at MDOT and Michigan Tech recognized that agencies could easily import safety data to Roadsoft's linear referencing system. (Linear referencing refers to measuring distance between road elements, repr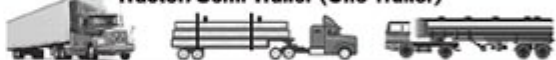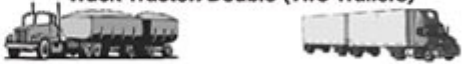esented by points on a line.) Through Roadsoft, more than 400 local agencies--including cities, villages, county road commissions, tribes, planning organizations, and police departments--enter and share their safety and asset data with regional and metropolitan planning agencies across the State. Roadsoft, in turn, benefits local agencies and the State DOT.

Roadsoft now functions as a one-stop shop for local agencies to manage their operations, maintenance, and roadway safety processes. The software has tools to manage pavement condition data, signs, guardrails, bridges, culverts, signals, sidewalks, driveways, maintenance histories, traffic counts, intersection features, and crash data.

"I jokingly refer to our approach to the development and support of Roadsoft as removing the 'I can't,'" says Tim Colling, director of the Michigan Tech Center for Technology and Training. "I can't do safety analysis because I don't have the data. I can't do safety analysis because I don't have the data analysis tools. I can't do safety analysis because I don't have the technical training. Roadsoft helps clear those hurdles to safety analysis by providing data tools and training that remove the 'I can'ts.'"

The element of user control is what makes Roadsoft distinctive. Roadsoft is used by MDOT staff who work on the Local Safety Initiative, which helps local agencies make data-driven decisions to improve safety on their roads. The program is guided by the people who use it, it is provided at no cost to local agencies, it is voluntary, and users receive technical assistance and software support from the people who wrote the software.
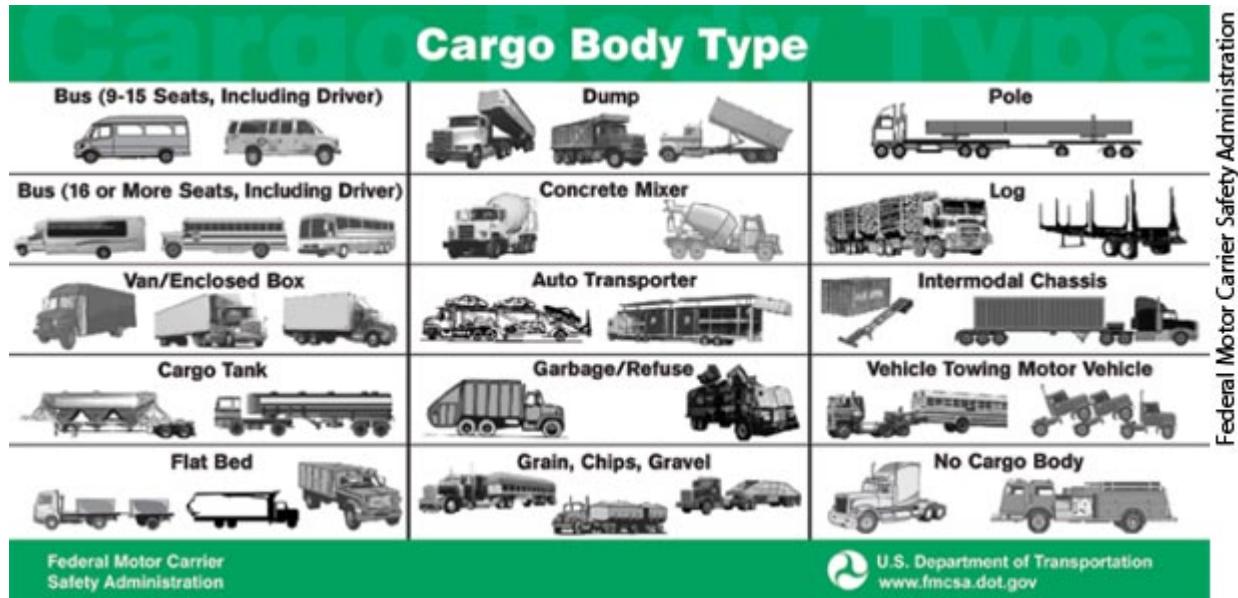

These are examples of the visor cards that State police in Michigan will use to quickly identify the vehicle configurations of large trucks involved in crashes.

In a collaborative environment with academia, local agencies make decisions about safety improvements using a three-pronged approach that is at the core of LSI: data analysis, common software tools, and safety training.

First Prong: Technical Assistance And Data Analysis

To meet the goals of Michigan's Toward Zero Deaths campaign, MDOT created the LSI program in 2004 to help counties, cities, tribes, and villages make road safety improvements based on actionable data. Data analysis based on high-quality, accurate data is the backbone of LSI and data-driven decisionmaking in Michigan.

"As a neutral third party [to local and State governments], the difference I see is that LSI is a partnership; it's a relationship," Colling says. "LSI is not something that is prescriptive or dictatorial or parochial. It's a totally different paradigm of how locals and a DOT can work together."

MDOT has three full-time safety engineers dedicated to assisting local agencies with data analysis. When local agencies do not have the staff or technology to perform indepth safety data analyses, they can reach out to MDOT technical staff, who can perform trend analyses on crash data within the local agency's purview and pinpoint specific sites where there are safety concerns. The local agency then reviews the list and adds or subtracts from it.

"We were really successful at using Roadsoft to identify problem areas, as well as utilizing MDOT to help us find hotspots," says Wayne Schoonover, former highway engineer at the Ionia County Road Commission. "We addressed quite a few of those over the years, and a lot of those hotspots started disappearing. That's when the focus shifted to look at more systemic fixes."

But systemic and even piecemeal improvements are only as good as the data that back them up. That is why the Michigan State Police and MDOT work closely together to improve the quality of crash data. They will launch a new crash report form for law enforcement in January 2016. The agencies expect the new form, which they have worked on for more than 3 years, to lead to more accurate crash data. For instance, State police will not need extensive knowledge of large truck types to accurately identify trucks involved in crashes. Laptops in police vehicles will have electronic versions of Federal Motor Carrier

Safety Administration visor cards, which will enable quick visual identification of commercial vehicles involved in crashes.

Through meetings, collaboration between State police and MDOT, and data analysis on both sides, it became evident that the weak points in crash information were in the reporting forms. To address this issue, State police sent MDOT the first electronic crash report in 2006, and today Michigan's crash data entry is 96 percent electronic. State police staff and MDOT continue to collaborate and share ideas during bimonthly meetings of their joint Crash Data Users Group. In addition, a dedicated trainer from the State police has visited police across the State to teach them about the new form.

"We talk about data at the users group meetings," says Sydney Smith, manager of the Michigan State Police Traffic Crash Reporting Unit. "We talk a lot about quality control, and we talk about MDOT's concerns, if they have any, and concerns from road commissions. We take down the necessary information and try to find a way to incorporate their input into our quality control efforts."

In 2013, the Michigan Governor's Traffic Safety Advisory Commission presented an Outstanding Traffic Safety Achievement Award to the cross-disciplinary collaborative team that made Michigan's crash form easier to use and more aligned with Federal standards.

Second Prong: Common Software Tools

Local agencies that use Roadsoft oversee more than 90 percent of the State's total road mileage. Because so many Michigan road agencies use Roadsoft, it serves as a common software language for discussions between local agencies and MDOT about crashes and road elements.

In the early 2000s, Michigan Tech and Roadsoft users, primarily at Michigan road commissions, formed the Roadsoft User Group and began meeting to discuss improvements to the software. The group holds meetings several times per year as needed, in person or via webinar.

Here, MDOT staff and law enforcement participate in road safety audit training, which is part of Michigan's Local Safety Initiative.

The meetings have led to every major function in Roadsoft, including collision diagrams, connections to the Google Street View™ mapping service, and interactive reports that let users rank the relative safety of

road sections and curves. The user group also has improved intra-agency communication, as new modules have brought in data from outside the safety realm (for example, from road maintenance staff).

"As my sign shop was out doing their work, they would upload their progress to Roadsoft, and the next day I would take a look," Schoonover says. "I would have a brand-new, updated database, and I would know what was going on with my signs. A lot of that…came about from the Roadsoft User Group, which we and other road commissions, along with the Michigan Local Technical Assistance Program, set up."

Local agencies also have available to them a simple benefit-cost spreadsheet for their crash data. With the spreadsheet, agencies can skip the time and effort needed to create their own system to track the effects of safety improvements. The spreadsheet includes commonly used crash reduction factors, so that agency staff can easily see which crash reduction measures, such as implementing centerline rumble strips or guardrails, will address problem areas most effectively. MDOT also provides *Highway Safety Manual* (HSM) spreadsheets, which help local agencies stay proactive in road safety design by using HSM tools.

Along with implementing changes to Roadsoft driven by the user group, Michigan Tech also offers technical support to Roadsoft users at local agency offices through an effort called Roadsoft on the Road. This effort helps local agencies in Michigan and MDOT share ideas and knowledge face-to-face. There are also numerous workshops and webinars on the basics of Roadsoft for MDOT and local agency staff.

Michigan State Trooper Scott Carlson presents Michigan's new crash reporting form at the 2015 Michigan Traffic Safety Summit.

Third Prong: Safety Training

The cornerstone of LSI safety training and knowledge exchange is on-the-road training sessions for local agencies. These sessions begin with MDOT engineers reviewing local data and identifying locations for field review. Local agencies then have the opportunity to add or subtract from the list of locations. After pinpointing the locations, State engineers and local staff drive those stretches of road and talk about what they can do to make the roads safer. MDOT also hosts peer exchanges every other year, which were inspired by FHWA-led peer exchanges.

"I've been to a number of FHWA peer exchanges, and the one where the lightbulb clicked was a virtual peer exchange on horizontal curve treatment," says Tracie Leix, supervising engineer at MDOT, who

helps run LSI. "That was my inspiration. I realized we needed to have peer exchanges in Michigan to give more of our local agencies the chance to share expertise."

Education and training also are key components of the Michigan Traffic Safety Summit, hosted by the Michigan State Police Office of Highway Safety Planning and MDOT. The most recent summit, held in March 2015, featured nearly 70 speakers from the State and around the country leading discussions on alcohol, medians, wintry roads, and other topics relevant to road safety. With roughly 600 participants, the 2015 event was the most well-attended in the summit's 20-year history. The safety summit brings together a full range of road safety stakeholders in one place and highlights advances in improving road safety in Michigan.

"Trooper Scott Carlson put on a training presentation [about] our new crash form, and we provided training on accurately recording location information for crashes," Smith says. "It's just a very good opportunity for us to reach many different groups. Not just law enforcement, but many people from various areas attend."

As with the entire LSI program, the peer exchanges focus on local agency needs, while the safety summit covers engineering, education, enforcement, and emergency medical services with engineering presentations relevant to local agencies. MDOT or the State police may host an event, but the purpose is to enable the free flow of information and best practices among local agency staff. Concepts and ideas from local agencies are featured, as are presenters from local agencies. The safety summit and peer exchanges are about more than getting people in the same room; they also build collaboration and trust between local and State partners.

"We can talk about things all day long and watch presentations," says Larry Hummel, engineer-manager for the Van Buren County Road Commission. "But if we can link to the 'what's in it for us and our residents,' and...to the 'what's happening crash-wise in my area is no different from [what's happening in] northern or eastern Michigan'--being able to share that perspective on stage from one local agency to another pulls a ton of credibility with peers."

Although the annual safety summit is the LSI's highest profile educational opportunity, the most valuable in terms of maintaining momentum for safety improvements may be the on-the-road sessions. Those sessions typically look like this: An MDOT staff member drives a State-owned vehicle, a local agency staff member sits in the front seat, and one of the MDOT engineers dedicated to LSI is in the back seat. The drive-through is more than reviewing a particular site in person--it is comparing one site to the next and asking questions. Should a guardrail be installed in between these sites? What sort of pavement marking capabilities does the local agency have? What does the local public think about rumble strips?

"The best version of training is when we're behind the wheel, driving around with a local agency, talking about branches in front of signs, or culvert headwalls, and how vehicles are impacted when they're hit," Leix says. "We don't just focus on sites we've selected. We talk about everything in between."

The conversations that happen between local agencies and MDOT staff may not lead to big construction projects, but they definitely have an impact on safety. A conversation can spur ideas on how to make maintenance and other activities that local agencies already do more efficient and provide immediate safety benefits to the traveling public without a huge financial investment.

It is not that no one cared before, Hummel says, "But when you start to get those things pointed out, it helps. [For example,] if we're already mowing every mile of road, why can't we double-mow [mow double the width] in front of signs? If we're doing tree trimming anyway, just make the signs more visible. The extra cost is minimal. We try to use every resource we have--from drivers to engineers to the public--to identify safety improvements."

This stretch of road in Van Buren County, MI, was identified through LSI and additional reviews as needing improved safety infrastructure. A center turn lane, a bike lane, and a road verge— the strip of grass along the right side—were added as a result of data analysis showing that these elements would improve the road's safety.

Breaking Down Barriers

Transparent communication with the public and within agencies is perhaps the most important effect from knowledge sharing, data analysis, and better data collection in Michigan. Data-driven safety decisions are defensible in the public sphere, and agencies that participate in LSI have found that their relationships with the public are more collaborative. With the LSI framework setting a "safety first" paradigm, agencies can quickly investigate potential problem areas brought to their attention during public meetings and other interactions with the public.

The road safety message at the core of LSI also breaks down barriers within and between agencies. When safety is the foundation of everything an agency does, safety becomes an organizational mantra. Maintenance and construction personnel identify ways to make their work more efficient in order to support the safety paradigm. They contact engineers if they see problem locations in the field. And with MDOT serving as a resource for agencies, rather than an arbiter of regulations, the relationship between the State and local agencies also steers toward collaboration.

"I've had the pleasure of being in this seat for 12 years," Smith says. "To sit here today and be in a position where data flows almost in real time, where we used to have stacks of papers to be processed--it's amazing. Like other agencies here in Michigan, we're very close in our partnership with MDOT. I'm over there, our programmer sits in the MDOT office, and [MDOT is] our main audience. Those 8 hours we used to spend entering crash data, we now use to examine that data."

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For more information, visit www.roadsoft.org.