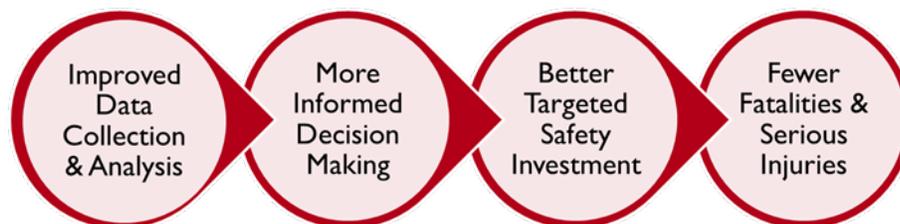# NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION SAFETY DATA SYSTEMS AND PROCESSES

CASE STUDY

FHWA-SA-15-058

Prepared for

Federal Highway Administration

Office of Safety

Improved Data Collection & Analysis → More Informed Decision Making → Better Targeted Safety Investment → Fewer Fatalities & Serious Injuries

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ACRONYMS

Acronym	Description
AASHTO	American Association of State Highway and Transportation Officials
DOT	Department of Transportation
FHWA	Federal Highway Administration
GIS	Geographic Information System
HSM	Highway Safety Manual
IT	Information Technology
LRS	Linear Referencing System
MIRE	Model Inventory of Roadway Elements
NCHRP	National Cooperative Highway Research Program
NHDOS	New Hampshire Department of Safety
NHDOT	New Hampshire Department of Transportation

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INTRODUCTION

The purpose of this case study is to highlight noteworthy practices of the New Hampshire Department of Transportation (NHDOT) in leveraging technology to enhance safety data management—in particular, NHDOT's use of an integrated Linear Referencing System (LRS) and use of information technology (IT) tools to analyze safety data (e.g., AASHTOWare Safety Analyst™, American Association of State and Highway Officials (AASHTO) Highway Safety Manual (HSM), and Graphical Information Systems (GIS) tools). New Hampshire's use of technology improves management of safety data systems by providing mechanisms for:

- Electronic data collection, thereby reducing data errors at the point of collection;

- Integration of data from different systems, using GIS and a consolidated LRS;

- Access to multiple types of safety data through a single portal that extracts and displays crash, traffic, and road inventory data; and

- Analysis of data for identification of high crash "hot spots," or locations with potential for safety improvement, using safety performance functions to estimate expected crash frequency of all sites across the road network.

NHDOT uses an integrated LRS which provides a common link between safety data sets, including crash, traffic, and road inventory data. Their use of GIS applications helps to improve overall data quality by providing a method for visualization of data on maps and identification of data errors for correction, prior to their potential use with analytical tools. NHDOT's use of analytical tools, such as AASHTOWare Safety Analyst™ and the AASHTO HSM, promotes data quality by requiring data formatted in a certain way, according to specific data standards, and within defined levels of accuracy in order for the analytical tools to work properly. Many States, including New Hampshire, are also working to improve the quality of the data recommended within the Model Inventory of Roadway Elements (MIRE). For NHDOT, improving the quality of data following MIRE recommendations is important, and they plan their data collection scope and methods accordingly. They prioritize their efforts toward meeting recommended minimum conditions by concentrating on the intended use of data and the way it supports analysis tools.

One of the prominent research projects recently completed pertaining to the topic of enhancing data management and data governance practices is _NCHRP 666: Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies (2010)_. NCHRP 666 provides systematic guidance for establishing data management

(and data governance) programs within an organization. The following six steps from NCHRP 666 have been adapted for safety data programs:[1]

1. Establishing a need for safety data management and governance

2. Establishing goals for safety data management

3. Assessing the current state of safety data program systems

4. Establishing safety data governance programs

5. Leverage technology for safety data management

6. Linking safety data to planning, performance measures, and target processes

One of the key steps (outlined below) is the necessity to leverage technology to support data management practices, which is the primary focus of this case study.

This case study focuses on how New Hampshire has leveraged technology for safety data management through analytical, integration, and data sharing tools as well as through standards set forth as part of their data governance efforts.

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[1] NCHRP Report 666: Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies (2010), http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_666.pdf.

NHDOT TECHNOLOGY AND SAFETY DATA MANAGEMENT

NHDOT's use of technology for safety data management focuses on their use of an integrated LRS and the use of analytical tools, including the HSM and AASHTOWare Safety Analyst™. Each analytical tool requires data defined and formatted in a particular way. The Department has invested resources in the collection of ramp and intersections data elements to provide more analytical capabilities for their safety program. NHDOT made the decision to focus on improving the quality of their data prior to establishing formal data management policies, standards, and procedures within a data business plan framework. Ultimately, improving data quality will improve decision-making, especially with the use of analytical tools to support their safety program.

Analytical Tools

NHDOT's experience includes the use of safety analytical tools (including the HSM and AASHTOWare Safety Analyst™) to support their safety programs. NHDOT uses their safety datasets to calibrate Safety Performance Functions (SPF) in AASHTOWare Safety Analyst™ to local conditions. At NHDOT, the use of software-based analytical tools such as Safety Analyst™, the Interactive Highway Safety Design Model, safety analysis spreadsheets, and internally developed software necessitates a thorough review of data elements, requires the safety group collaboration with IT, and helps demonstrate a need for institutionalizing methods outlined in the HSM.

Integration Tools

NHDOT's data integration efforts began around 2005 and they are now able to provide access to multiple data sets using a single platform through their LRS. Offices at NHDOT collaborated with the New Hampshire Department of Information Technology to demonstrate the benefits of using a common GIS and LRS platform (e.g., access to multiple data sets through use of an integrated LRS platform), which resulted in strong support for continued maintenance of the system.

Part of development and management of the LRS at NHDOT is ensuring it includes all public roads and associated data needed for safety analysis and decision-making. Using GIS tools and a common LRS, NHDOT works directly with local communities each year to keep all available road network data complete, accurate, and current in one official state road network. In addition, NHDOT uses the LRS to link crash data to the official road network by verifying and relating crash locations derived from records maintained by the New Hampshire Department

of Safety (NHDOS), the official repository of all crash records. The NHDOT works closely with the NHDOS to verify locations to relate crash data to the road network. The result of this cross-department collaboration is accurate and reliable crash data integrated with other data linked to the official road network such as traffic volumes and roadway elements. This integration benefits a number of tools and applications used to support safety analysis and decision-making.

At NHDOT, the Transportation Systems Management group in the Bureau of Planning and Community Assistance are the data stewards for the LRS. They continue to work to integrate data sets from multiple business areas, while demonstrating how the LRS can provide access to the multiple types of data that support business area needs, especially those related to the safety program. The LRS supports the safety program by providing consistent location data for integrating essential datasets for safety analysis purposes. Use of the LRS requires following specific business rules, data standards, and procedures for management of the data. Participation is also required from many offices that have responsibility for maintaining the different data layers such as bridge, traffic, crash, and pavement data. The LRS encourages multiple users to contribute to the maintenance of their data layer by rewarding them with access to other data layers in the integrated system for use in their business areas.
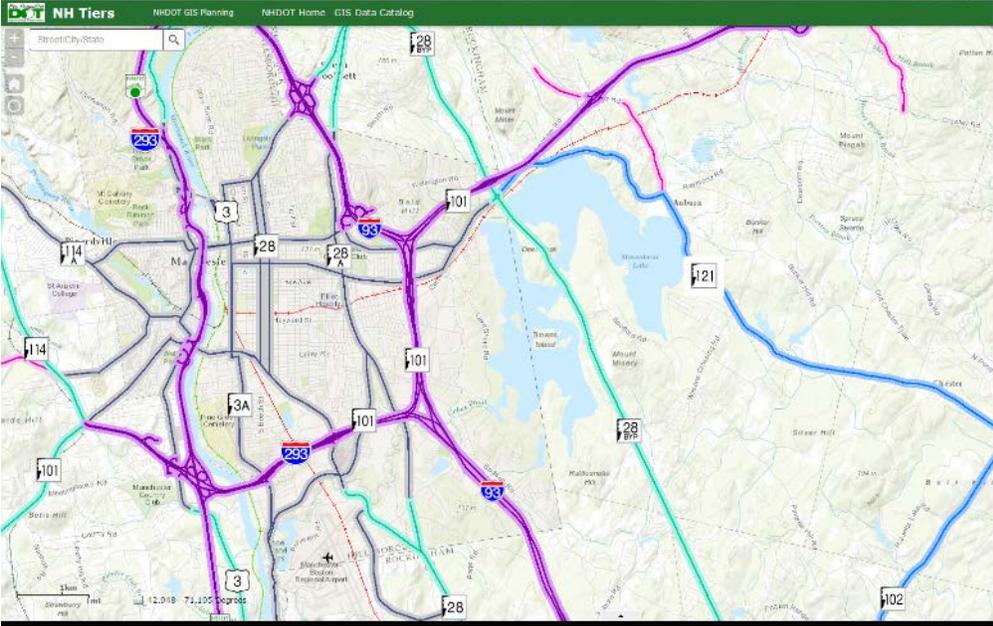
NHDOT's use of the LRS extends to data visualization on interactive web maps (Figure 1). This ability helps to improve data quality by providing a means for safety analysts to investigate areas where there is missing data or where data values appear to be out of anticipated ranges. For instance, greater than expected traffic volumes may appear as heavier lines or as a different color compared to lower traffic volumes or missing traffic data might appear as gaps in line segments on the map.

Data Sharing Tools

NHDOT uses data sharing technology to provide data to a wider audience. Sharing data maximizes the potential to locate and correct errors reported by the data reviewers, which ultimately leads to improved data quality. Since NHDOT's safety programs rely on the ability to access crash data collected by the NHDOS, investments in data sharing technology are critical for sustaining and enhancing NHDOT's safety program. The current method to transfer crash data from the NHDOS to NHDOT is through text files. However, plans are underway to update this method to allow access to the data within a relational database environment. NHDOT also shares data using a variety of methods to meet different user needs. These methods include providing quarterly snapshots of GIS data to regional planning agencies, providing GIS data to an online statewide GIS warehouse called GRANIT (which stands for

Geographically Referenced Analysis and Information Transfer System), and providing GIS web maps maintained by NHDOT that are publicly available online (Figure 1).

Figure 1. New Hampshire DOT Interactive Map

Source: NHDOT GIS Data Catalog

NHDOT TECHNOLOGY AND DATA GOVERNANCE

NHDOT is focusing on improving the quality of their safety data and other key data sets as part of the current data management strategy. The safety program data managers utilize all available sources of data definitions and data structures, like those defined for MIRE and Model Minimum Uniform Crash Criteria Guideline, to improve the quality of data sets used with AASHTOWare Safety Analyst™ and the Highway Safety Manual.

NHDOT's current focus on improving data quality and their use of information technology tools provides the building blocks of data governance for the safety program. Establishing a successful data governance program for safety begins with defining goals for the program. NHDOT's 2012-2016 Strategic Highway Safety Plan identifies three goals specified for safety data improvement:

1) Improve collection and submission of crash reports by implementing electronic reporting

2) Improve road inventory data by adopting MIRE

3) Evaluate the current state system and needs for improvement

These goals drive the initiatives at NHDOT for improving access to and use of safety-related data sets to support the Strategic Highway Safety Plan, as well as the Highway Safety Improvement Program and other program areas that support safety initiatives.

Although NHDOT does not have a formal safety data business plan in place, because of their success in effectively managing data and implementing safety analysis tools, they are in an ideal position to take the next steps by defining a mission statement and identifying roles and responsibilities for the management of their safety data sets. Getting to the stage they are in now has taken coordination and collaboration between business areas and IT professionals, and wouldn't be functional without some informal data governance structure.

At NHDOT, safety project identification and prioritization processes use performance-based criteria through one or more methods, including:

- Network screening - ranks sites by Potential for Safety Improvement (PSI), either in all crashes or a specific type of crash.

- Road Safety Audits - typically locally or politically requested safety audits at sites with noted safety concerns.

- Systemic approach - wide implementation of low unit-cost countermeasures at sites with high potential for improvement or demonstrated risk factors.

- Systematic improvement projects - wide implementation of research proven safety countermeasures.. These projects typically include certain processes, infrastructure design techniques, and highway features.

Based on the importance of performance-based criteria for prioritization of safety projects, NHDOT could tie the process to data business planning by developing and adopting mission statement(s) and a list of responsibilities for the safety program similar to that adopted for the pavement management program.

While NHDOT does not currently have a safety data business plan implemented, the commitment to the use of information technology tools for safety data analysis and continued emphasis on improving data quality of safety-related data sets, combined with the spirit of cooperation among different business areas at the Department, provides the perfect foundation for future expansion of data governance and data business planning to support the Safety Program at NHDOT.

APPLICABILITY TO OTHER STATES

New Hampshire DOT's experience demonstrates the importance of leveraging IT to support safety programs at State DOTs. All business areas rely heavily on an IT infrastructure to store, process and manage large data sets within multiple platforms. The challenges associated with this dependency (business needs and IT hardware/software) can sometimes be overwhelming. However, new technologies are available to assist in this effort and they are useful in improving data quality and improving data sharing to support the safety program.

Many of NHDOT's experiences in the use of information technology are readily transferable to other State DOTs. These experiences can serve as a checklist and reminder to States of what works well (e.g., benefits derived) with regard to utilizing technology. The benefits include the ability to demonstrate how continued improvements in information technology provide a return on investment for funding of IT initiatives. Listed below is a summary of some of NHDOT's experiences in using technology to improve safety data. These experiences are similarly applicable at other State DOTs.

- State DOT business areas, including safety program managers, should reach out to their partners in the IT offices to remain informed on the technology that is available (or recommended) to support various business operations. This approach provides an incentive for safety managers to solicit support from the IT office in designing application systems or procuring hardware and software products that best suit the needs of the Safety Program.

- It is beneficial to have people in the Safety office who understand technology or, at a minimum, have working relationships with people who do, for the purposes of obtaining advice on how IT products can improve access to, integration of, and sharing of data sets used for the Safety Program.

- Safety program managers should stay informed on what others are doing in the department regarding data collection and management of data sets that currently or potentially could be useful for the Safety Program. In addition, it is important to prioritize data collection efforts to focus on required data elements over optional ones.

- Collect data that works with the technology used. This requires an understanding of the capabilities offered by vendor data analysis products and an understanding (that can be

provided by IT staff) of how the products may be integrated for use to support the safety program.

- Think long-term about how technology fits into an overall safety data management/safety data governance strategy. The safety program area primarily consumes data from other business areas, so technology that provides integration and sharing of data across business areas is critical for meeting the needs of the safety program and for supporting safety data governance.

- Determine what data is required for the type of analysis performed for the Safety Program, and focus on data and analytical tools needed to support that analysis.

- Start with the LRS as the foundation and integrate safety-related data sets that can be associated with the LRS, and then improve the data over time.

- Coordinate data collection efforts with other agencies (including local agencies) to expand the pool of data available for the safety program.

RESOURCES

The source of funding for the various safety data management and information technology initiatives at NHDOT depends upon the initiative.

State Planning and Research (SPR) funds are used to maintain the GIS and LRS data; Highway Safety Improvement Program funds are used to support safety data collection, to procure licenses for AASHTOWare Safety Analyst™, and for other analytical tools; and the National Highway Transportation Safety Administration 405 grants are used to develop the electronic crash reporting system and to collect and maintain the crash records database.

REFERENCES

The following sources aided in developing this case study.

- Phone interviews and email conversations with:

    - Martin (Marty) Calawa, Safety Engineer, FHWA New Hampshire Division

    - Glenn Davison, Planning, GIS Manager, NHDOT

    - William (Bill) Oldenburg, Assistant Director of Project Development, NHDOT

    - Michelle Marshall, Highway Safety Engineer, NHDOT

    - Timothy (Tim) Harmon, Assistant Highway Safety Engineer, NHDOT

    - Nicholas (Nick) Alexander, Asset Management, Performance, and Strategy (AMPS) Manager, NHDOT

- NCHRP Report 666: Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies (2010), http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_666.pdf.

- Calibration of the Highway Safety Manual for Missouri, (Final Report Date: December, 2013), http://library.modot.mo.gov/rdt/reports/tr201302/cmr14-007_reduced.pdf.

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