

# Roadway Safety Data Program



## MICHIGAN ROADSOFT

### INTEGRATION OF STATE AND LOCAL SAFETY DATA

CASE STUDY  
FHWA-SA-14-035

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## ACKNOWLEDGEMENTS

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## ACRONYMS

AADT	Annual average daily traffic
AASHTO	American Association of State Highway and Transportation Officials
BMP	Beginning milepoint
CSS	Center for Shared Solutions
CTT	Center for Technology and Training
DOT	Department of Transportation
FDE	Fundamental Data Elements
FHWA	Federal Highway Administration
GIS	Geographic information system
GPS	Global positioning system
HPMS	Highway Performance Monitoring System
HSIP	Highway Safety Improvement Program
HSIS	Highway Safety Information System
HSM	Highway Safety Manual
KML	Keyhole Markup Language
LIDAR	Light detection and ranging
LRS	Linear Referencing System
MDOT	Michigan Department of Transportation
MIRE	Model Inventory of Roadway Elements
MIS	Management Information System
NCHRP	National Cooperative Highway Research Program
NHS	National Highway System
OIT	Office of Information Technology
PR	Physical Road
TAMC	Transportation Asset Management Council
TMS	Traffic Monitoring System
XML	Extensible Markup Language

## EXECUTIVE SUMMARY

Quality data are the foundation for making important decisions regarding the design, operation, and safety of roadways. While crash data have been a consistent element of highway safety analysis, in recent years there has been an increased focus on the combination of crash, roadway and traffic data to make more precise and prioritized safety decisions. The application of advanced highway safety analysis processes and tools requires a comprehensive inventory of roadway safety data combined with crash data to better identify and understand problems, prioritize locations for treatment, apply appropriate countermeasures, and evaluate the effectiveness of the those countermeasures. Comprehensive roadway safety data include information on roadway and roadside features, traffic operations, traffic volumes, and crashes.

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## INTRODUCTION

This case study presents the Michigan Roadsoft system for local roadway data and analysis. With funding provided by the Michigan Department of Transportation (MDOT), Michigan Technological University's Center for Technology and Training (CTT) developed Roadsoft to integrate the local road system into the State database by assigning a consistent linear referencing system to the local roads. The program provides roadway asset management, field data collection, maintenance management, and safety analysis tools to local agencies. Each local agency maintains its own data in a local copy of Roadsoft and shares that information with the State upon request.

## BACKGROUND

Local roads represent 70 percent of all roads in Michigan. In the early 1990s, MDOT had an asset management system in place for the State trunk network and Federal-aid eligible roads, but no corresponding system for local roads that are not eligible for Federal-aid. This represented a challenge as local agencies varied widely in their level of access to IT support, software tools, and analytic capabilities for managing roadway assets.

In response to this need, MDOT funded the development of Roadsoft in the early 1990s as a proof of concept for a way to meet local agencies' needs for data with which to manage the roadway assets under their jurisdiction. The CTT designed Roadsoft specifically for local roadway system managers. Roadsoft provides a standard suite of data management and analysis tools free to local agencies and over which they have a great deal of control.

As the user base for Roadsoft grew, MDOT and the CTT enhanced the system to cover a broader range of assets, support planning and budgeting, and incorporate features beyond basic asset management including traffic and crash data for use in safety analysis. They expanded Roadsoft with new capabilities and new modules as the State legislature and the State Transportation Asset Management Council (TAMC) implemented new reporting requirements.

In the early 2000s, the CTT implemented two major expansions of Roadsoft. The first, taking place in 2000, added a statewide basemap and GIS so that users could identify locations using mapped reference points (Physical Road – PR – number), street names, and spatial coordinates. Prior to this date, Roadsoft strictly used a linear referencing system and had no mapping component.

The second expansion followed the formation of the TAMC in 2002 in response to Michigan Public Act 499. The TAMC sets requirements and minimum data collection cycles for asset

management by local agencies. The TAMC provides the local agencies with money and participates in field data collection to support asset management efforts in Michigan for all public roads. The CTT added functionality to Roadsoft to support collection, use, and reporting of the necessary data to meet the TAMC requirements.

Local agencies serve on the TAMC and they control the Roadsoft Users Group—the body that determines which enhancements the CTT will implement in Roadsoft. The CTT has adopted a rapid prototyping development model that allows for early user feedback. The goal is to “fail early” with low cost mock-ups so that whatever is ultimately developed meets the user community’s needs at a reasonable cost.

Central support comes from MDOT and the CTT, but the Roadsoft data model relies on local ownership and control. While there is no centralized database of local data, Roadsoft makes it easier for local agencies to share data since all can use the same system, database structures, and data definitions. Decisions about Roadsoft expansion are a cooperative effort among the local agencies and MDOT.

## SYSTEM DESCRIPTION AND USE

As of the date of this case study, Roadsoft includes the following modules and capabilities:

- [Asset inventory](#)
  - [Bridges](#)
  - [Crash data](#)
  - [Culverts](#)
  - [Driveways](#)
  - [Guardrails](#)
  - Interchanges
  - [Intersections](#)
  - [Linear pavement markings](#)
  - [Point pavement markings](#)
  - [Roads](#)
  - [Safety analysis tools](#)
  - [Sidewalks](#)
  - [Signs](#)
  - [Traffic counts](#)
  - Traffic Signals
- GPS-based Laptop Data Collector
- Maintenance management

- [Pavement strategy evaluation](#)
- [TAMC reporting](#)
- Sign retroreflectivity management
- Customizable reports

(Note: The links in the preceding list hyperlink to descriptions at <http://Roadsoft.org>).

For safety data and safety analysis, Roadsoft serves as a single, uniform safety analysis platform that can meet most analysis needs at the local agency level. The system allows support for specific types of safety analysis. For example, the CTT delivers specific training and tools designed to help local agencies find and apply for safety grants using their data. During the development of Roadsoft, MDOT's staff served as the subject matter experts and helped the CTT determine what data and analytic features to include in the safety analysis module. The system includes basic safety network screening methods using frequencies, rates, and equivalent property-damage-only calculations. More advanced analyses such as those described in the Highway Safety Manual are not included in Roadsoft in part because the data expertise required for those analyses may be lacking at the local level.

The system allows local agencies to create a data extract that they can incorporate into other analysis packages including advanced safety analysis. There is support for a spreadsheet analysis based on a model developed by Oregon State University as part of NCHRP Project 17-38<sup>1</sup> for training and as a companion tool to the Highway Safety Manual Part C Predictive Methods. Roadsoft has the ability to perform the necessary data extracts to complete this spreadsheet analysis. MDOT handles advanced safety analysis for the local agencies through its Local Safety Initiative. This brings professional services (e.g., traffic engineering) to the local agencies. Roadsoft serves as the tool for MDOT safety engineers to interact with local agencies in the field of safety.

As of 2013, 412 agencies actively use Roadsoft. These include:

- All 83 county road commissions
- 175 of 276 cities
- 52 of 257 villages
- 22 of over 1,000 townships

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<sup>1</sup> downloadable at: [http://www.highwaysafetymanual.org/tools\\_sub.aspx#4](http://www.highwaysafetymanual.org/tools_sub.aspx#4)

- 23 planning organizations (of 26 Metropolitan Planning Organizations and Regional Planning Commissions)
- All 29 MDOT regional offices and transportation service centers
- Four of 12 Native American tribes
- Two Federal agencies
- 20 other entities (e.g., law enforcement agencies and GIS departments)

## DATA INTEGRATION

Roadsoft data integration is based on location as coded in the Linear Referencing System (LRS) and mapped in the GIS using a cross-walk among the three LRSs as follows:

- Physical Road ID Number (PR): PR is a system developed and managed by the Michigan Department of Management and Budget (DTMB) Center for Shared Solutions (CSS). It covers all roads in the State. This is the LRS used in Roadsoft. Law enforcement agencies throughout Michigan also use the PR system. PR numbers are unique values given to each section of roadway. The beginning milepoint (BMP) and ending milepoint (EMP) define a section. Any location within the section is identified by a milepoint between the BMP and EMP.
- Control Section (CS) milepoint: The MDOT CS milepoint system applies only to the State Trunk Network. MDOT maintains an online PR Finder which is used to access PR and CS numbers using a map-based interface. The tool also provides access to traffic count data (AADT) and functional class information.
- Michigan Accident Location Index (MALI): MALI is a crash location methodology developed by MDOT. MALI was the original basis for the location referencing system used by DTMB to develop its GIS framework. MALI is the source for the PR number system.

## DATA MANAGEMENT PRACTICES

The Transportation Research Board's NCHRP Report 666: Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies defined the concepts of data management, data governance, and data stewardship. Briefly, Data Management is the set of practices related to collecting, storing, and preparing data for use (e.g., in safety decision-making). Data Governance is the set of standards and practices applied to any data resource to control the quality of the data. Data Stewardship refers to ownership

responsibility and control over data including authority for its collection, storage, integration, and use. Regarding data management, there is no centralized local roads database in Michigan. Roadsoft fills the need for a local roads asset management database and analysis tool by providing each local client agency a copy of the software, which they install and maintain locally. The local agencies are the stewards of their own data and choose what portions to share with the MDOT. Data governance is a combination of practices including reporting standards established for federal-aid-eligible roads, standards for local roads established by the TAMC in cooperation with the local agencies and CTT, which manages the system documentation for Roadsoft.

## RESOURCES

Funding for Roadsoft comes out of the local roadway portion of Michigan's distribution of Federal-aid funds. MDOT manages the distribution of funding and the contract with Michigan Tech CTT. Some of the initial funding in 1991 came from FHWA Local Technical Assistance Program (LTAP) funds during the proof-of-concept stage. Michigan Tech serves as the LTAP center for Michigan.

## KEY OUTCOMES AND LESSONS LEARNED

Roadsoft delivered the following key outcomes and products for local agencies and MDOT:

- Improved location referencing for crashes on local roads.
- Consistent mapping and data standards for all local jurisdictions.
- Data sharing among local, regional, and State agencies.
- Efficient processes for conducting safety analyses.
- Comprehensive asset management capabilities.

The lessons learned from the Roadsoft effort are that long-term support, local agency control, and frequent, gradual, incremental updates, are the keys to Roadsoft's success. CTT supports the incremental, gradual nature of Roadsoft development using a rapid prototyping model. This model is necessary due to a high level of variability of users, many of whom are not GIS experts, and there is no template or roadmap for this type of a management system to follow. Allowing users to experiment with functionality early in the development cycle allows the CTT to identify and take advantage of opportunities that were not initially apparent when development began.

## SUMMARY

This case study presents a user-driven program. Roadsoft began with a single focus on establishing the database and LRS for an all-public-roads asset management system. As the user base for Roadsoft grew, MDOT and the CTT enhanced the system to cover a broader range of assets, support planning and budgeting, and incorporate features beyond basic asset management, such as traffic and crash data for use in safety analysis. The CTT designed Roadsoft for local roadway system managers. They control the selection of upgrades and enhancements to the system. MDOT supports the system financially and benefits by having access to local data that is maintained and managed by the system owners—the local agencies.

## SOURCES

The following sources aided in developing this case study:

- Phone and email conversations with:
  - Michigan Tech CTT.
  - Michigan DOT Asset Management Department.
  - Genesee County Road Commission.
  - Macon County Road Commission.
- NCHRP Synthesis 458: Roadway Safety Data Interoperability between Local and State Agencies, [http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_syn\\_458.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_458.pdf).
- NCHRP Report 666: Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies (Section I: Chapter 4, page I-58), [http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_666.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_666.pdf).
- Michigan's submissions to the FHWA Office of Safety project, State Safety Data Capabilities Assessment—used with permission from the State and FHWA.
- Federal, State and local personnel and university-based contractors interviewed:
  - Michigan Tech CTT: Tim Colling, Gary Schlaff
  - MDOT: Brian Sanada, Mike Toth, Ron Vibbert
  - Northeast Michigan Council of Governments: Nico Tucker
  - Genesee County Road Commission: Ken Johnson
  - Mason County Road Commission: Wayne Schoonover
  - Van Buren County Road Commission: Larry Hummel
- Resources available online at: <http://Roadsoft.org>

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