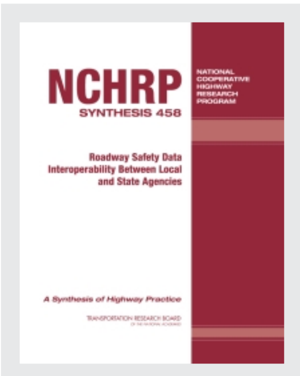

Roadway Safety Data Interoperability Between Local and State Agencies

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP SYNTHESIS 458

Roadway Safety Data Interoperability Between Local and State Agencies

A Synthesis of Highway Practice

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FOREWORD

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire highway community, the American Association of State Highway and Transportation Officials—through the mechanism of the National Cooperative Highway Research Program—authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-5, "Synthesis of Information Related to Highway Problems," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, *Synthesis of Highway Practice*.

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

By Jon M. Williams
Program Director
Transportation
Research Board

This synthesis provides an overview of the state of the practice regarding the interoperability between state and local safety data and highlights agency practices that support a data-driven safety program on all public roads. Results of this synthesis found that in terms of interoperability between state and local agencies, agencies are more advanced for crash data than roadway or traffic data.

Data for this study were collected through a literature review, interviews with leading agencies, and a survey of all state departments of transportation.

Nancy X. Lefler, Vanasse Hangen Brustlin, Inc. (VHB), Raleigh, North Carolina, collected and synthesized the information and wrote the report. The members of the topic panel are acknowledged on the preceding page. This synthesis is an immediately useful document that records the practices that were acceptable with the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

CONTENTS

Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the Web at www.trb.org) retains the color versions.

ROADWAY SAFETY DATA INTEROPERABILITY BETWEEN LOCAL AND STATE AGENCIES

SUMMARY

Quality data are the foundation for making important decisions regarding the design, operation, and safety of roadways. With the passage of the Moving Ahead for Progress in the 21st Century (MAP-21) transportation legislation, the importance of safety data was further enhanced, particularly for local roads. For the purposes of this report, local roads are defined as non-state-owned public roads and represent more than 3 million miles of roadway. MAP-21 notes that "a state shall have in place a safety data system with the ability to perform safety problem identification and countermeasure analysis" (MAP-21 § 1112). It defines safety data as roadway, traffic, and crash data. It further clarifies that this system includes all public roads. MAP-21 also includes requirements for the collection and maintenance of a subset of the Model Inventory of Roadway Elements (MIRE). FHWA has described this subset as the MIRE Fundamental Data Elements (MIRE FDEs). The MIRE FDEs include segment, intersection, and ramp elements on all public roads. In addition to collecting the MIRE FDEs, states are also required to have a linear referencing system for all public roads. Many agencies lack the data or the data management systems needed to meet these requirements.

Making safety decisions on local roads can be challenging, especially in rural areas. High crash locations can be difficult to isolate through the traditional site analysis because severe crashes can be spread out over a wide area. Additionally, collecting, storing, and maintaining data for non-state-maintained roads is a challenge for many states. As states move toward improving the quality of their roadway, traffic, and crash data for safety, they will be looking for examples from other agencies that have been able to do so. This synthesis provides an overview of the state of the practice regarding the interoperability between state and local safety data and highlights agency practices that support a data-driven safety program on all public roads. Interoperability is defined in this report as the ability of data, systems, or organizations to work together.

To compile resources for this synthesis, the project team conducted a literature review, reviewed the results of the FHWA Roadway Safety Data Capabilities Assessment and Peer Exchange proceedings, surveyed state and local transportation agencies, and conducted interviews with agencies that have been identified as having roadway safety data practices that support data-driven safety programs that incorporate both state-maintained and local roads. Forty-three of 51 states completed the survey; an 84% response rate (for the purpose of this project, Washington, D.C. is considered a state). The response rate from local agencies was not as robust as that from the states; 25 local agencies completed the survey.

This synthesis found that in terms of interoperability between state and local agencies, agencies are more advanced for crash data than roadway or traffic data. When asked to rank themselves on a scale of 1 to 10, with 1 being the least advanced and 10 being the most advanced in terms of interoperability with state and local data, states on average rated themselves an 8.5 for crash data, but only 5.7 and 5.8 for roadway and traffic data, respectively. The results of the literature review support these assessments.

This study found that many states are striving to obtain, maintain, and use safety data for local roadways to meet the new federal mandate to incorporate local roadway data into a

statewide base map and support analysis of that data. Local agencies are collecting some of the roadway data elements that states are in most need of and most interested in collecting, including information regarding intersections, curves, and supplemental datasets, such as signs. Collaboration with local agencies may be a good opportunity to populate the states' inventories for these elements. The costs of developing and maintaining statewide safety data systems could be significant. States will need information and assistance to build the budget justifications for the required projects. Some cost savings may be realized if states and local agencies can partner such that the local agencies provide the data to the state in exchange for analytic support. Some states have been able to obtain and make use of local safety data, and these states provide examples from which those states that are striving to improve can learn.

There are generally two approaches states can take to obtain local safety data: (1) develop a mechanism for local agencies to provide the data, or (2) collect the data themselves. One benefit of the first approach is that it minimizes the state's direct expenses. The challenges include getting cooperation from the local agencies and having confidence in the quality of the data. These challenges can be met by a concentrated effort to work directly with local agencies to provide the support needed in terms of outreach, training, and funding. Some states have enacted legislation that requires local agency cooperation. The states that have been able to achieve cooperation from local agencies have developed tools that not only meet the state's needs but provide a benefit to the local agencies as well. The more benefits the local agencies perceive, the more likely they are to participate. The benefit of the second approach is that it eliminates the dependence on local agencies. The state has more control over what data are collected, how the data are collected, the format of the data, etc. They have more assurance over the quality of the data, as well; however, this approach can be costly.

Safety decision making at the local level can be a challenge for states. For many states, particularly large states, the number of local agencies can be overwhelming. Also, it is often difficult for state departments of transportation to identify the correct person to work with at the local level. The majority of the local agencies surveyed engage in roadway safety; that is, they implement countermeasures and treatments on their roadways for the purpose of improving safety. In addition, many of the states engage in some type of safety decision making on local roadways, whether it is conducting analysis, installing improvements, or providing funding.

Overall, a key lesson learned from this effort is the need for support of data improvement efforts from both the state department of transportation and the local agency leadership. Executives need to understand the value of investing in safety data and local agencies to believe there will be some benefit to them for participating.

Agencies suggested that there should be more mechanisms in place to continue to learn from each other. One agency suggested a "safety data pooled fund" effort would be helpful so states can have more structured opportunities for collaboration and combine resources to move all of the states forward. The findings of this synthesis support the need for this type of structured collaboration.

One of the key themes found is that state safety practitioners need to demonstrate the value of the data to executives/leadership to gain their support for data initiatives. The states that have been able to develop data-driven safety programs on all public roads have had leadership that understood the value of quality transportation data. Although conceptually quality data can help lead to better decisions, make more effective use of the available funding, and improve safety on the roadways, it has not yet been quantitatively proven. The FHWA Office of Safety has developed a guidebook that demonstrates a potential methodology for quantifying the value of safety data: *Benefit-Cost Analysis of Investing in Data Systems and Processes for Data-Driven Safety Programs: Decision-Making Guidebook*. However, further research is needed to explore this concept and provide concrete results to states in terms of tools and resources for communicating the value of investing in data to their leadership.

CHAPTER ONE

INTRODUCTION

BACKGROUND

The NHTSA estimates that 34,080 people died in motor vehicle traffic crashes in the United states in 2012 (*1*). Furthermore, approximately 40% of all fatal crashes on the nation's highways occurred on local roads (*2*). Locally owned roadways in the United States are operated by more than 30,000 local jurisdictions and cover approximately 3 million miles of roadway. For the purposes of this report, local roads are defined as non-state-owned public roads. The amount of local roadway mileage and diversity of authority over local roadways create challenges for federal, state, and local safety stakeholders to effectively direct funding and resources to mitigate safety issues on these roadways. This diversity can affect the ability of transportation to effectively allocate funding and resources to mitigate safety issues on these roadways. Safety improvements at the local road level must be addressed methodically along with those efforts at the state level in order to significantly reduce the number of roadway related crashes on the nation's network. However, in many states local road safety still remains an afterthought owing to a lack of communication and/or resources, including adequate data (*2*).

There are several federal agencies and associated programs that provide guidance and resources to help states improve their data for safety decision making, including FHWA, NHTSA, and FMCSA. FHWA administers the Highway Safety Improvement Program (HSIP), a core federal-aid program whose purpose is to achieve a significant reduction in fatalities and serious injuries on all public roads, including non-state-owned public roads and roads on tribal land. The HSIP focuses on performance and employs a data-driven strategic approach to improving highway safety on all public roads (*3*). NHTSA administers several data programs, including the Traffic Records program, which provides resources, guidance, and funding to states on the collection, management, and analysis of data used to inform highway and traffic safety decision making (*4*). FMCSA conducts activities geared toward commercial motor vehicle safety (*5*). NHTSA also plans to develop an Integrated Highway Safety Program Office with FMCSA, the purpose of which will be to maximize the overall quality of safety data and analysis based on state traffic records at departments of transportation (DOTs) (*6*).

These federal programs are primarily aimed at state DOTs; it is the responsibility of the state to coordinate with local agencies. One exception is the Local Technical Assistance and Tribal Technical Assistance Programs (LTAP/TTAP). LTAP/TTAP provides assistance directly to local agencies and tribal lands for a variety of transportation issues, including safety (*7*).

Quality data are the foundation for making important decisions regarding the design, operation, and safety of roadways. With the development of more advanced safety analysis tools, such as the *Highway Safety Manual* (*8*), *SafetyAnalyst* (*9*), *Interactive Highway Safety Design Model* (*10*), and the Crash Modification Factors Clearinghouse (*11*), many agencies are realizing the value of better roadway data. Theoretically, the more an agency knows about its roadways, the better it can use its resources to effectively and efficiently identify problem locations, diagnose the issues, prescribe appropriate countermeasures, and then evaluate the effectiveness of those countermeasures.

With the passage of the Moving Ahead for Progress in the 21st Century (MAP-21) transportation legislation, the role of data was recognized as critical for safety decision making. In particular, the legislation highlights the need for data on local roads. The legislation notes that "a state shall have in place a safety data system with the ability to perform safety problem identification and countermeasure analysis" (MAP-21 § 1112). It defines safety data as roadway, traffic, and crash data.

Crash data refer to data contained in the crash reports submitted following an accident (e.g., date, time, location, crash type, and severity). Roadway data refer to information pertaining to the physical and locational attributes of a roadway; general categories include segments, curves, intersections, and interchanges and ramps. Traffic data refer to information on the traffic volume and operations of roadways and intersections.

MAP-21 further clarifies that this system should include all public roads. In addition, MAP-21 requires the DOT Secretary to establish a subset of the Model Inventory of Roadway Elements (MIRE) that are useful for the inventory of roadway safety data and ensure that states adopt and use the subset to improve data collection (MAP-21 § 1112) (*3*). MIRE is a recommended listing of roadway and traffic elements critical to safety management. FHWA developed MIRE as a guide to help transportation agencies improve their roadway and traffic data inventories (*12*).

To meet the requirements of MAP-21, FHWA released the *MAP-21: Guidance on State Safety Data Systems* (*3*). This guidance provides information on the set of roadway and traffic data elements that states need to collect on all public roads because they are fundamental to supporting a state's HSIP. This set of elements is referred to as the MIRE Fundamental Data Elements (MIRE FDEs). The MIRE FDEs are divided into a full set of MIRE FDEs for roads with an annual average daily traffic (AADT) greater than or equal to 400 vehicles and a reduced set of MIRE FDEs for roads with an AADT of fewer less than 400 vehicles. The MIRE FDEs include segment, intersection, and ramp data elements and are determined to be the basic set of data elements that an agency would need to conduct enhanced safety analyses to support a state's HSIP. Tables 1 and 2 provide a summary of the MIRE FDEs (*3*).

FHWA also requires that states have a linear referencing system (LRS) for all public roads. A LRS is a system that identifies a specific location with respect to a known point and allows for procedures to store, manage, and retrieve information about roadway location data. An LRS allows roadway data inventories to be logically linked with other traffic records systems, with this linkage most likely occurring based on location (*13*).The FHWA Office of Highway Policy Information and Office of Planning, Environment, and Realty issued the "Memorandum on Geospatial Network for All Public Roads" on August 7, 2012, which identified a Highway Performance Monitoring System (HPMS) requirement for states to update their LRS to include all public roadways within the state by June 15, 2014 (*14*). This LRS will enable states to locate high crash locations on all public roads in the state. As states expand their inventories, additional data, such as roadway and traffic data, should be linkable by LRS geolocation (*14*). The FHWA Office of Safety conducted an economic analysis of the cost of collecting the MIRE FDE on all public roadways and developing a statewide linear referencing system; costs per state range from $908,471 to $40,318,314; with an average of $4,325,400 (*15*).

However, many agencies lack the data or the data management systems needed to meet these requirements. Collecting, storing, and maintaining data for non-state-maintained roads is a challenge for many states (*16*). In addition, local agencies face similar problems as the states in collecting these data for their own jurisdictions. A number of issues inhibit the effective implementation of comprehensive and meaningful local road safety practices. Based on the results of a 2012 FHWA Peer Exchange on safety data, challenges to effective roadway safety practices include the following (*17*):

- The extent of the local roadway network.
- The financial impacts based on how the responsibilities of maintenance are allocated.
- The variety of agencies involved in local roadway safety activities throughout each state.
- The lack of complete, accurate crash data and analysis tools.
- The diversity in organizational structure and capabilities of local jurisdictions.
- The limited training and expertise in roadway safety practices at the local level.
- The shortage of funding and sometimes relative low priority for a local roadway safety program.
- Management structure that cannot adequately accommodate the delivery of a local road safety program.
- Federal requirements that may increase the cost and time to implement effective safety improvements.
- The cost and maintenance of supporting the infrastructure to house the data/data system itself.

To capitalize on the advanced safety analysis tools and methodologies to more efficiently and effectively address overall roadway safety issues and meet the MAP-21 data requirements, agencies will need to improve their safety data—particularly roadway, traffic, and crash data—on all public roads. The greatest challenge will be the collection, storage, maintenance, and integration of safety data for locally owned roadways. As states move toward improving the quality of their roadway, traffic, and crash data for safety on all public roads, they will be looking for examples from other agencies with such previous experience. This synthesis provides an overview of the state of the practice regarding the interoperability between state and local safety data and highlights practices of agencies that are moving toward a safety data management system to support a data-driven safety program. Interoperability is defined in this report as the ability of data, systems, or organizations to work together.

OBJECTIVES

The objective of this synthesis is to summarize current practices among local and state agencies that use reliable and current data for effective and accurate safety analysis. There is an emphasis on the interoperability of local and state datasets and the current practices for merging data between local and state agencies. There are several other topics regarding state and local safety explored in this study, including:

- Local and state agencies that are programming systemic safety improvements using risk-based and other methods to improve safety on rural roads;
- Resource and staffing availability related to managing and maintaining databases;
- Assistance to local agencies with analysis and countermeasure application; and
- Availability and use of safety data for legal and liability concerns.

This synthesis also includes suggestions for future research based on existing gaps identified through the literature review, survey, and agency interviews. It provides a reference to transportation agencies regarding existing practices in safety data management on all public roads.

TABLE 1
MIRE FDEs FOR ALL PUBLIC ROADS WITH AADT ≥ 400 VEHICLES PER DAY

FDE (MIRE Number)[a]	Definition
Roadway Segment	
Segment Identifier (12)	Unique segment identifier
Route Number (8)[b]	Signed numeric value for the roadway segment
Route/Street Name (9)[b]	Route or street name, where different from route number
Federal-aid/Route Type (21)[c]	Federal-aid/National Highway System (NHS) route type
Rural/Urban Designation (20)[c]	Rural or urban designation based on Census urban boundary and population
Surface Type (23)	Surface type of the segment
Begin Point Segment Descriptor (10)	Location of the starting point of the roadway segment
End Point Segment Descriptor (11)	Location of the ending point of the roadway segment
Segment Length (13)	Length of the segment
Direction of Inventory (18)	Direction of inventory if divided roads are inventoried in each direction
Functional Class (19)[c]	Functional class of the segment
Median Type (54)	Type of median present on the segment
Access Control (22)[d]	Degree of access control
One/Two-Way Operations (91)[c]	Indication of whether the segment operates as a one- or two-way roadway
Number of Through Lanes (31)[c]	Total number of through lanes on the segment; excludes turn lanes and auxiliary lanes
Average Annual Daily Traffic (AADT) (79)[c]	Average number of vehicles passing through a segment from both directions of the mainline route for all days of a specified year
AADT Year (80)	Year of AADT
Type of Government Ownership (4)[c]	Type of governmental ownership
Intersection	
Unique Junction Identifier (120)	A unique junction identifier
Location Identifier for Road 1 Crossing Point (122)	Location of the center of the junction on the first intersecting route (e.g., route-milepost)
Location Identifier for Road 2 Crossing Point (123)	Location of the center of the junction on the second intersecting route (e.g., route-milepost). Not applicable if intersecting route is not an inventoried road (i.e., a railroad or bicycle path).
Intersection/Junction Geometry (126)	Type of geometric configuration that best describes the intersection/junction
Intersection/Junction Traffic Control (131)	Traffic control present at intersection/junction
AADT (79) (for each intersecting road)	AADT on the approach leg of the intersection/junction
AADT Year (80) (for each intersecting road)	Year of the AADT on the approach leg of the intersection/junction
Unique Approach Identifier (139)	A unique identifier for each approach of an intersection
Interchange/Ramp	
Unique Interchange Identifier (178)	A unique identifier for each interchange
Location Identifier for Roadway at Beginning Ramp Terminal (197)	Location on the roadway at the beginning ramp terminal (e.g., route-milepost for that roadway) if the ramp connects with a roadway at that point
Location Identifier for Roadway at Ending Ramp Terminal (201)	Location on the roadway at the ending ramp terminal (e.g., route-milepost for that roadway) if the ramp connects with a roadway at that point
Ramp Length (187)	Length of ramp

(*continued on next page*)

TABLE 1
(*continued*)

FDE (MIRE Number)[a]	Definition
Roadway Type at Beginning Ramp Terminal (195)	A ramp is described by a beginning and ending ramp terminal in the direction of ramp traffic flow or the direction of inventory. This element describes the type of roadway intersecting with the ramp at the beginning terminal.
Roadway Type at Ending Ramp Terminal (199)	A ramp is described by a beginning and ending ramp terminal in the direction of inventory. This element describes the type of roadway intersecting with the ramp at the ending terminal.
Interchange Type (182)	Type of interchange
Ramp AADT (191)[c]	AADT on ramp
Year of Ramp AADT (192)	Year of AADT on ramp
Functional Class (19)[c]	Functional class of the segment
Type of Government Ownership (4)[c]	Type of governmental ownership

[a]*Model Inventory of Roadway Elements—MIRE, Version 1.0* (*12*).

[b]HPMS element required on all NHS, interstates, freeways and expressways, principal arterials, and minor arterials.

[c]HPMS full extent elements required on all federal-aid highways and ramps located within grade-separated interchanges; i.e., NHS and all functional systems excluding rural minor collectors and locals.

[d]HPMS element required on all NHS, interstates, freeways and expressways, and principal arterials.

TABLE 2
MIRE FDEs FOR ALL PUBLIC ROADS WITH AADT < 400 VEHICLES PER DAY

FDE (MIRE Number)[a]	Definition
Roadway Segment	
Segment Identifier (12)	Unique segment identifier
Functional Class (19)[b]	Functional class of the segment
Surface Type (23)	Surface type of the segment
Type of Government Ownership (4)[b]	Type of governmental ownership
Number of Through Lanes (31)[b]	Total number of through lanes on the segment. This excludes turn lanes and auxiliary lanes
Average Annual Daily Traffic (AADT) (79)[b]	Average number of vehicles passing through a segment from both directions of the mainline route for all days of a specified year
Begin Point Segment Descriptor (10)	Location of the starting point of the roadway segment
End Point Segment Descriptor (11)	Location of the ending point of the roadway segment
Rural/Urban Designation (20)[b]	Rural or urban designation based on Census urban boundary and population
Intersection	
Unique Junction Identifier (120)	A unique junction identifier
Location Identifier for Road 1 Crossing Point (122)	Location of the center of the junction on the first intersecting route (e.g., route-milepost)
Location Identifier for Road 2 Crossing Point (123)	Location of the center of the junction on the second intersecting route (e.g., route-milepost). Not applicable if intersecting route is not an inventoried road (i.e., a railroad or bicycle path)
Intersection/Junction Geometry (126)	Type of geometric configuration that best describes the intersection/junction
Intersection/Junction Traffic Control (131)	Traffic control present at intersection/junction

[a]*Model Inventory of Roadway Elements—MIRE, Version 1.0* (*12*).

[b]HPMS full extent elements required on all federal-aid highways and ramps located within grade-separated interchanges; i.e., NHS and all functional systems excluding rural minor collectors and locals.

STUDY APPROACH

A multifaceted approach was taken for this study that included a literature review, review of a recent safety data assessment from FHWA, survey of state and local transportation agencies, and interviews with agencies identified as having existing safety data practices on all public roads. The following provides more detail for each area.

Literature Review

An extensive literature search was conducted, including a review of pertinent websites, key publications and technical journals, and conference proceedings. Several sources of literature were utilized, including the National Transportation Library Transportation Research Information Database (TRIS), the NHTSA Traffic Records Improvement Program Reporting System, *Journal of the American Planning Association*, FHWA websites, university research centers, and Internet search engines, such as Google.

Roadway Safety Data Program Capabilities Assessment

The FHWA Office of Safety conducted a comprehensive assessment of states' capabilities of their roadway safety data to support their safety programs. The Roadway Safety Data Program Capabilities Assessment (RSDPCA) conducted in 2011–2012 focused on data collection, data use, data management, and data interoperability and expandability and assessed all 50 states, Washington, D.C., and Puerto Rico. Furthermore, as part of the effort, FHWA hosted a series of four Peer Exchanges from 2012–2013 to allow states to discuss their roadway safety data practices and issues and challenges with their peers. Forty-three states participated in the Peer Exchanges. The FHWA Office of Safety provided a database of the assessment responses (redacted to remove identifying information) and a summary of the draft proceedings for the four Peer Exchanges. The RSDPCA and Peer Exchanges provided information directly relevant to this synthesis.

Survey

The survey obtained information on current practices among local and state agencies regarding their collection, management, and use of safety data (roadway, traffic, and crash). The project team developed two separate questionnaires, one for state agencies (see Appendix A) and one for local agencies (see Appendix B).

The state questionnaire was distributed through the AASHTO Standing Committee on Highway Traffic Safety, Subcommittee on Safety Management. Specific contacts were provided in each state. This allowed the project team to directly follow up with individuals to solicit their participation in this study. Forty-two of 50 states fully completed the survey (plus Washington, D.C.), an 84% response rate. Three states, Hawaii, Maine, and Wisconsin, partially completed the survey; however, for consistency, their responses are not included in this report. Figure 1 is a map of the states that fully completed the survey. The list of state respondents is provided in Appendix C.

The local agency questionnaire was distributed through several avenues targeted at reaching local agency representatives who may be responsible for safety and/or roadway data. These include:

- ITE Public Agency Council
- National Association of County Engineers (NACE)
- American Public Works Association (APWA)
- LTAPs/TTAPs.

Owing to the large number of local agencies throughout the country, it was not feasible to follow up with individual contacts. The response from local agencies was not as robust as from the states. Twenty-five local agencies completed the

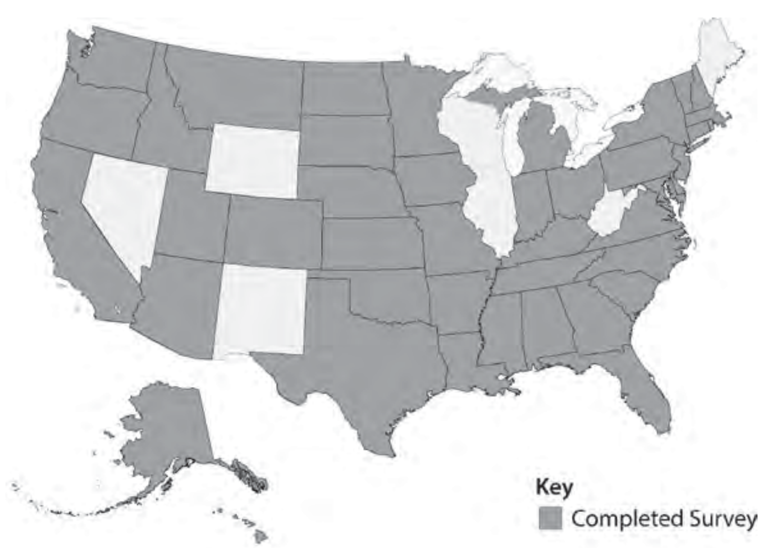


FIGURE 1 State respondents to project survey.

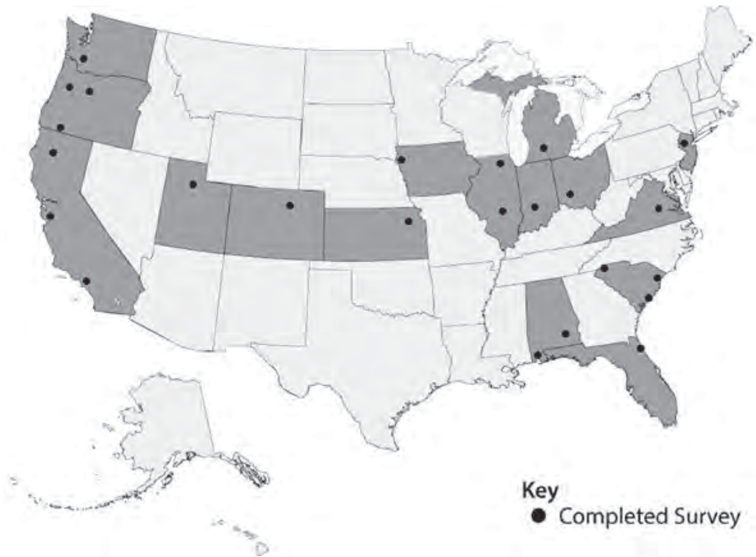


FIGURE 2 Local respondents to project survey.

survey. However, these did provide a diverse geographic representation, as shown in Figure 2. Of the 25 agencies, 20 were counties and five were cities. The list of local agency respondents is provided in Appendix D.

Interviews

Interviews were conducted with four state agencies that have projects or programs aimed at local road safety, particularly focused on increasing the interoperability of state and local data. These practices were identified based on findings from the literature review and RSDP Peer Exchange proceedings, and include:

- Tennessee: Automated Inventory Project and Tennessee Roadway Information Management System (TRIMS)
- Wisconsin: Wisconsin Information Systems for Local Roads (WISLR)
- Michigan: RoadSoft
- Minnesota: County Roadway Safety Plans

The project team developed a standard list of questions for the interviews, which is provided in Appendix E. A full summary of the interviews is provided in Appendix F.

ORGANIZATION OF SYNTHESIS

The synthesis is organized by primary topics, including data collection, data interoperability, safety decisions making, and data management. The following provides an overview of each chapter.

Chapter two—Data Collection: addresses what data are collected at the local level and at the state level for crash, roadway, and traffic data. This chapter also discusses any data sharing agreements between local agencies and state agencies.

Chapter three—Data Interoperability: addresses the interoperability of local and state data, including a discussion of compatibility, linkability, and accessibility for crash, roadway, and traffic data.

Chapter four—Safety Decision Making: addresses if and how local agencies make safety decisions and if and how states make safety decisions on local roads. This includes any support states provide to local agencies and highlights local and state coordination efforts.

Chapter five—Data Management: addresses issues with managing and maintaining the data such as staffing, funding, technology, coordination within the organization, and support from leadership for crash, roadway, and traffic data. This also includes a discussion of any support state agencies are providing to local agencies regarding the management of their safety data.

Chapter six—Conclusions: provides a brief overview of the background and objectives, a summary of the key findings, discussion of barriers to widespread implementation of the documented practices, and suggestions for further research.

Each topic within a chapter follows a similar format—the results of the local agency survey, the results of the state agency survey, and documented practices. The documented practices are drawn from the literature review, RSDPCA and Peer Exchanges, and interviews.

CHAPTER TWO

DATA COLLECTION

Data collection practices for crash, roadway, and traffic data are discussed in further detail in the following sections.

CRASH DATA

Local Agency Survey Results

Crash data are the data contained in the crash reports submitted after a collision (e.g., date, time, location, crash type, and severity). Eighteen of the 25 local agencies that responded to the survey maintain records for crashes that occur within their jurisdiction; seven agencies did not maintain any crash records. Of the 18 that maintain crash records, 15 maintain the records electronically and three maintain the records in hard copy format as shown in Figure 3.

State Agency Survey Results

Forty-three states completed the survey. However, there are two scenarios where the total number of responding states may not equal 43. First, the total number of responding states for several of the survey questions is 41, because two of those 43 states responded that they do not maintain any data for local roads and did not respond to a majority of the questions in the survey. Second, the total number of responding states for some questions may total more than 43. In these cases, the states were allowed to choose "all that apply" and gave multiple responses to a single survey question.

Forty-one of 43 states responded that they maintain at least some crash data for local roads. The majority of the states obtain the data through a combination of the state collecting the crash records and local agencies the records collecting and providing them to the state as shown in Figure 4.

Documented Practices

Electronic crash records are maintained in a variety of ways across states, including geographic information systems (GIS), structured query language (SQL), Microsoft Excel or Access, and other either in-house or off-the-shelf software packages. The formats can vary across agencies within the same state. Data that are provided in different formats (e.g., hard copy or different software platforms) make aggregation and analysis of the data much more difficult (*18*).

Local agency crash data collection varies by state. For example, California has 38 counties and 478 cities. California Highway Patrol performs crash data collection for counties. However, local police collect data for cities unless it is contracted to the Sheriff or the California Highway Patrol (*18*).

In Idaho, state statute requires a crash to be reported if there is an injury or property damage of more than $1,500. Law enforcement agencies are required to provide a report to the Idaho Transportation Department (ITD) within 24 hours of the incident. ITD provides standardized crash forms and trains law enforcement on how to complete them (*18*).

In Alaska, each local agency has its own crash system. The local agencies receive crash data directly from their local police departments. The metropolitan planning organization (MPO) acquires data from the Department of Motor Vehicles. MPOs are missing driver record reports, as well as crash reports, from the state police within MPO boundaries (*19*).

There are several states with existing practices regarding working with local agencies to obtain quality crash data. In Louisiana, the Louisiana Department of Transportation and Development (LDOTD) is responsible for collecting crash data for the entire state and maintaining the state crash database. This totals approximately 165,000 crash reports annually between state, parish, and local law enforcement agencies. LDOTD discovered that the quality and accuracy of the crash data was being affected by incorrect and incomplete coding of the crash reports by law enforcement officers. LDOTD hired a law enforcement expert (LEE) dedicated to working with law enforcement agencies on improving crash data collection. The LEE also assists in implementing the Strategic Highway Safety Plan (SHSP). The LEE works statewide and reviews crash reports to identify and resolve potential issues with crash report completion in the various jurisdictions. When there are issues identified, the LEE helps train the officers on proper procedures. Because the LEE is a retired police officer; the law enforcement agencies respond well since this officer is "one of their own." Louisiana's crash data accuracy and completeness has improved through the use of the LEE, which has helped lead to better informed decision making in the state's efforts to improve safety. Local agencies also benefit from this program. This outreach to local law enforcement has helped raise awareness of the availability of data from the state to guide local safety programs (*17*).

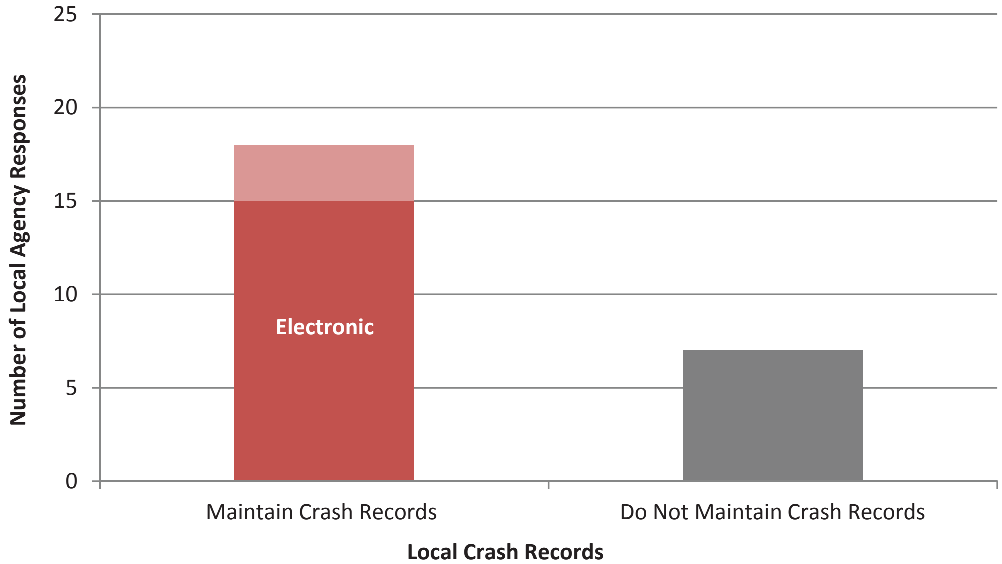


FIGURE 3 Local agency crash records maintenance.

The Illinois Department of Transportation (IDOT) recognized that limited access to crash data in the state is a barrier to being able to identify issues that were contributing to fatal and serious injury crashes on local roads. In 2005, IDOT developed an innovative program to improve its local crash database. IDOT allocated $1 million of HSIP funds for counties to collect and geo-locate five years of fatal and serious injury crashes on local roads. Some counties pooled their funds to coordinate with a regional MPO to do the work. Other counties used temporary staff, part-time interns, or contractors to complete the work. This effort benefited the local agencies, as well as the state. These crash databases have helped the counties meet the IDOT requirement for five years of data to apply for HSIP funds. Many local agencies recognized the significant benefits of the data and have chosen to continue collecting and geo-locating crash data using other funding sources (*2*).

In Iowa, police agencies use the Traffic and Criminal Software (TraCS) (Figure 5). TraCS is application software used for electronic crash data capture. It can create a near real-time local crash database given agencies reported crashes into TraCS. TraCS includes a "Smart Map" location tool that enables law enforcement officers in the field to capture the crash location, as well as locate the crashes at the state custodial agency level. The coverage is statewide and captures coordinates for crashes, citations, and other spatial events. The upload to the local database takes place simultaneously with the upload to the state custodial office. Thus, all data being captured electronically by TraCS's agencies could be immediately located for both local agency and state use (*20*).

Having access to the state crash data has been useful for local agencies. In Buchanan County, Iowa, there are roadways

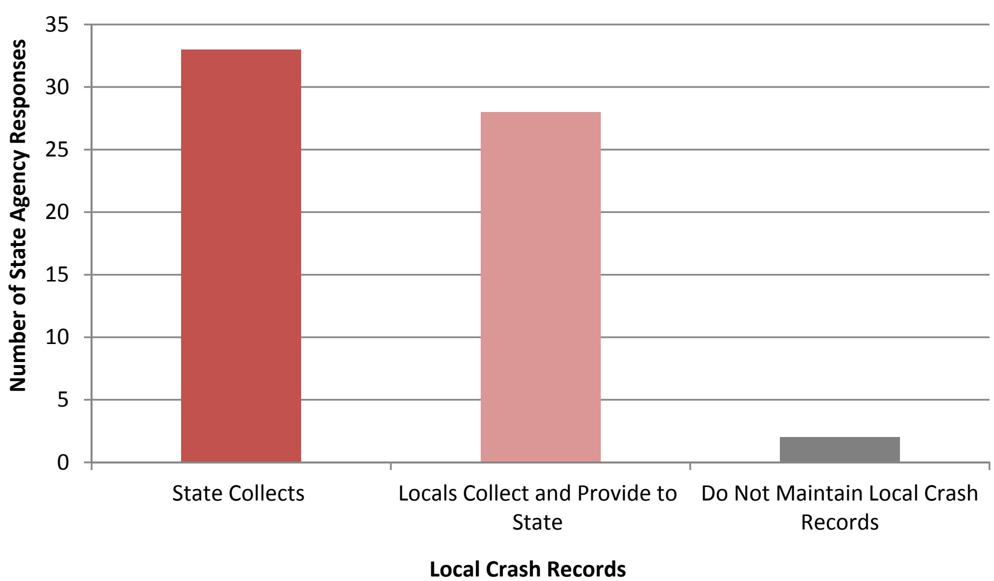


FIGURE 4 State agency local crash records.

FIGURE 5 TraCS logo (*top*) and image of police officer entering crash data in his vehicle (*bottom*).

with minimal or no shoulders and steep slopes that may pose a potential safety concern. Through the TraCS tool, law enforcement officials report all crashes to the online database, which can be accessed by the county engineers. County engineering staff uses the online crash database to identify and prioritize locations where the highest number of fatal crashes has taken place. County engineers then conduct a site visit and consider how to best treat the location. Collecting the information on fatal crashes in the county, in combination with evaluating the police crash reports, is a big step in prioritizing areas for safety improvements as part of the county's safety improvement plan (*21*).

Over the past ten years, however, the Ohio Department of Transportation (ODOT) has used its SHSP and Traffic Records Coordinating Committee (TRCC) to better coordinate data collection, management, and use. There are more than 1,000 law enforcement agencies collecting crash data and as many local partners (i.e., MPOs, counties, and towns) analyzing and using the data. In the past, each local agency cleaned and analyzed data on their own, which led to disparate datasets. ODOT has since instituted agreements with local agencies across the state that promote data sharing, so that all agencies are relying on a common dataset that is constantly improved (*22*). LTAPs and the County Engineers Association of Ohio have helped promote safety at the local level.

ROADWAY DATA

Roadway data refer to information pertaining to the physical and locational attributes of a roadway. General categories include segments, curves, intersections, and interchanges and ramps. The survey conducted for this study acquired information on the data collection practices of both state and local agencies for a variety of roadway information including base maps, roadway segments, curves, intersections, and supplemental datasets such as signs, signals, pavement, pedestrians and/or bicycles, and safety improvements.

Local Agency Survey Results

Twenty-four of the 25 local agencies surveyed have a base map of the roadways in their jurisdiction. Of these 24 local agencies, 21 maintain the base map in GIS, whereas the remaining three agencies maintain their base maps in either a LRS or link/node without using GIS as shown in Figure 6.

Of the 25 local agencies that completed the survey, only one responded that it did not collect any roadway information. Table 3 provides an overview of the local agency responses on their roadway data collection practices for roadway segment,

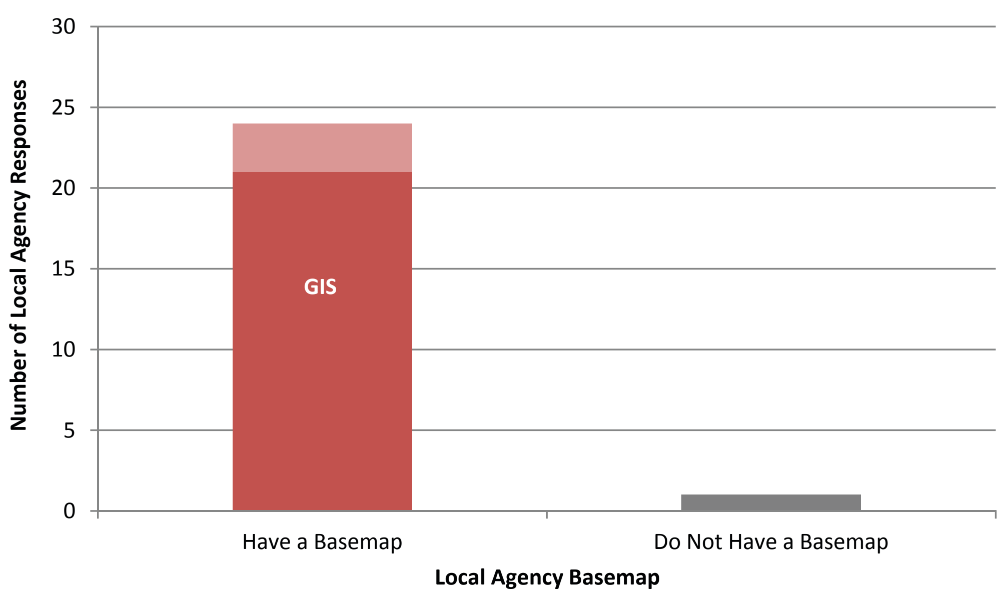


FIGURE 6 Local agency roadway base map.

TABLE 3
OVERVIEW OF LOCAL AGENCY RESPONSES ON ROADWAY DATA COLLECTION PRACTICES

Roadway Elements	Agency Collects Only for Internal Use	Agency Collects and Provides to the State	State Collects and Provides to Agency on Regular Basis
Roadway Segment Descriptors			
Segment Location/Linkage Elements	19	2	2
Segment Roadway Classification	18	6	4
Segment Cross Section	16	0	1
Roadside Descriptors	14	0	1
Roadway Alignment Descriptors			
Horizontal Curve Data	12	0	1
Vertical Grade Data	11	0	1
Roadway Junction Descriptors			
At-Grade Intersection/Junctions	16	0	1
Interchange and Ramp Descriptors	3	0	1
Supplemental Datasets			
Signs	23	0	0
Signals	14	2	1
Pavement	22	1	1
Pedestrians and/or Bicycles	14	0	0
Safety Improvements	17	0	0
Other, Please Describe	3	1	0

alignment, junctions (i.e., intersections), and supplemental datasets. Respondents were asked to indicate if they collect each dataset for internal use only, if they collect the data and provide it to the state, or if the state collects and provides data to the local agency. The majority of local agencies that collect roadway data collect it for internal use only. Of the data types listed, the highest number of local agencies indicated that they collect sign information (23 of 25), while the next highest is pavement information (22 of 25), followed by roadway location information (19 of 25). A number of agencies collect information on intersections (16 of 25) and horizontal curves (12 of 25). These are often datasets that state agencies would like to collect but are not currently doing so owing to multiple factors including staffing, funding, technology, competing priorities, etc. (*16*). Coordinating with local agencies may provide opportunities for states looking to develop these types of datasets statewide.

State Agency Survey Results

Thirty-two of the 41 states responded that they maintain at least some roadway segment information for local roads, whereas nine reported that they do not maintain any roadway segment information. Of the 32 states that maintain some segment information, 30 responded that they collect the roadway segment data on local roads and 17 reported that the local agencies collect roadway segment data and provide it to the states (survey respondents were given the option to choose all that apply). Of the 30 state agencies that collect roadway segment data, 21 responded that they then provide the data to local agencies. Of the 17 state agencies that responded that the local agencies collect and provide data to the state, ten responded that they review and revise the data and send the revised data back to the local agencies, as shown in Figure 7.

Sixteen of 41 states responded that they maintain at least some curve information on local roads and 29 that they do not maintain local curve data, as shown in Figure 8. States were given the option of selecting all of the responses that apply. Of the 16 states that maintain curve information, three responded that they and local agencies both collect the data and provide them to the states. In addition, some states responded that they both collect curve data and do not collect curve data. There was no further information available as to why this inconsistency occurred.

Of the states that collect the curve data, eight reported that they provide the curve data to local agencies. Of the states that responded that the local agencies collect and provide it to the state, two states reported that they review and revise the data and send the revised data back to the local agencies.

Fifteen states responded that they maintain at least some intersection information on local roads, whereas 28 states

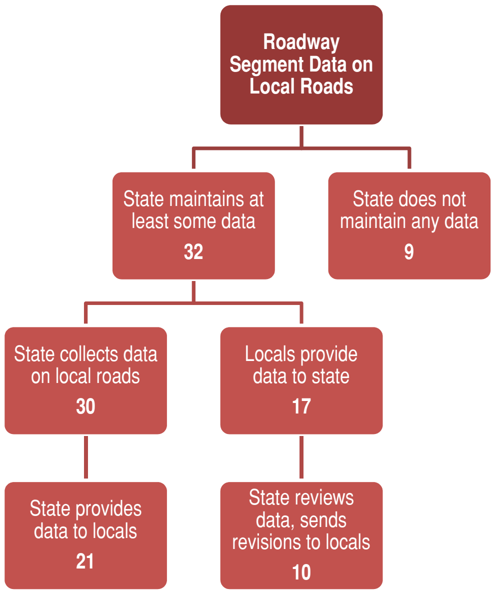


FIGURE 7 Breakdown of state roadway segment data practices on local roads.

reported that they do not, as shown in Figure 9. Of the 15 states that collect intersection information, five responded that local agencies also collect intersection information and provide it to the state. As with the curve information, there was a small number of states that both reported that they collects intersection information and do not collect intersection information. As with curve data there was no additional information available to explain why this inconsistency occurred.

Of the 15 states that collect intersection data on local roads, nine provide data to local agencies. Of the three states that responded that local agencies collect and provide it to the state, two reported that they review and revise the data and send the revised data back to the local agencies.

Eighteen of 41 states responded that they maintain at least some supplemental data on local roads (e.g., signs, signals, pedestrian, etc.) and 25 that they do not collect any supplemental data on local roads, as shown in Figure 10. States were given the option of selecting all of the responses that apply. Of the 18 states that maintain supplemental information, 15 responded that they collect the supplemental data, whereas eight reported that local agencies collect the data and provide it to the state. A small number of states noted that the state both collects and does not collect supplemental information. There was no further information available as to why this inconsistency occurred.

Of the 15 states that collect supplemental data on local roads, nine provide the data to local agencies. Of the states reporting that local agencies collect and provide the data to the state, four responded that they review and revise the data and return the revised data to local agencies.

Conflicting Responses

There were some inconsistencies between responses from states and local agencies within the same state with regard to the collection and sharing of roadway data, as shown in Table 4.

Such conflicting responses highlight the challenges of coordination and communication between state and local agencies. Conversely, there were several instances where both the state and local agencies responded that they collect roadway, intersection, and/or curve data on local roadways; a duplication of effort that could indicate a lack of coordination

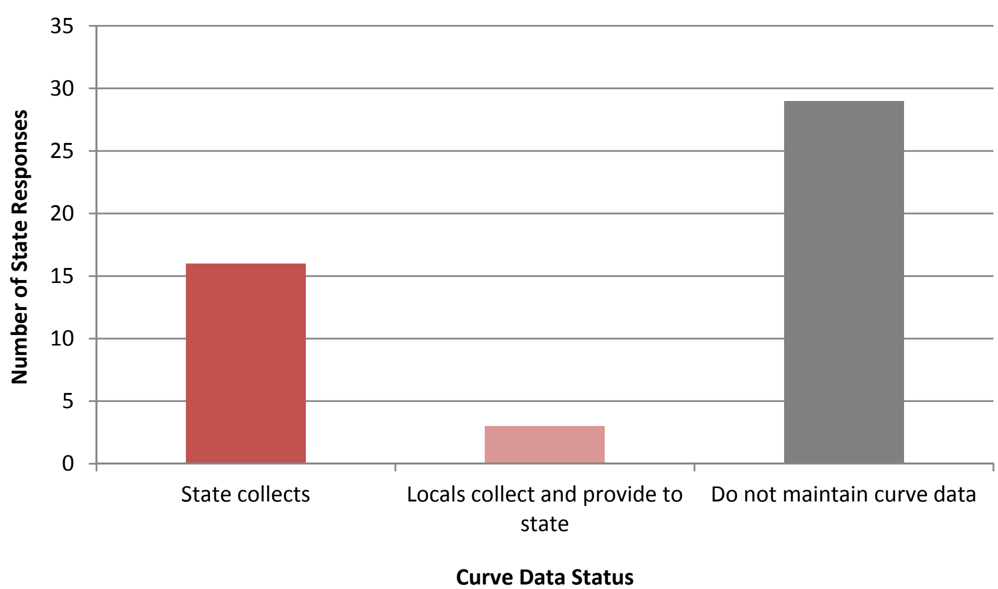


FIGURE 8 Curve data on local roads maintained by state.

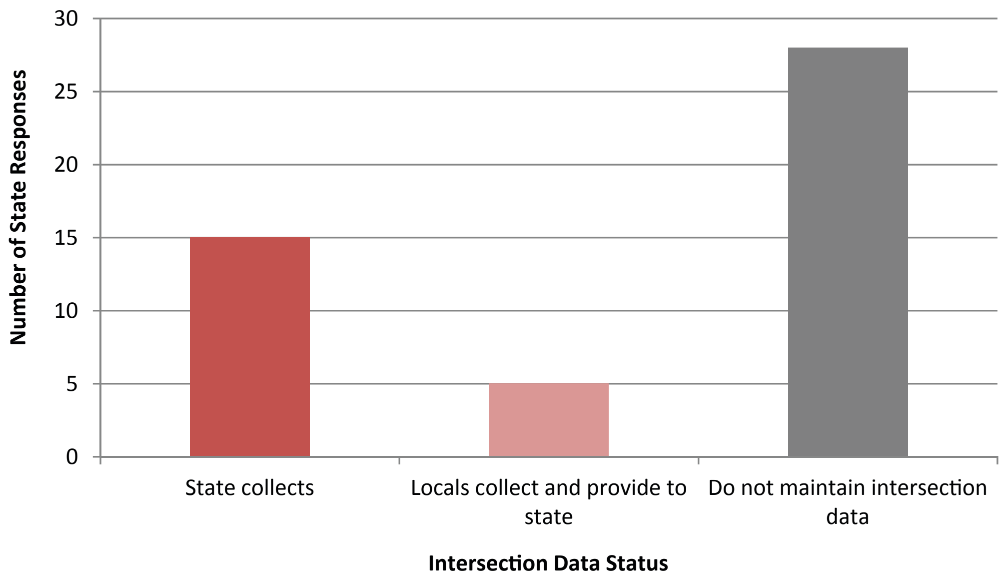


FIGURE 9 Intersection data on local roads maintained by state.

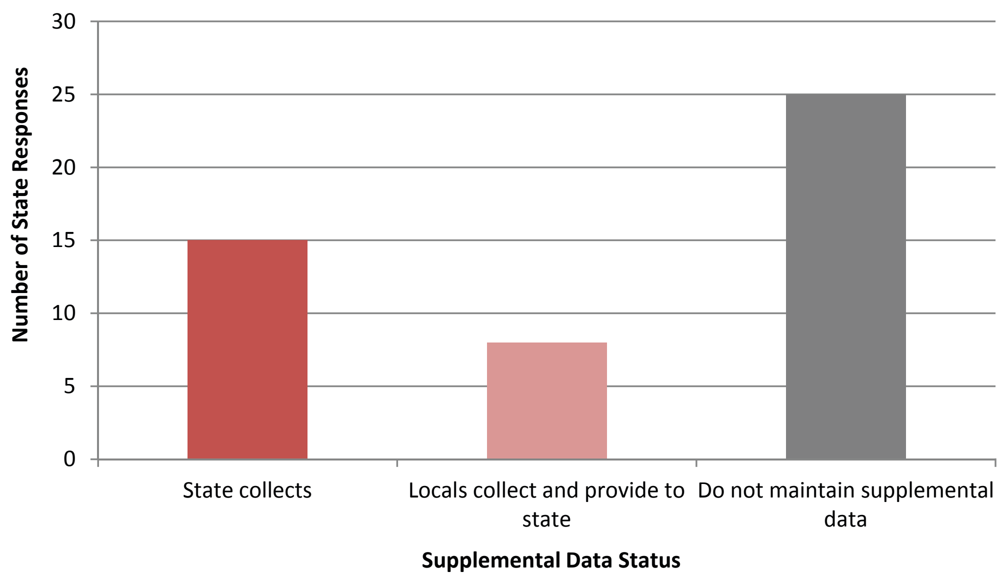


FIGURE 10 Supplemental data on local roads maintained by state.

TABLE 4
CONFLICTING RESPONSES BETWEEN STATE AND LOCAL AGENCIES FOR ROADWAY DATA-RELATED SURVEY QUESTIONS

Survey Question	Number of Conflicting Responses
How does the state obtain roadway data on segments for local roads?	6
Does the state provide roadway segment data to locals (if collected)?	8
How does the state obtain roadway data on curves for local roads?	3
Does the state provide curve data to locals (if collected)?	3
How does the state obtain intersection data for local roads?	4
Does the state provide intersection data to locals (if collected)?	3
If locals provide roadway data to the state, does the state review/revise and send back to locals?	3

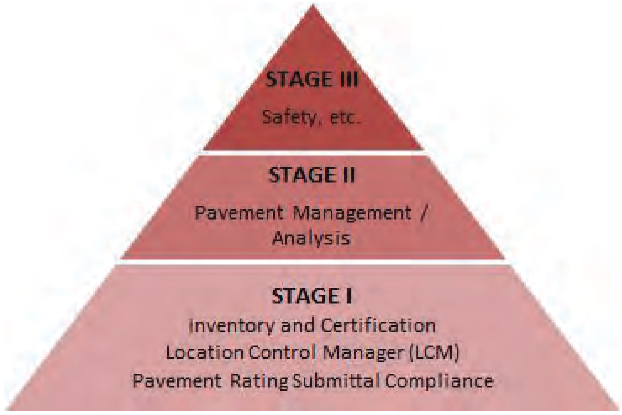
potentially leading to inefficient use of funds (if both agencies use funds to collect the same data elements).

Documented Practices

According to the RSDPCA, 44 of 51 states have at least some local roads in a base map, although the percentage varies from 5% to 100% of local roads (for the purposes the RSDPCA project, Washington, D.C., was included as a state). The results of the RSDPCA showed that roadway elements acquired at the state level are not collected at the same level of detail for locally maintained roadways or functionally classified local roads. In general, roadway data on local roadways are less robust than roadway data on the state system, particularly related to completeness and coverage (*16*).

There are several states with existing practices regarding obtaining roadway data on local roads. Ohio has developed a Location Based Response System (LBRS), which establishes partnerships between state and local government agencies for sharing street centerline data with address ranges. The local agencies are responsible for developing and maintaining the data at a high level of accuracy. The data are verified for completeness, consistency, and accessibility at the local level, and then provided to the state and incorporated into a statewide dataset that can be accessed by multiple agencies. The data sharing eliminates redundant data collection, thereby saving money, and meets the needs of multiple agencies. In addition, all of the information collected through LBRS exists in the public domain and can be easily accessed. ODOT is the program sponsor, but it is administered through the Ohio Geographically Referenced Information Program (*23*).

Wisconsin has 113,330 miles of public roadways, of which 102,000 miles (90%) are local roads. These local roads are managed by more than 1,200 towns, 400 villages, 190 cities, and 72 counties. There was an existing state statute that required local agencies to submit local roadway location and attribute changes. Originally, Wisconsin had a Local Roads and Streets Council (LRSC) made up of officials from cities, villages, and towns. In 1996, the LRSC began discussing how to make meeting the statute requirements easier and more efficient and devised a central repository into which they could submit the data, which they then presented to the secretary of transportation. From this need, the Wisconsin DOT (WisDOT) developed the Wisconsin Information System for Local Roads (WISLR) as a means to collect, store, and share data on local roads.



WISLR is a web-based GIS (see Figure 11). Local governments are required to submit data on new roads and changes to existing roads on an annual basis. Prior to WISLR, each municipality had its own map stored in a computer-aided design and drafting system or GIS; the state combined these maps into one database.

The development of WISLR took five years, with a multi-tiered implementation. Stage 1 was to comply with inventory and certification of the local roads statute. WISLR data support the distribution of approximately $400 million in general transportation aids to local governments. Stage 2 provided local governments with a tool that highlights location-specific estimates of pavement needs that are prioritized and placed within a 5-year budget plan. Stage 3 was designed to improve decision making for safety initiatives using WISLR's statewide data and location network. With recent federal requirements, along with the need to more efficiently manage limited safety improvement resources, data-driven approaches to supporting operations and planning decisions have become key. WisDOT has recently completed a project to geocode multiple years of state and non-state crashes to a single statewide network. The crash map was subsequently leveraged to develop an automated approach to identifying a statewide list for the high-risk rural roads program (HRRRP) for potential HSIP projects.

There were three primary champions of the development of this system: (1) WisDOT Management; (2) the WISLR Development Team; and (3) LRSC comprised of local officials, regional planning commissions, and MPOs. They were able to secure support from leadership because of a strong partnership between the DOT Secretary's Office and LRSC. WisDOT was able to arrange the cooperation of approximately 98% of local agencies covering approximately 100% of reported local roads.

WisDOT undertook a significant outreach effort to acquire support and cooperation from local agencies, and the outreach and education continues today. This includes:

- Training, education, informational hand-outs, and a training CD
- Bi-annual face-to-face training sessions statewide
- Bi-annual webinar training sessions on multiple topics
- WISLR uses group forums for outreach, to solicit their input, and for additional training
- Local access to a help line 24/7
- Being present at local government annual conferences/meetings.

This outreach helps provide feedback to WisDOT on local agency issues and potentially needed upgrades or revisions to the data.

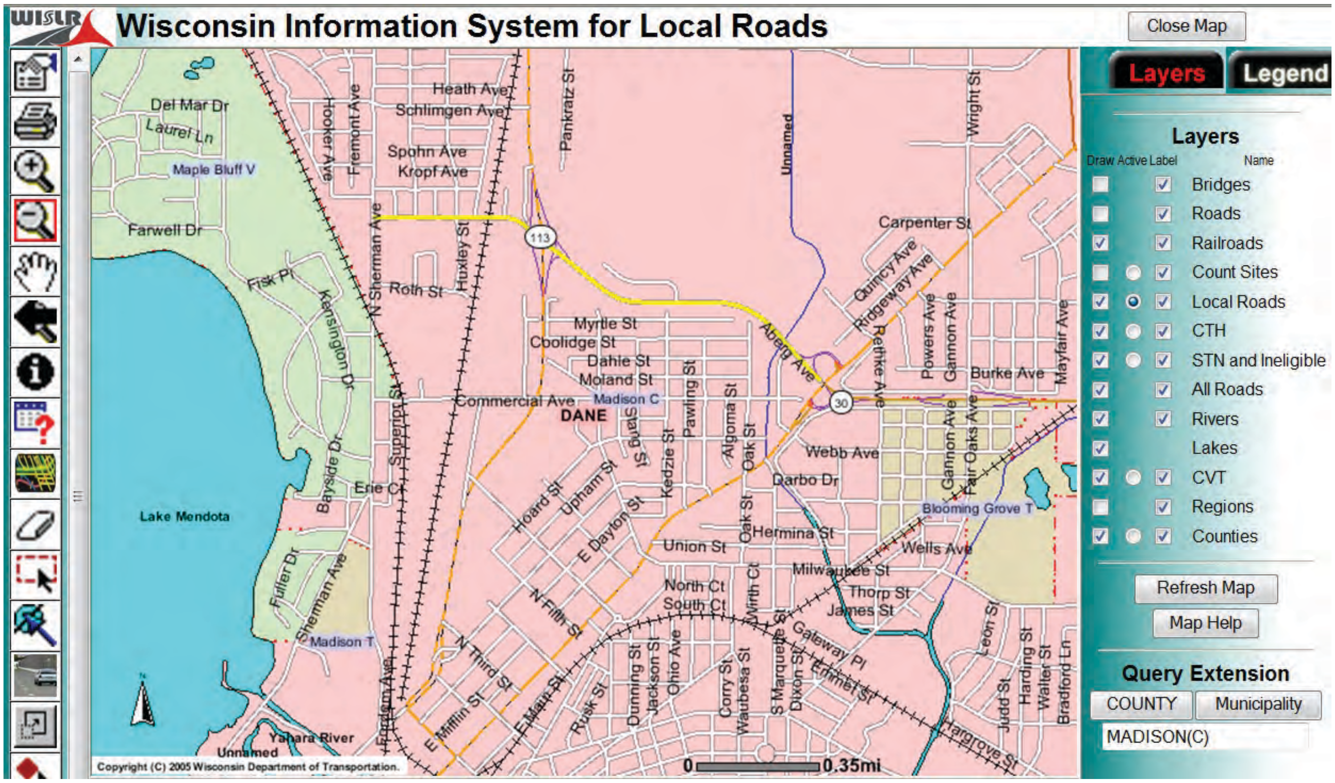


FIGURE 11 Screenshot of WISLR mapping.

WisDOT reported several benefits to the state from this effort. They are able to meet ongoing federal requirements; for example, HPMS, HRRRP, MAP-21, and All Roads Network of Linear Referenced Data (ARNOLD), etc. In addition, the WISLR network was selected as the Incident Locator Tool map used in law enforcement vehicles, providing one common network. WISLR coverage contains the statewide local road network and includes state highways for visual reference and continuous lines.

Not only are there benefits to the state for having this information, there are benefits to the local agencies as well. Many local agencies do not have the resources to maintain a roadway inventory; WISLR provides a repository for roadway data. In addition, local agencies are able to access not only their own data, but data statewide. WISLR provides local agencies with the ability to access statewide roadway inventory data 24/7. It also includes a 5-year pavement analysis tool, interactive mapping capabilities, and various reports, maps, and querying tools, etc.

Several factors contributed to the development and continued deployment of the tool:

- Meeting a real need
- Identifying core stakeholders and communicating with them regularly on the status of the project helped to keep them engaged
- Having support from both DOT management and local agencies
- Being able to show progress
- Using solid project management methods, including a Business Model Report, from the user perspective that demonstrated how the design will fulfill the scope and objectives.

Additional important considerations for undertaking this type of effort include the maintenance of the data. It is important to consider not only the initial data collection but also how to maintain the data in the long term. This includes considering the current structure of the relationship with local agencies, and developing something that not only benefits the state, but also benefits the local agencies so they will continue to use it and maintain their data in the future.

WisDOT is currently working on a project to upgrade WISLR with a crash mapping tool and eventually with a crash analysis tool. This tool will allow users to conduct an analysis with all crashes on a single map, and provide law enforcement the same base map on electronic collection units to more accurately locate crashes.

Information on this practice is based on an interview with WisDOT. For more information, see the complete interview summary in Appendix F.

Tennessee has 97,500 miles of public roadways, of which 67,500 miles (69%) are local roads. Tennessee DOT (TDOT) has undertaken a significant effort to collect roadway information on local roads. The TDOT GIS Mapping and Facilities Data Office updated existing local road inventory and collected Global Positioning System (GPS) centerlines on the local roads to complete the LRS spatial network. The LRS spatial network is used for accurate mapping and reporting of HPMS data, crash data, bridge data, and asset management. TDOT collected 67,500 miles of local road inventory and GPS centerline data, which were added to the existing 30,000 miles of interstate, state highway, and functional route roadway inventory and GPS centerline data. The types of information included linear reference points, lane widths, shoulder widths, intersections, speed limits, etc., using an instrumented vehicle. Data were collected using an instrumented vehicle as shown in Figure 12.

The data are stored in TRIMS, a client/server application LRS database that contains roadway inventory, structures, pavement, photolog, traffic, and crash data. TDOT identifies crash data on 30,000 miles of state and functionally classified routes. They are working toward inputting the local road crash data to incorporate it with the local road inventory data obtained in 2012. TDOT recently passed a new law that all police agencies must submit crash reports electronically by 2015.

FIGURE 12 Instrumented vehicle used in Tennessee data collection.

There were champions within the GIS Mapping and Facilities Data Office, Safety, and HPMS that collaborated on this effort. The project took from 2007 to 2012 and cost $11,900,000. State Planning and Research Funds were used to fund the project. The greatest challenge was being able to prove the value of the project to obtain the funding. TDOT's number one priority is safety on all state roadways. It was able to line up support from leadership because executives recognized the importance of being able to address safety issues on all state roadways. In addition, the University of Tennessee's Transportation Research Center conducted a study on the existing method of collecting roadway inventory and GPS data collection compared with an automated method. The study was beneficial in providing the information needed to undertake the data collection project.

The roadway data are available to local agencies. TDOT has been working with the MPOs and regional planning organizations to notify local agencies that they have access to the data. TDOT also identifies safety issues on local roads, and has worked directly with local agencies on addressing these issues. This has been a significant benefit to the local agencies. These agencies do not always have the necessary funding; therefore, by working with the state, the state is able to help provide funding to address safety issues. The state has already realized benefits of these efforts as local road fatalities have decreased.

A key lesson learned from this effort is the need for support from the both the local agencies and state DOT leadership. Both practitioners and leadership/executives need to understand the importance of addressing safety on local roads, and the importance of data in being able to do that. Other lessons learned included the importance of:

- Doing the research and drafting the request for proposal to include all requirements.
- Testing data collection procedures in a pilot jurisdiction.
- Automating for quality assurance and quality control.
- Expecting and being ready to address unforeseen hurdles.

Information on this practice was based on an interview with TDOT. The complete interview summary is provided in Appendix F.

TRAFFIC DATA

Traffic data include information on the traffic volume and operations of roadways and intersections. The survey covered traffic data on segments, both traffic volume data and

TABLE 5
OVERVIEW OF LOCAL AGENCY RESPONSES ON TRAFFIC DATA COLLECTION PRACTICES

Traffic Elements	Agency Collects Only for Internal Use	Agency Collects and Provides to the State	State Collects and Provides to Agency on Regular Basis
Segments			
Segment Traffic Volume Data	17	2	7
Segment Traffic Operations/Control Data	6	0	2
Junction Counts			
Turning Movement Counts	13	1	2
Ramp Counts	2	0	4
Supplemental Counts			
Pedestrian Counts	5	0	1
Bicycle Counts	5	0	1
Other, Please Describe	0	0	0

traffic operations and control data; junction counts, both turning movement counts and ramp counts; and supplemental counts, including pedestrian counts and bicycle counts.

Local Agency Survey Results

Twenty of 25 local agencies collect some traffic data. Table 5 provides an overview of local agency responses on traffic data collection practices. The majority of local agencies that collect traffic data collect traffic volume data (17 of 20), followed by turning movement counts (13 of 20). Few agencies responded that they collect traffic data and provide it to the state. Seven local agencies responded that the state provides the traffic volume information.

State Agency Survey Results

Thirty-three of 41 states responded that they maintain some traffic volume data on local roads. Figure 13 illustrates the breakdown of state agency local segment data practices on local roads based on the survey results. Thirty states responded they collect traffic volume data on local roads and 17 that local agencies collect and provide the data to the state. Of the 30 states that collect traffic volume data, 23 provide it to local agencies. Of the states where local agencies collect and provide data to the states, ten responded that they review/revise the data and provide it back to the local agencies.

Eighteen of 41 states responded that they maintain some segment traffic operations and control data for local roads. States were given the option of selecting all of the responses that apply. Fourteen states responded that they collect segment traffic operations and control data for local roads and seven that local agencies collect and provide the data to the state, as shown in Figure 14. Of the states that collect traffic operations and control data for local roads, eight provide it to local agencies. Of the states where local agencies collect and provide data to the states, five responded that they review/revise the data and provide it back to the local agencies.

Seventeen of 41 states responded that they maintain intersection turning movement counts for local roads. States were given the option of selecting all of the responses that apply. Thirteen states responded that they collect intersection turning movement counts and nine that local agencies collect and provide the data to the state, as shown in Figure 15. Of the 13 states that collect intersection turning movement counts, seven provide it to local agencies. Of the nine states where local agencies collect and provide data to the state, three review/revise the data and send it back to the local agencies.

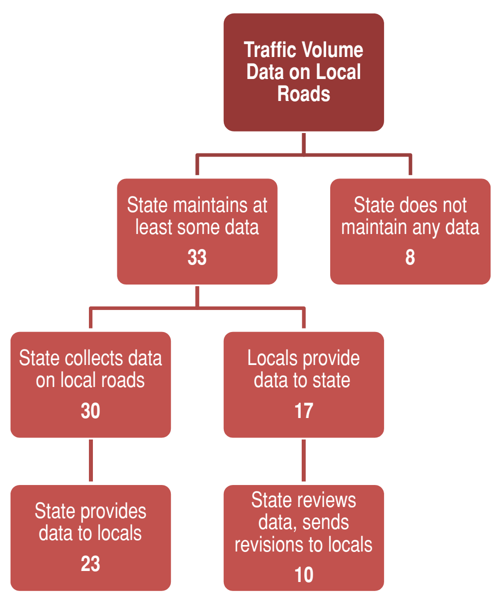


FIGURE 13 Breakdown of state local segment data practices on local roads.

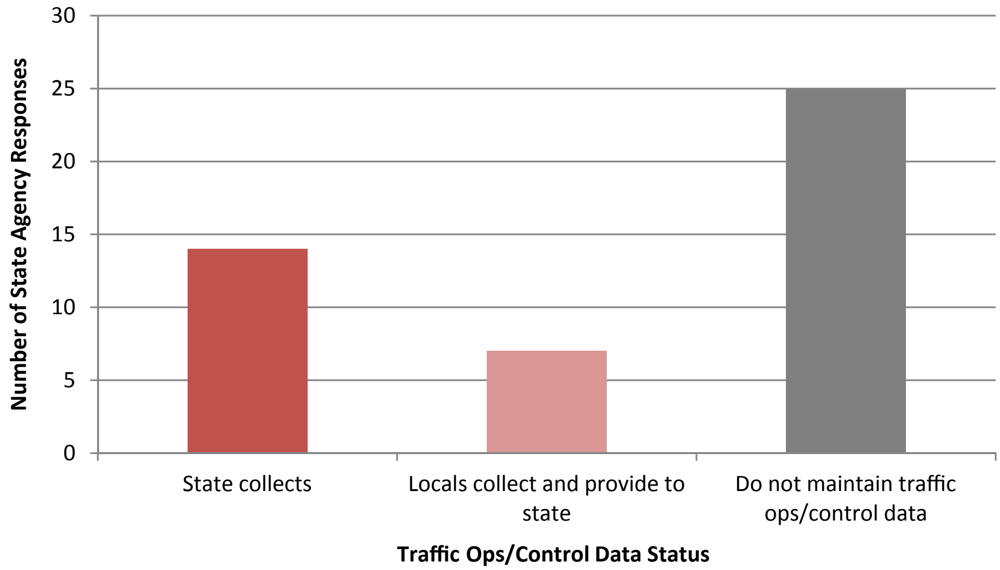


FIGURE 14 Traffic operations and control data on local roads maintained by state.

Nine of 41 states responded that they maintain some supplemental counts (e.g., pedestrian counts and bicycle counts). States were given the option of selecting all of the responses that apply. Five states responded that they collect supplemental counts for local roads and six that local agencies collect and provide the data to the states, as shown in Figure 16. Of the nine states that collect supplemental counts, two provide them to local agencies. Of the six states where local agencies collect and provide the data to the state, two review/revise the data and send it back to the local agencies.

Conflicting Responses

Some inconsistencies were evident between responses from state and local agencies in the same state with regard to the collection and sharing of traffic data, as shown in Table 6. For example, one state responded that they provide traffic data to the local agency, but the local agency responded that the state does not provide traffic data. Conversely, there was at least one state and one local agency within the same state that both reported collecting traffic data on local roads, signaling a potential duplication of efforts.

Documented Practices

Collecting traffic counts on local roads can be a challenge for many states. Several states are investigating different methods for obtaining traffic counts on local roads. In Minnesota, the most traffic data are collected by Minnesota DOT (MnDOT) district offices. MnDOT has investigated alternatives to this

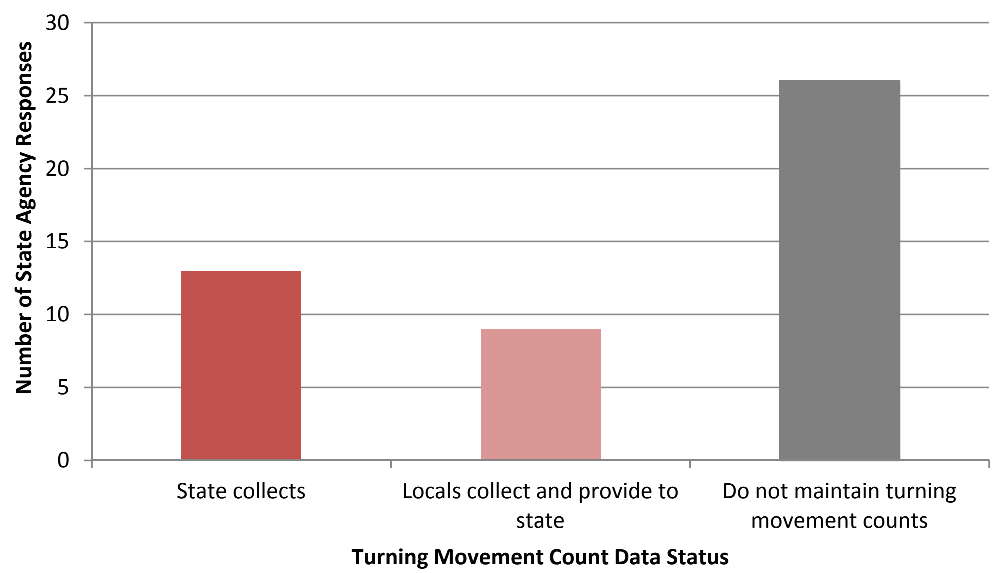


FIGURE 15 Turning movement counts data on local roads maintained by state.

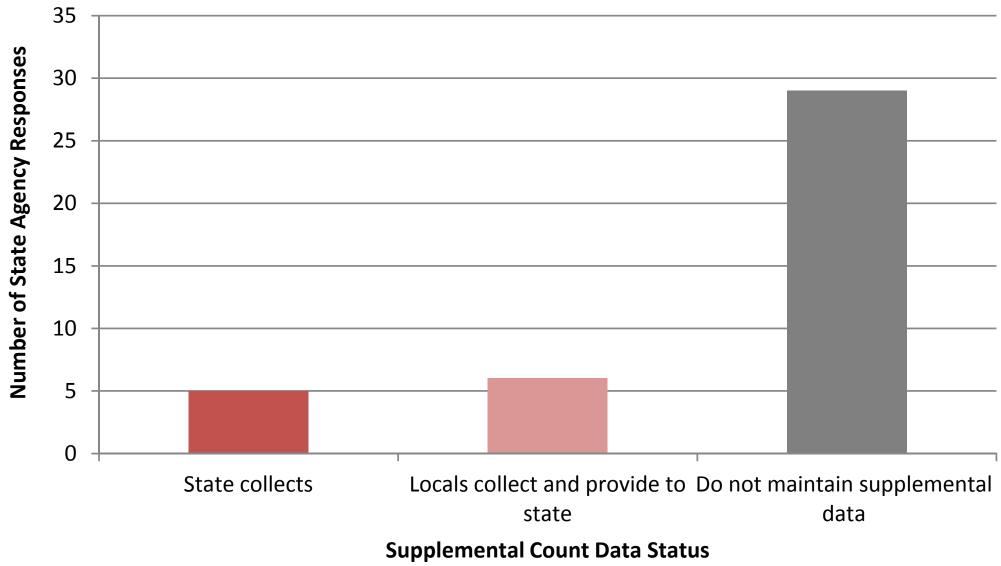


FIGURE 16 Supplemental data on local roads maintained by state.

primarily centralized approach to gathering traffic counts, an effort that examined traffic counting practices on local roads from five perspectives (*24*):

1. Current MnDOT traffic counting practices.
2. Traffic counting technologies appropriate for temporary deployment.
3. Literature review of traffic counting practices on local roads.
4. Surveys of statewide participants in MnDOT's traffic data collection program (initial and supplemental surveys).
5. Survey of state DOT local road traffic data collection practices.

The literature review from the MnDOT study found that Alaska, Florida, Kentucky, Pennsylvania, and Texas have all explored sampling procedures for estimating traffic data on local roads (*24*). In Pennsylvania, there are more than 72,000 miles of roadways owned by 2,565 municipalities that are classified as local roads. Currently, the Pennsylvania Department of Transportation (PennDOT) does not have a systematic approach to monitoring the traffic volumes on these roadways to produce estimates of vehicle-miles traveled (VMT). PennDOT explored a sampling method to collect the data required to produce VMT estimates on local roads owned by municipalities. The proposed research methodology built on the guidance contained in the *Traffic Monitoring Guide* (*25*) and *Highway Performance Monitoring System Field Manual* (*26*), the experiences acquired through a survey of state DOTs, and an extensive literature search, to develop a plan specific to the circumstances facing PennDOT.

The methodology was developed to be feasible using the resources PennDOT has available to devote to local road monitoring and to provide a foundation of data upon which VMT estimates could be made at the county level for each urban and rural code. The methodology relied on sample panel selection that involved deciding on the variables that the local roads would be stratified and the sample sizes within each stratum. Once the sample panel selection methodology was in place, the required sample was randomly drawn. The project team stratified the roadway segments according to how the VMT estimates would be made at the county level for each of the four urban and rural

TABLE 6
CONFLICTING RESPONSES BETWEEN STATE AND LOCAL AGENCIES FOR TRAFFIC DATA RELATED SURVEY QUESTIONS

Question	Number of Conflicting Responses
Does the state provide segment traffic data to locals?	4
Does the state provide traffic operations/control data to locals?	1
If locals provide traffic data to the state, does the state review/revise and send back to locals?	5

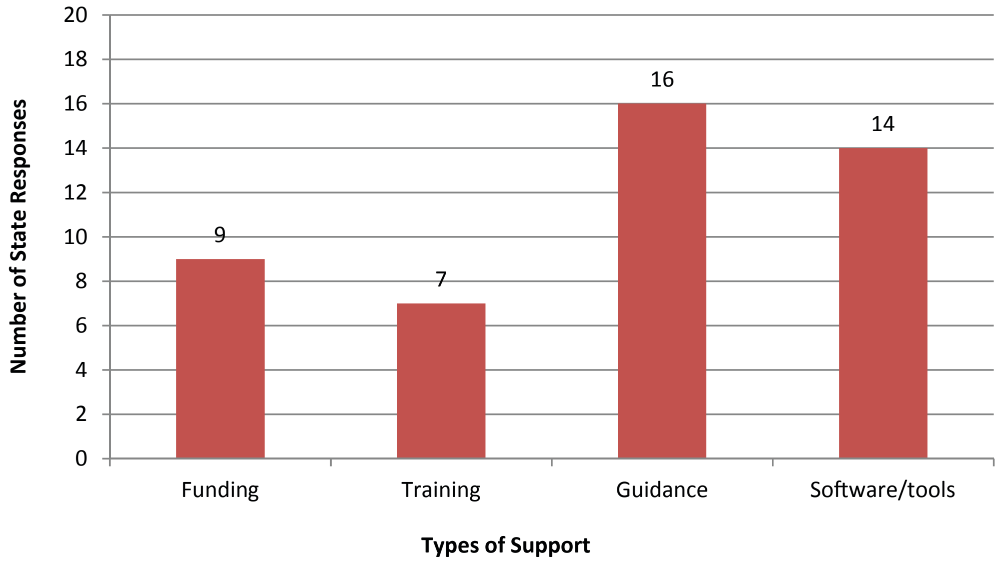


FIGURE 17 Safety data collection support provided to local agencies.

codes. This scheme was selected as the basis for stratifying the roadway segments. The end result was a plan that contained 7,171 count stations spread proportionally over 152 strata (*27*).

Data Collection Support

States responded to survey questions regarding the type of support provided to local agencies for safety data collection for all three data categories: crash, roadway, and traffic. Sixteen of 43 states responded that they provide guidance in terms of data dictionaries, format requirements, collection guidebooks, etc., to local agencies for safety data collection. Additional support provided to local agencies included funding, training, and software and tools, as shown in Figure 17.

A summary of the documented data collection practices, including contact information and websites when available, are provided in Table 7.

TABLE 7
SUMMARY OF DATA COLLECTION PRACTICES

State	Practice	Description	Contact Information
Crash Data			
Idaho	Crash Reporting	ITD provides standardized crash forms and trains law enforcement on how to complete them.	Kelly Campbell Research Analyst, Principal Idaho Transportation Department kelly.campbell@itd.idaho.gov 208-334-8105
Louisiana	Law Enforcement Expert	LDOTD hired a Law Enforcement Expert (LEE) dedicated to working with law enforcement agencies on improving crash data collection.	Terri Monaghan Highway Safety Manager Louisiana Department of Transportation and Development Terri.Monaghan@la.gov 225-379-1941
Illinois	Geo-located Local Crash Data	IDOT allocated HSIP funds for counties to collect and geo-locate five years of fatal and serious injury crashes on local roads.	Priscilla Tobias State Safety Engineer Illinois DOT Priscilla.tobias@illinois.gov 217-782-3568

(*continued on next page*)

TABLE 7
(*continued*)

State	Practice	Description	Contact Information
		Crash Data	
Iowa	TraCS	TraCS is application software used for electronic crash data capture. TraCS includes a "Smart Map" Location Tool that enables law enforcement officers in the field to capture the crash location, as well as locating the crashes at the state custodial agency level.	David Meyers TraCS Program Manager Iowa DOT david.meyers@dot.iowa.gov 515-237-3042 http://www.iowatracs.us/
Ohio	Data Sharing	ODOT has instituted agreements with local agencies across the state that promote data sharing. ODOT has used its SHSP and TRCC to better coordinate data collection, management, and use in the state.	Derek Troyer Systems Planning & Program Management Ohio DOT Derek.Troyer@dot.state.oh.us 614-387-5164
		Roadway Data	
Ohio	LBRS	Ohio has developed a LBRS, which establishes partnerships between state and local government agencies for sharing street centerline data with address ranges.	Jeff Smith OSDI Manager Ohio Geographically Referenced Information Program | DAS/OIT Jeff.Smith@das.ohio.gov 614-466-8862 http://ogrip.oit.ohio.gov/ProjectsInitiatives/LBRS.aspx
Wisconsin	WISLR	WisDOT developed the web-based GIS products—WISLR to collect, store, and share data on local roads.	Susie Forde Data Management Section Chief Wisconsin DOT, Bureau of State Highway Programs susie.forde@dot.wi.gov 608-266-7140 http://www.dot.state.wi.us/localgov/wislr/index.htm
Tennessee	Local Road Inventory	TennDOT GIS Mapping and Facilities Data Office updated existing local road inventory and collected GPS center lines on the local roads to complete the LRS spatial network. The data are then stored in the TRIMS and will be incorporated with local crash data.	Brian Hurst Safety Manager Tennessee DOT Brian.Hurst@tn.gov 615-253-2433 http://www.tdot.state.tn.us/longrange/trims.htm
		Traffic Data	
Minnesota	Collecting and Managing Traffic Data on Local Roads	MnDOT conducted a study on traffic counting practices on local roads.	Office of Policy Analysis, Research, and Innovation 651-366-3780 www.research.dot.state.mn.us
Pennsylvania	Traffic Data on Local Roads Estimation	PennDOT explored a sampling method to collect the data required to produce VMT estimates on local roads owned by municipalities.	Jeremy M. Freeland Transportation Planning Manager Pennsylvania DOT, Bureau of Planning and Research jfreeland@pa.gov 717-787-2939

CHAPTER THREE

DATA INTEROPERABILITY

Interoperability is defined in this report as the ability of data, systems, or organizations to work together. In terms of safety data, interoperability takes into account compatibility, the ability to integrate, and the accessibility of local and state data for crash, roadway, and traffic data. Based on the results of a 2006 Peer Exchange on Integrating Roadway, Traffic, and Crash Data hosted by TRB and FHWA, state transportation agencies recognized that data management and integration needs were growing more complex (*28*). This growing complexity is the result of an increasingly robust user base and the growing use of data in web-based decision-support products internal and external to the organization. Owing to advancements in data management technologies and upper management emphasis, many state agencies have made significant progress in developing a formal process to integrate their data resources on an enterprise basis. However, significant issues remain for many agencies. One issue concerns the difficulties in accessing and incorporating local agency data into decision-support products. Additional issues include an inability to spatially integrate disparate systems because of differing spatial identifiers, lack of a common LRS, and temporal issues, such as how to integrate historical data into the current spatial data (*28*).

As part of the survey conducted for this project, states were asked their opinion on how close they are to meeting the MAP-21 requirements to have an integrated safety data system (roadway, traffic, and crash) with the ability to perform safety analysis on all public roads. Of 43 states, only four responded that they meet the MAP-21 requirements, whereas nine are "close to meeting the MAP-21 requirements," 22 "meet somewhat," six "do not meet," and two "do not maintain any data for local roads." These results are shown in Figure 18.

As part of the RSDPCA, states were asked about their overall level of transportation data system integration. Systems in four of 51 states responded that their transportation datasets operate in stovepipes and silos; seven operate in multiple platforms and are difficult to integrate; 24 have some of their systems on a common platform; 12 have all systems on a common platform; and one has a fully integrated enterprise system.

The interoperability of crash, roadway, and traffic data, both between agencies and within an agency, are discussed in the following sections.

CRASH DATA

Local Agency Survey Results

Nineteen of the 25 local respondents reported that they receive crash data from the state. Of these 19 local agencies, there are varying degrees of ease of merging and interoperability of the state's data with local data. As shown in Figure 19, eight agencies reported there was a "moderate" degree of interoperability, because the state's data requires some physical labor to mold it into a useable format. Five agencies responded that the data can "very easily" be merged, as it is provided in the same format as the local agency's data. Three agencies reported that the data can be "easily" merged, whereas two agencies reported it as "difficult," because the state's data requires extensive labor to mold it into a useable format. One agency reports that the state's data cannot be used in the current format, nor can it be transformed into a useable format.

As noted earlier, interoperability refers not only to the compatibility of data, but also to the accessibility of data. Of the 25 local agency respondents, 17 agencies have access to state crash data. Of these 18, nine have web-based access. For five, the state will provide their electronic crash database upon request, and for three, the state provides a copy of its electronic crash database on a regular (e.g., annual) basis. Three agencies responded that they do not have access to the state's crash database; however, the state will provide reports or other outputs (e.g., crash maps). One agency responded there was no access to any of the crash data maintained in the state, whereas four agencies responded "Other."

The survey also asked local agencies which roadway inventory datasets can most often be linked with crash data. The two most common responses were intersections and segments, as shown in Figure 20.

The survey also looked at which traffic count datasets are linkable with crash data. Similar to roadway data, the traffic datasets that are most often linkable with crash data within a local agency are intersections and segments, as shown in Figure 21.

State Agency Survey Results

States were asked, on a scale of 1 to 10, with 1 being least interoperable and 10 being the most, how they would rate

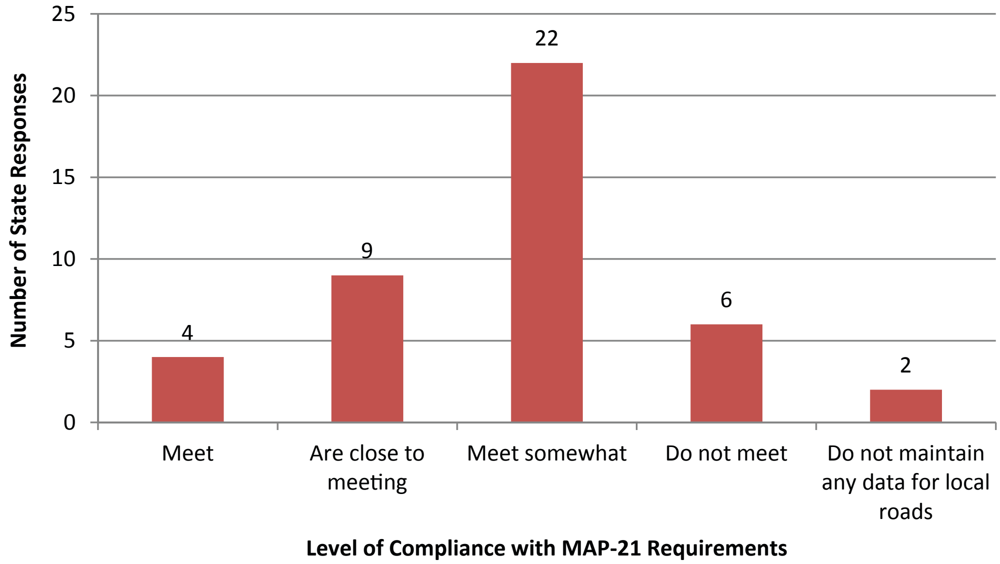


FIGURE 18 Compliance with MAP-21 requirements for integrated safety data system.

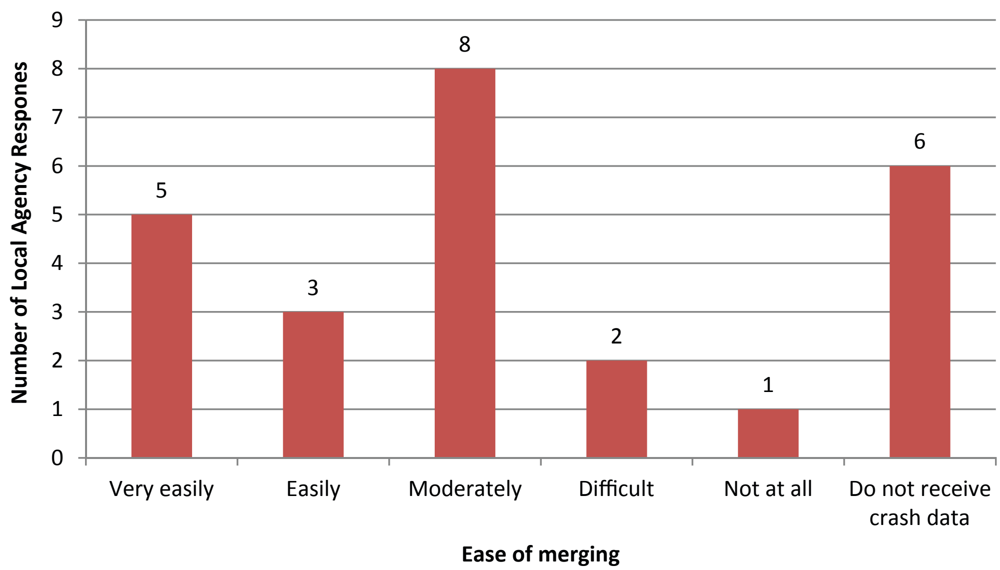


FIGURE 19 Ease of merging state crash data with local crash data.

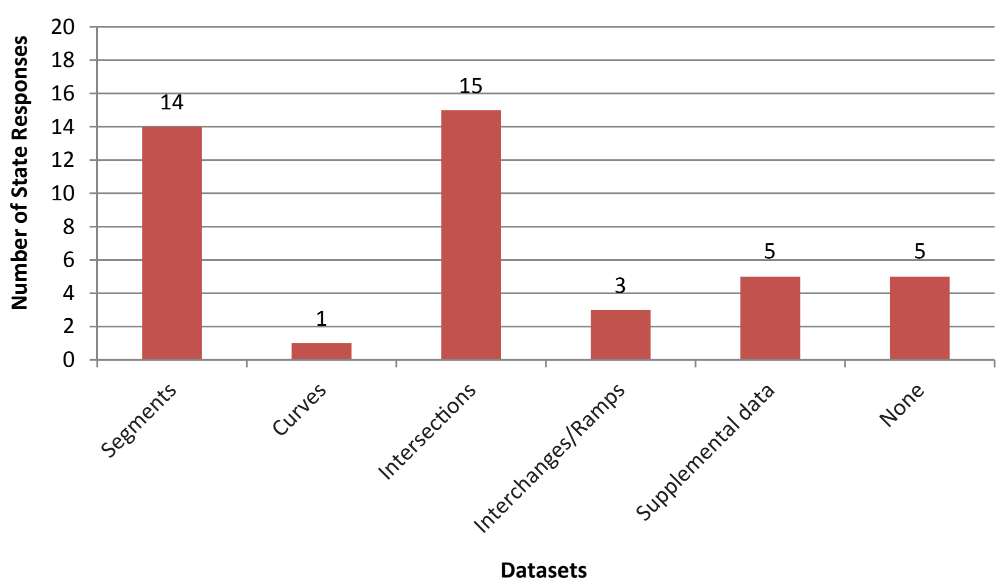


FIGURE 20 Local roadway datasets linkable with crash data within a local agency.

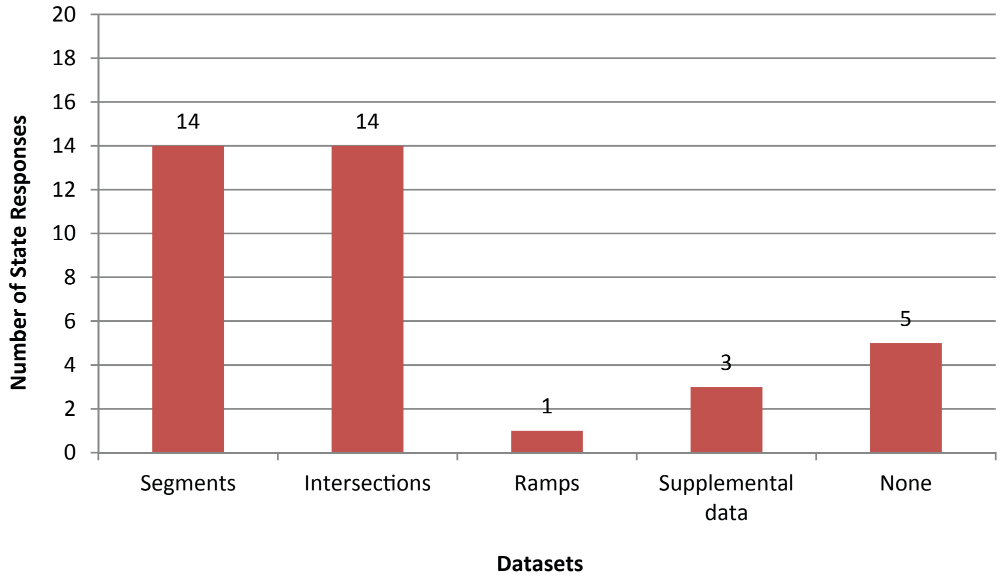


FIGURE 21 Local traffic datasets linkable with crash data within a local agency.

the overall compatibility/interoperability of their state and local safety data (for crash, roadway, and traffic). The average response for interoperability of state and local crash data was 8.5 (Figure 22 shows the distribution of responses). Of the 41 states responding, 14 noted that the interoperability of state and local crash data in their state rated a 10. Ten states responded 9, ten states 8, and one state a 1.

Twenty-five states responded that they locate local crash records for merging with state data. Of these 25, ten use a LRS and GIS to locate crashes, four use a LRS only, four use GIS only, and seven responded “Other.”

The ease of merging varies by state. Fifteen of the 25 states responded that the local data do not require locating, as it is already included in the same location format the state uses. Three of the states responded that the data can be merged easily, because the data are provided in the same format used by the state. Five states responded that the data are moderately difficult to merge because the data require some manual labor to be changed into a useable format. Two states responded that the data were difficult to merge and required extensive manual labor to fashion them into a useable format, as shown in Figure 23.

Conflicting Responses

There were some inconsistencies between responses from states and local agencies in the same states regarding the ease

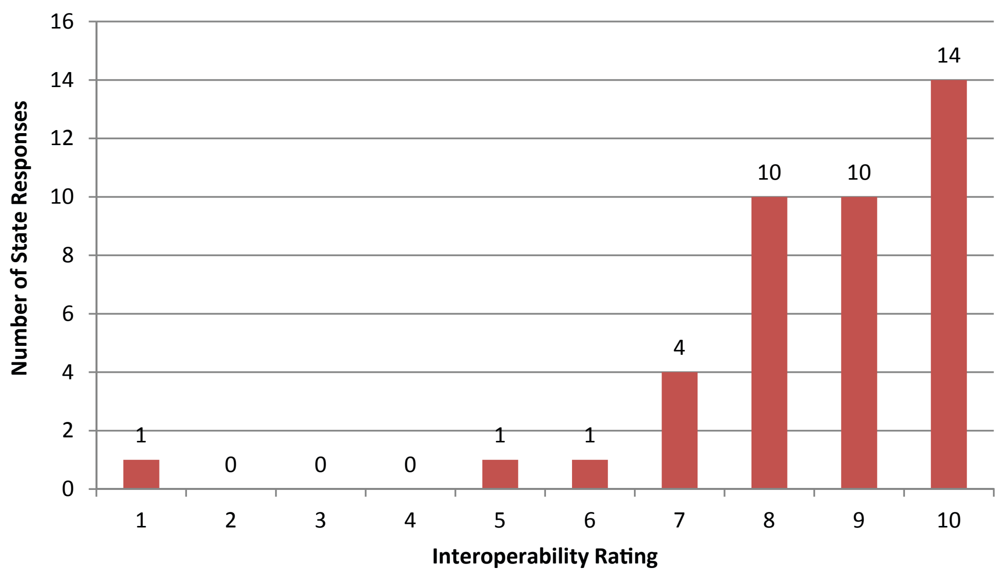


FIGURE 22 Number of state respondents by rating of interoperability of state and local crash data.

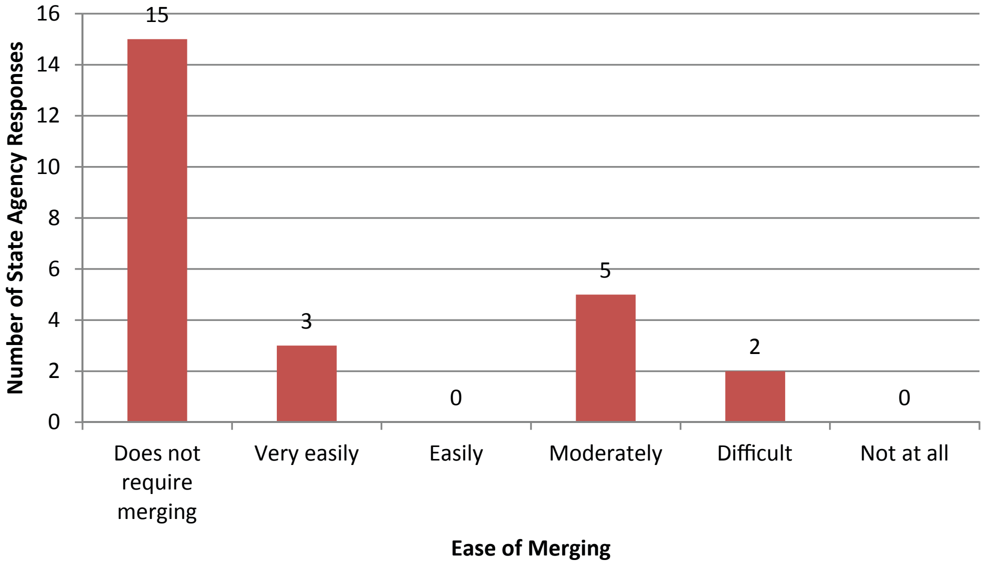


FIGURE 23 Ease of merging local crash data with state crash data.

or difficulty in merging crash data between state and local agencies, as shown in Table 8.

Documented Practices

As part of the RSDPCA, states were asked about their ability to merge crash frequency with roadway attributes. The responses are shown in Figure 24.

As demonstrated through the survey and RSDPCA, interoperability between state and local agencies varies by state. Some states, such as Wisconsin, have coordination and sharing between the state, MPOs, and local agencies in which local agencies share and access data through the WISLR. In Kentucky, sources of data outside of the state government are the area development districts, each of which supports 15 to 20 counties with GIS, engineering, and planning support. Wyoming coordinates with the MPOs to collect data for the statewide base map, which includes local roads (*29*). In Minnesota, the Crash Database Interface for Law Enforcement Agencies creates links between local records management systems and the statewide crash repository at the Department of Public Safety, eliminating duplicate data entry (*30*). Currently, only the Minnesota State Patrol uses the interface; however, they have started planning for a replacement system that will provide this capability to all law enforcement agencies.

During the RSDP Peer Exchanges, some states (including North Carolina and Indiana) indicated that some of the MPOs and cities are more advanced than the state when it came to GIS and integrating spatial data with other data. The city of Charlotte, North Carolina, for example, has data sharing agreements with the county where they are located, but do not share data with the state because of existing firewalls. Other states, such as Nebraska, do not have much involvement or data sharing between the state and the MPOs (*29*).

The use of electronic, field-deployed data entry and electronic data transfer is associated with dramatic improvements in data accessibility. As previously discussed, Iowa's TraCS system maximizes readily available data at the data-collection stage, reducing data-entry time and duplicate data entry. The associated business rules mitigate the need for additional staff intervention to validate and provide quality control on incident records. Automatic electronic data-transfer processes distribute incident records to all necessary agencies, eliminating the need for end-users to export data from the enterprise system for analysis and reporting. The desktop interface allows for easy access to custom tools and reporting capabilities for managers and analysts. Furthermore, enterprise database systems provide quick and seamless data access to those who need the information. Specialized tools on the desktop or the Internet can provide managers and analysts with quick

TABLE 8
CONFLICTING RESPONSES BETWEEN STATE AND LOCAL AGENCIES FOR CRASH DATA MERGING RELATED SURVEY QUESTIONS

Question	Number of Conflicting Responses
Ease (or difficulty) of merging crash data between state and locals	1
Ease (or difficulty) of merging roadway data between state and locals	2

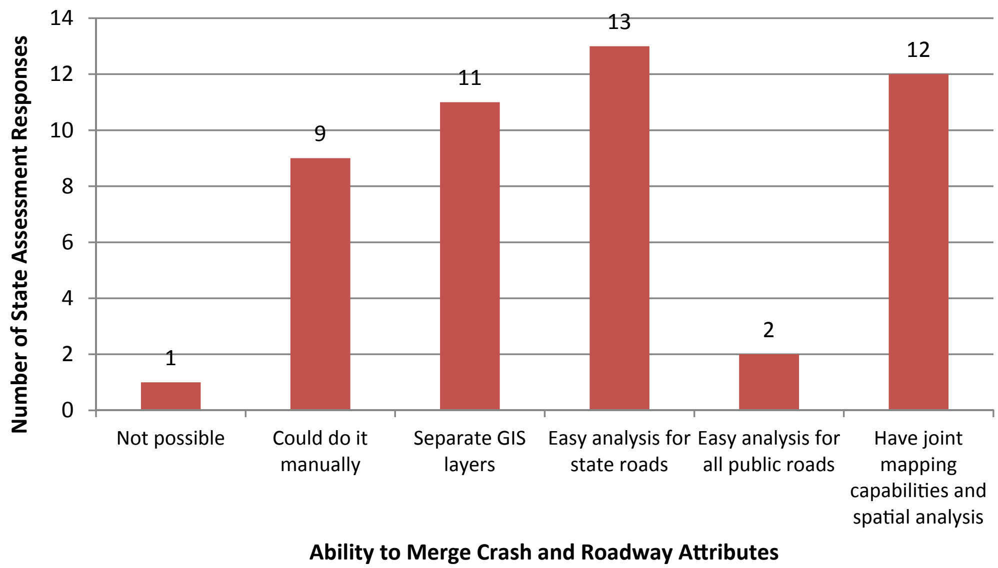


FIGURE 24 Ability of states to merge crash frequency with roadway attributes.

access to tools and reports that previously required significant amounts of time to generate (*20*).

ROADWAY DATA

Local Agency Survey Results

Local agencies were asked how easily roadway data received from the state can be merged with their data. Of the 24 local survey respondents, 13 do not receive roadway data from the state, as shown in Figure 25. Of the agencies that do receive roadway data from the state, five responded that the data can easily be merged, as they are provided in a format that can be easily transformed to the same format as their data; four responded "moderately," as the data require some manual labor to adapt into a useable format; and two responded "difficult," as the data require extensive manual labor to adapt into a useable format.

Of the local agencies that responded to questions regarding accessibility, six agencies reported that they have web-based access to the state data, seven that the state will provide its electronic database upon request, and nine that have no access to any of the roadway data maintained by the state.

State Agency Survey Results

State respondents were also asked to rate the overall compatibility/interoperability of their state and local roadway

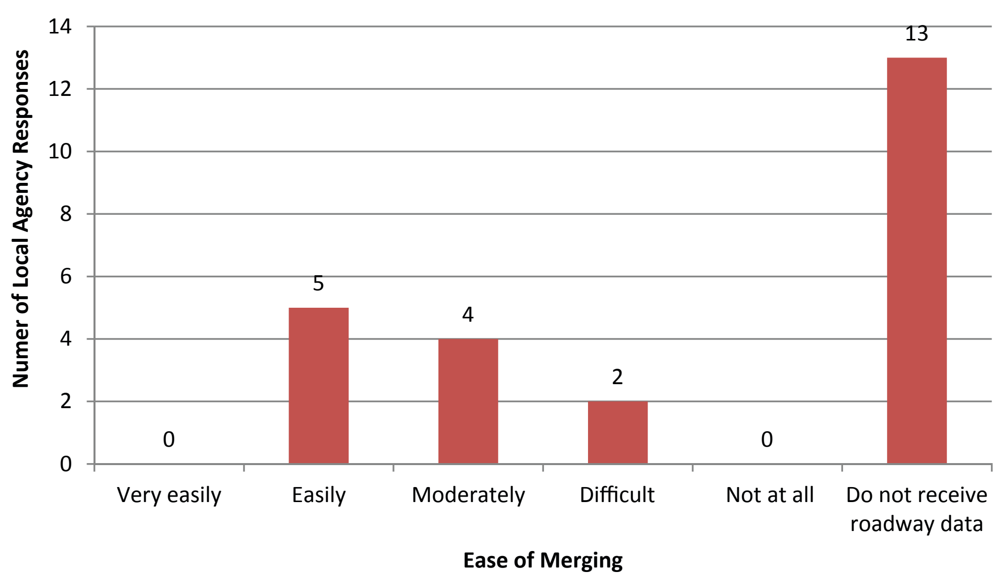


FIGURE 25 Ease of merging state roadway data with local roadway data.

data, on a scale of 1 to 10, with 1 being least interoperable and 10 being the most. The state average for roadway data was 5.7 (compared with 8.5 for crash data). Figure 26 shows the distribution of responses. Eight states mentioned that they rated the overall compatibility/interoperability of their roadway data a 5 and another eight that they rated theirs an 8. Only one state reported a rating of 10 and three states responded that they rated theirs a 1. The total number of state responses was 41, as two do not collect roadway data on local roads and therefore did not respond to this question.

States provided information on how they merge local roadway data with state data. Of the states that receive roadway data from local agencies, ten use a combination of LRS and GIS, four use GIS only, one uses LRS only, one provided "Other"—data are provided using a web application with a unique ID for each segment, and 11 responded that they do not merge local roadway data with state data.

The ease of merging local roadway data varies by state. Of the 16 states that can merge local roadway data, three responded that data can be merged very easily because the data are provided in the same format as that used by the state. Three states responded that the data can be merged easily, because the data are provided in a format that can be easily transformed to the same format as the state; seven noted that data can be merged moderately easily, as the data require some manual labor to adapt them into a useable format; and three reported that the data are difficult to merge because they need extensive manual labor to adapt them into a useable format.

Documented Practices

As part of the RSDPCA, 38 of 51 states responded that element definitions and coding are consistent for inventory contained on both state and local roadways. States were asked about the integration of various roadway files within a state. Of 51 states, five have roadway datasets in stovepipes or silos; 13 can merge some of the data sources, although some are still stand-alone; 14 can merge most of the data sources with only a few stand-alone; nine have almost all data sources merged; and seven have all roadway data sources merged.

In Maryland, an enterprise GIS web application has made local data coordination easier. Many Maryland counties had incongruent centerline data. The web application allowed them to consolidate data into a single dataset by sharing geometry and addresses across the system (*31*). In 2012, Iowa implemented a redesigned GIS management system (GIMS 2.2). GIMS 2.2 houses the roadway data for all public roads in the state. Although the crash data are housed in a separate database, the two are integrated through the use of Iowa's LRS, making the information more accessible to users. This integration is supported by the coordinated effort to improve collection of latitude and longitude coordinates on crash reports (*30*).

Another existing state practice in safety data operability is Michigan's RoadSoft. Michigan has approximately 122,000 miles of public roadways, of which 112,200 miles (92%) are local roads. RoadSoft is a roadway asset management system for collecting, storing, and analyzing data associated with transportation infrastructure, and it is maintained by Michigan Technological University with funding from the Michigan DOT. RoadSoft includes crash data, traffic counts, and roadway data—including bridges, culverts, driveways, guardrails, intersections, linear pavement markings, point pavement markings, roads, sidewalks, and signs. RoadSoft provides tools to conduct safety analysis, mobile data collection, maintenance management, pavement management strategy evaluation, asset management reporting to the DOT, and sign retroreflectivity management. Figure 27 is a screenshot of RoadSoft's mapping capabilities.

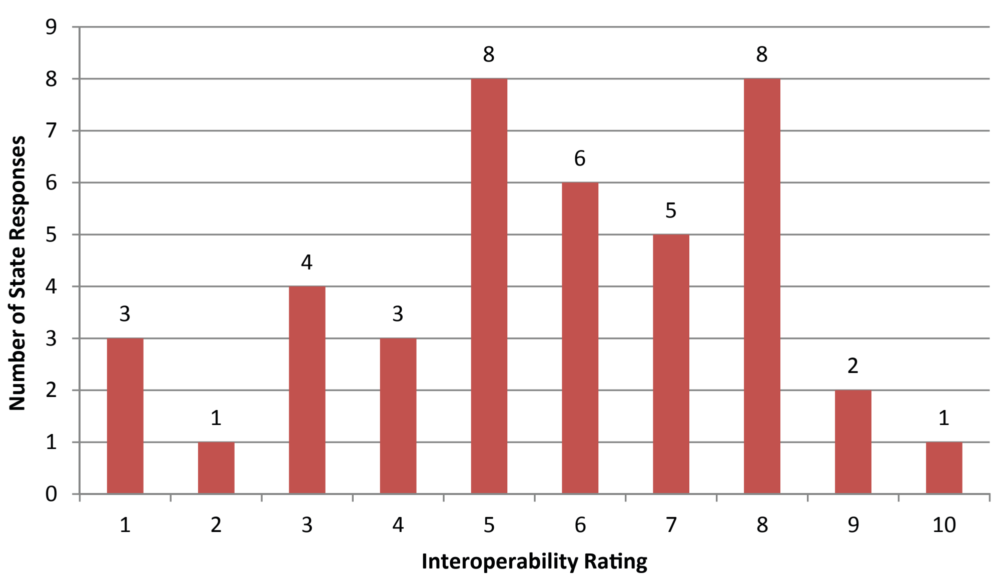


FIGURE 26 Number of state respondents by rating of interoperability of state and local roadway data.

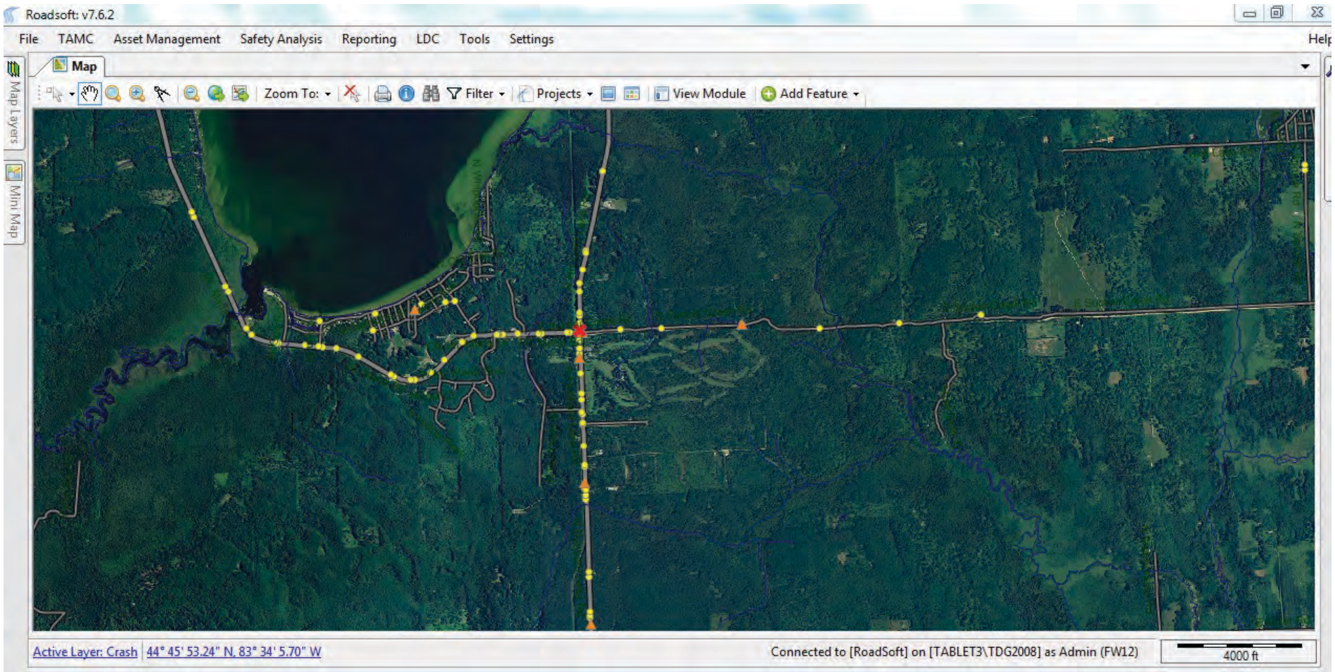


FIGURE 27 Screenshot of RoadSoft crash mapping.

RoadSoft includes a unified map of the state and allows for data to be shared between the state and more than 400 local agencies. The state collects crash data on all local roads and provides these data to the local agencies; the local agencies collect roadway data on local roads and provide these data to the state.

RoadSoft was begun in 1991 as a "proof of concept" when the Intermodal Surface Transportation Efficiency Act (ISTEA) legislation was introduced. There was a mandate that states had to have an asset management system. At that time the DOT had its own asset management system; however, local agencies did not. RoadSoft was developed as a tool to meet the requirement. The legislation was later rescinded, but Michigan DOT and the local agencies decided it was worth keeping. The state developed a fledgling asset management system, which needed to have the capacity to locate roads; therefore, they used the crash LRS as the foundation. The tool that eventually became RoadSoft gradually evolved from there, adding more and more capabilities. The current RoadSoft project has grown to include support activity necessary to allow users to gain the most benefit from the program. The current total annual budget for RoadSoft is $699,000, and it is funded through federal-aid money from the state of Michigan. Most of the annual project budget is dedicated to user support, which includes one-on-one software technical support for several hundred users, engineering technical assistance for using advanced features such as pavement modeling, user data migration, user training, and development of tutorials and help files.

There was strong local agency and DOT support from traffic, safety, and asset/pavement management. There was also support from leadership, since initially there were legislative requirements that high-level executives were required to meet. Even after the requirements were rescinded, leadership continued to support the project because they understood its value. The state is providing a service that local agencies find valuable. Local agencies benefit from efficiency in daily operations, access to crash and other data in a format they can use, and tools that streamline safety analysis. Local agencies also have a sense of ownership of the tool, as each of the agencies maintains its own version of the software, which is user-driven. The state holds user group meetings to get feedback from the local agencies to revise and/or refine the tool based on the local agencies' needs.

Approximately 412 of 635 agencies, or 72%, participate in RoadSoft. It is used by nearly all of the "big 124" agencies (83 counties, MDOT, and the 40 largest transportation-owning cities) that own 91% of the total road mileage in Michigan. Use of RoadSoft is totally voluntary.

RoadSoft provides many benefits to the state. These include the ability to exchange data between state and local agencies. It also reduces data collection costs: collecting all of these data on local roads would be a significant expenditure for the state and, conversely, the state has data that can be of great benefit to the local and regional agencies. Another benefit to the state is having data on a majority of public roads because effective safety improvements need local data. A challenge is keeping the software current and flexible enough to meet the needs of all agencies and the ability to react and develop features quickly. This challenge has been overcome by developing a "one-stop shop" for local agencies data needs. By allowing local agencies to make recommendations, the state is able to develop a tool that is part of the process of doing business.

Local agencies drive the development of the software through quarterly user's group meetings to suggest changes.

One of the key lessons learned from this effort is that local agencies need to believe they "own" the software in order for it to be used. Additional lessons learned include:

- Getting a strong, committed user base developed early.
- Having continuous contact with the users.
- The software is only part of the effort; the bigger issue is user support. Keeping users supplied with the knowledge, data, tools, and training they need leads to success.
- Being able to react and add new features quickly.

Information on this practice is based on an interview with Michigan Technological University, the developers and managers of the system. For more information, please see the complete interview summary in Appendix F.

TRAFFIC DATA

Local Agency Survey Results

Of the 25 local agency survey respondents, five do not maintain any traffic data. Of the 20 that do, ten do not receive any traffic data from the state. Of the ten that do receive traffic data from the state, only two responded that the data are provided in a format that can be easily transformed to the same format as their data. Six responded that the data require some manual labor to be adapted into a useable format and two that the data require significant manual labor to adapt into a useable format. Regarding access to state data, seven local agencies noted that there is no access to any of the traffic data maintained by the state, five that the state will provide its electronic database upon request, and eight that they have web-based access to the state data.

State Agency Survey Results

State respondents were also asked how they would rate the overall compatibility/interoperability of their state and local traffic data on a scale of 1 to 10, with 1 being least interoperable and 10 being the most interoperable. The state average was 5.8 (compared with 8.4 for crash and 5.7 for roadway data). Figure 28 shows the distribution of state responses. Eight respondents each report ratings of between 8 and 6, and there was only one state with a rating of 10. Nine states responded with ratings of from 1 to 3 (three states each).

States provided information on how they merged local traffic data with state data. Of the states that received traffic data from local agencies, seven responded that they used a LRS and GIS, three that they used GIS, two that they used LRS, and three responded "Other." Other responses primarily included the need for manual merging of the data. Twelve agencies do not merge data.

The ease of merging local traffic data varies by state. Of the 15 states that can merge local roadway data, five responded that they can merge the data very easily because the local data are provided in the same format as that used by the state. Two states responded that they can merge the data easily because the data are provided in a format that can be freely transformed to the same format as that used by the state. Seven states responded that they can merge the data moderately easily because the data require some manual labor to adapt them into a useable format. One state responded that the data are difficult to merge because they require extensive manual labor to adapt them into a useable format.

A summary of the documented data interoperability practices, including contact information and websites when available, is provided in Table 9.

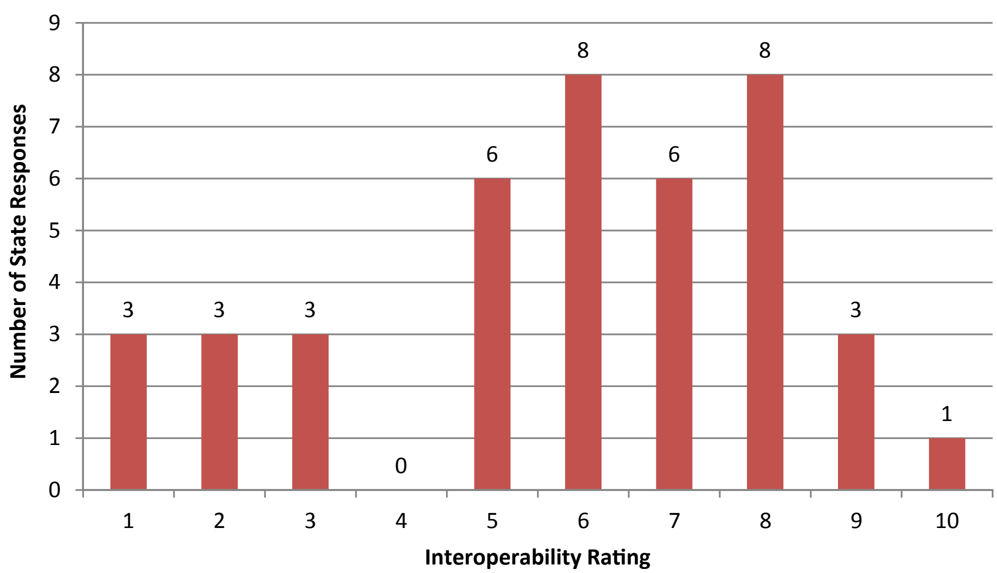


FIGURE 28 Number of state respondents by rating of interoperability of state and local traffic data.

TABLE 9
SUMMARY OF DOCUMENTED DATA INTEROPERABILITY PRACTICES

State	Practice	Description	Contact Information
		Crash Data	
Wisconsin	Effective Coordination and Sharing	Local agencies share and access data through the WISLR.	Susie Forde Data Management Section Chief Wisconsin DOT, Bureau of State Highway Programs susie.forde@dot.wi.gov 608-266-7140 http://www.dot.state.wi.us/localgov/wislr/index.htm
Kentucky	Effective Coordination and Sharing	The best source of data outside of the state government is the area development districts, each of which supports 15 to 20 counties with GIS, engineering, and planning support.	Kevin Cornette Buffalo Trace Area Development District kcornette@btadd.com 606-564-6894
Wyoming	Effective Coordination and Sharing	Wyoming coordinates with the MPOs to collect data for the statewide basemap, which includes local roads.	Matt Carlson State Highway Safety Engineer, Chairman Wyoming DOT matt.carlson@dot.state.wy.us 307-777-4450
Minnesota	Effective Coordination and Sharing	The Crash Database Interface for Law Enforcement Agencies creates links between local records management systems and the statewide crash repository at the Department of Public Safety, eliminating duplicate data entry.	Kathleen Haney Traffic Records Coordinator Minnesota Department of Public Safety kathleen.haney@state.mn.us 651-201-7064
Maryland	Enterprise GIS Web Services	In Maryland, many counties had incongruent centerline data. Enterprise GIS web services allowed them to consolidate data into a single dataset by sharing geometry and addresses across the system.	Mike Sheffer GIS Program Coordinator Maryland State Highway Administration msheffer@sha.state.md.us 410-545-5537
		Roadway Data	
Iowa	TraCS	Iowa's TraCS system maximizes readily available data in the data-collection stage, reducing data-entry time and duplicate data entry.	David Meyers TraCS Program Manager Iowa DOT david.meyers@dot.iowa.gov 515-237-3042 http://www.iowatracs.us/
Iowa	GIMS 2.2	Iowa has implemented a redesigned geographic information management system (GIMS 2.2) that houses the roadway data for all public roads in the state. The roadway data are integrated with crash data through the use of Iowa's LRS.	Karen Carroll Geographic Information Management System (GIMS) Iowa DOT Karen.Carroll@dot.iowa.gov 515-239-1448 http://www.iowadot.gov/maps/GIMS/
Michigan	RoadSoft	RoadSoft is a roadway asset management system for collecting, storing, and analyzing data associated with transportation infrastructure, which allows for data to be exchanged among the state and local agencies.	Tim Colling Director Center for Technology & Training, Michigan Technological University tkcollin@mtu.edu 906-487-2102 http://www.roadsoft.org/

CHAPTER FOUR

SAFETY DECISION MAKING

Many factors are involved in making safety decisions on roadways. The primary safety decisions include identifying locations for treatment, prioritizing the locations, identifying how they will be treated, and, when possible, evaluating the effectiveness of the treatments.

Making safety decisions on local roads can be challenging. High crash locations can be difficult to isolate through the traditional site analysis because severe crashes can be spread over a wide area. The systemic approach to safety provides agencies with an alternative to traditional crash data analysis. The systemic approach reviews crash history on an aggregate basis to identify high-risk roadway characteristics. Although the traditional site analysis approach results in safety investments at high-crash locations, the systemic approach leads to widespread implementation of projects to reduce the potential for severe crashes. The systemic approach does not replace the site analysis approach; it is a complementary technique intended to supplement site analysis and provide a more comprehensive and proactive approach to safety management efforts (*32*).

LOCAL SURVEY RESULTS

Twenty-four of 25 local agencies responded that they engage in safety for roadways; that is, they implement countermeasures and/or treatments on their roadways for the purpose of improving safety. Eighteen of 25 local agencies responded that they have staff assigned to conduct safety analysis and/or implement safety improvements; however, it is only part of their responsibilities. For the remaining seven agencies, two reported that they contract for these services, four that they do not have dedicated staff but would like to or need to, and one responded that it does not have or need dedicated staff, as shown in Figure 29.

The survey looked at whether agencies are implementing safety improvements on a site-specific or systemic approach. Of the 24 local agencies that engage in safety, nine predominantly implement site-specific countermeasures and/or improvements and 16 implement both site-specific and systemic improvements. Twelve agencies responded that funding for improvements on local roads is divided between the state and the local agency, seven responded the local agency completely funds all of the improvements, and six responded "Other," which included:

- "It depends on the cost of the countermeasure being applied. Low costs are covered by the county and high-cost improvements are done using HSIP funds, if available."
- "Local, state and federal funds from a variety of sources [are] used for spot, systemic, and maintenance related safety improvements."
- "Majority is funded by our department, some from other sources."

Figure 30 provides the responses from local agencies on the types of methods they use to conduct location identification. These agencies were asked to include all that apply. Twenty-two agencies responded they use crash-based analysis (e.g., frequency, rate, etc.) and 22 also responded that they use the concerns of citizens, law enforcement, or other members of the community to identify locations that need treatment. Fourteen agencies responded they use RSAs, four that they use crash-based comparisons of expected crashes to observe using Safety Performance Functions (SPFs) or similar methods, and four responded they use risk-based methods. Risk-based methods consider the location characteristics (e.g., intersection, segment, curve, etc.) instead of crashes. Examples of risk-based methods include an intersection index or risk score. One agency responded "Other" and noted that they use maintenance records (i.e., sign maintenance history).

Of the 24 local agency respondents that engage in safety, 20 use GIS tools for analysis, nine use the HSM, six use tools provided by the state, and 11 use "Other" tools or resources for analysis. Twenty-one of 24 local agencies responded that they use roadway data in safety analyses. Twenty-one of 24 local agencies mentioned that guidance and training on how to use roadway data in safety analysis would be helpful. Nineteen local agencies reported that they use traffic data in safety analyses, and 19 that guidance and training on how to use traffic data in safety analysis would be helpful.

In addition, the local agencies were asked about which type of support the state provides for each of the analysis types. The majority of these agencies responded that they conduct their own analyses and would continue to do so in the future, as shown in Table 10.

For those that responded that the state provides assistance to their agency, the assistance comes in the form of guidance (7 state agencies), funding (6), training (4), staff (3),

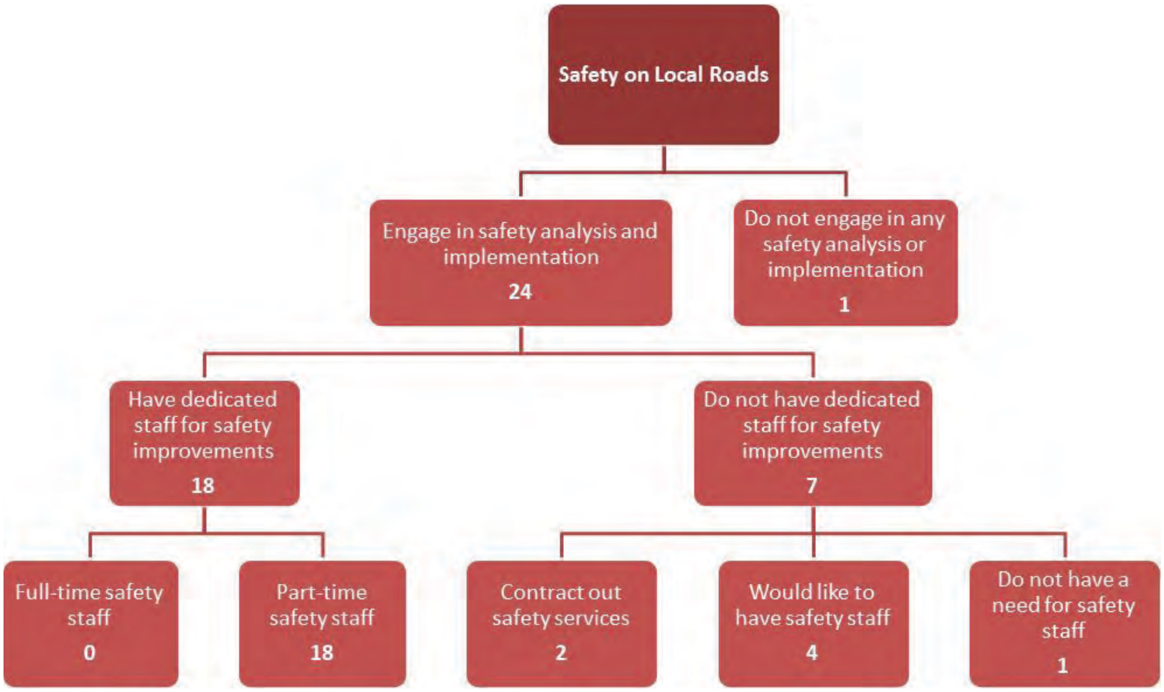


FIGURE 29 Local agency safety decision making.

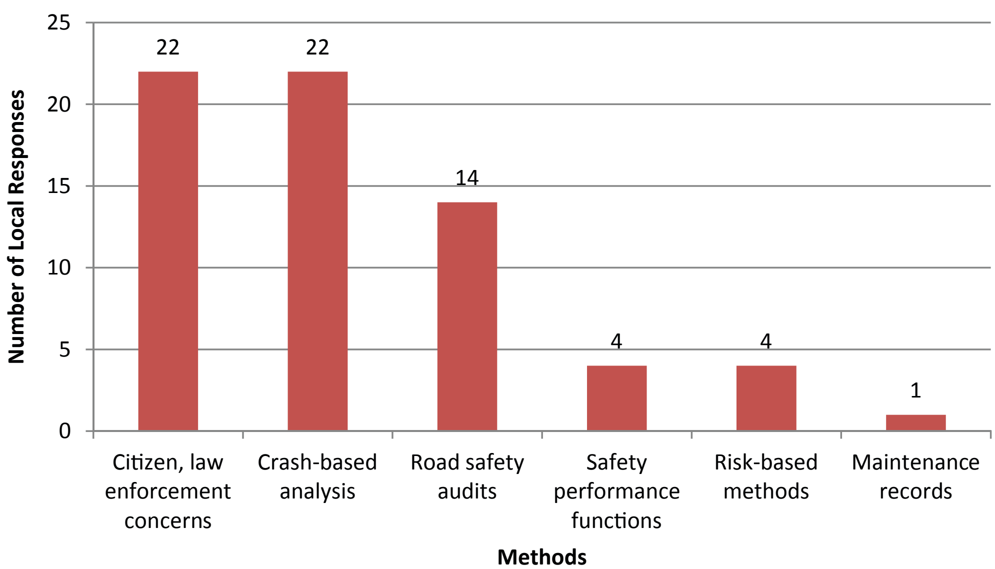


FIGURE 30 Local agency location identification methods.

TABLE 10
LEVEL OF STATE SUPPORT PROVIDED TO LOCALS FOR SAFETY ANALYSIS

Level of State Support	Location/ Project Identification	Project Prioritization	Countermeasure Selection	Countermeasure Evaluation
State conducts and provides results	2	0	0	0
State provides assistance to our agency	5	4	3	5
We conduct our own analysis and would like to continue doing so	19	18	19	15
We conduct our own analysis but would like assistance from the state	5	5	4	7

TABLE 11
LOCATION IDENTIFICATION METHODOLOGY FOR URBAN AND RURAL ROADWAYS

Method	Urban	Rural
Crash-based analysis of frequency, rate, or similar	30	29
Crash-based comparison of expected crashes to be observed using SPFs or similar methods	7	8
Risk-based method that considers the location (e.g., intersection, segment, curve) characteristics instead of crashes such as an intersection index or risk score	7	7
Road safety audits or other proactive review of a location	23	24
Concerns of citizens, law enforcement, or other members of the community	21	21
Other	3	3

and software (2) (respondents were given the option to check all that apply). Similarly, the states were asked which types of support they provide to local agencies for safety improvement efforts. Forty-one of the 43 state agencies provide some type of support in the form of guidance (36), funding (29), training (26), staff (12), software (13), and "Other" (respondents were given the option to check all that apply). Some examples of the "Other" responses included:

- "We are now just starting this year to provide funding, but have always provided assistance with data analysis."
- "High crash lists (including urban intersections) are prepared by the state. The state provides crash data to local engineers for studies."
- "HSIP funds the Safety Circuit Rider who provides support to Local Public Agencies."

STATE AGENCY SURVEY RESULTS

State agencies also reported on how they make decisions in implementing safety improvements on local roads. The number of states that responded to each scenario is shown in parenthesis. The responses were as follows:

- State identifies locations, prioritization, countermeasures, and implements improvements on local roadways (16).
- State identifies locations for improvements, prioritization, and potential countermeasures and provides funding for local agencies to implement the countermeasures (15).
- State identifies potential locations for improvements, prioritization, and funding, but local agency is responsible for identifying countermeasures and installing the improvements (13).
- State identifies potential locations for improvements and prioritization, but local agency is responsible for identifying countermeasures, securing funding, and installing the improvements (8).
- Local agencies identify locations for improvements, prioritization, and potential countermeasures, and submit applications to the state for funding (26).
- Local agencies are responsible for safety improvements on roadways in their jurisdiction; state is not involved in safety improvement implementation on local roadways (7).
- Other, please describe (9). Examples of "Other" methodologies included:
  - "The state works with the local government to determine appropriate countermeasures and obtain 'buy in' for projects."
  - "We have initiated a process to assist local agencies in identifying roadway segments with higher crash severity rates."
  - "Safety projects both off-system and on-system can be developed and delivered in a variety of ways. We have a standardized program for identifying improvements and countermeasures to be led by local governments but are open to all the potential methods discussed above."

For those that responded that the state identifies locations for improvement, additional information was requested regarding how those improvements are identified for rural and urban roadways. Based on the states' responses, the methods do not significantly differ based on rural or urban roadways, as shown in Table 11.

CONFLICTING RESPONSES

There were some inconsistencies among responses from state and local agencies in the same states regarding making safety decisions for local roads, as shown in Table 12.

TABLE 12
CONFLICTING RESPONSES BETWEEN STATE AND LOCAL AGENCIES FOR SAFETY DECISION MAKING MERGING RELATED SURVEY QUESTIONS

Question	Number of Conflicting Responses
How are safety improvements implemented on local roads?	2

There was also some duplication of effort, with several states reporting that they conduct analysis on local roads and the local agencies from these sates noting that they also conduct analysis on these same roads.

DOCUMENTED PRACTICES

According to the RSDPCA, 33 states reported that they are implementing the HSM, 12 they are implementing Safety-Analyst, and six that they are using the Interactive Highway Safety Design Model (IHSDM) to help them make safety decisions. There are various levels of implementation, from testing the capabilities of the tools to full deployment, including integration into analysis practices. However, the RSDPCA did not specify the level of implementation of these tools beyond that some states are using them. In addition, 37 states reported using the FHWA Crash Modification Factors Clearinghouse website, and at least ten are developing their own safety performance functions.

Furthermore, 47 states reported in the RSDPCA that their network screening analysis has the ability to cover all state-maintained roadways; however, only 21 reported that their network screening analysis has the ability to cover all local roadways.

In some states, the number of local agencies can be overwhelming. Also, it is often difficult for some state DOTs to identify the appropriate person to work with at the local level (*18*). Conversely, it can be difficult at the local level to find the appropriate state contact. However, there are several states that have developed programs to work with local agencies. Some highlights from the FHWA Local Safety Data Domestic Scan include (*2*):

- Alabama requires counties to participate in roadway safety training to be eligible for federal funds.
- Georgia funds off-system (local) coordinator positions, as well as off-system projects.
- Illinois provides HSIP funds to local agencies to collect and geo-locate crash data and presents safety workshops that highlight the application process for safety funds.
- Michigan's Local Safety Initiative provides technical assistance to local agencies.
- New Jersey's local safety program is administered through regional planning agencies.
- Minnesota develops county-level road safety plans to encourage low-cost countermeasures and creates funding targets for local agencies to use HSIP funding.

Minnesota has 142,485 miles of public roadways in the state, of which 130,606 miles (92%) are local roads. The Minnesota County Roadway Safety Plans (CRSP) provide safety decision-making support for local agencies. MnDOT has developed a roadway safety plan for each of the 87 counties in the state. Severe and fatal crashes in most counties are spread over many miles of roadways, resulting in a low density of crashes. The primary objective of the CRSP is to identify a specific set of low-cost systematic safety projects that is linked directly to the causation factors associated with the most severe crashes on the county's system of highways.

The initial effort began around 2004 during the development and implementation of the (SHSP) (formerly the Comprehensive Highway Safety Plan) and HSIP. MnDOT recognized the need to apply a greater share of state safety funds to local roadways in a data-driven system-wide approach if they were to be truly committed to eliminating fatal crashes. To meet this commitment, MnDOT created a new position dedicated to traffic safety on the local system. Through their outreach work, including conducting more than 30 RSAs throughout the state, a proof of concept was developed that focused on more intersections and segments in each county and crash data and research at a regional and/or state level. Next, a pilot county was evaluated using the idea of risk factors based on crash data trends at the regional and state levels and applied to segments, curves, and intersections across the entire system of county roads. In addition to the risk-based approach, a large group of stakeholders were involved in the plan. This concept evolved into the CRSP and was then applied to the remaining 86 counties.

There were multiple champions for the plans within the state DOT and from county engineers. Leadership supported the safety plan effort as well. Toward Zero Deaths (TZD) is a flagship initiative for MnDOT that is heavily supported by leadership. The CRSP provided clear and concise direction for increasing safety on local roadways, helping to further support the TZD initiative. The CRSP took approximately 6.5 years to complete; three years of ground work before plan development and 3.5 years to develop a plan for each county. The total cost of the project was approximately $3.5 million and was funded using NHTSA 164 funds.

MnDOT realized several key benefits from the CRSPs, including an increase in the quality and quantity of submitted and funded HSIP projects and a risk-based assessment of all county roadways, allowing for the prioritization and evaluation of safety investments. This project also strengthened relationships with the local units of government, as well as their understanding of crash data, crash modification factors, and the use and application of low-cost systemic safety improvements. The biggest challenge was getting buy-in from a vast majority of the counties before moving forward with the project. To overcome this challenge, MnDOT worked with safety champions at the county level to gather support; the agency assured the counties there would be benefits to completing the plan (i.e., safety funds for implementation) and provided consistent messaging related to the plans and following through with agreed upon obligations.

One of the lessons learned from the CRSP effort was the need for technical support regarding safety at the local level. However, not all of the counties need the same level or type of support, and some counties have chosen to not implement their plan. In addition, for states interested in undertaking a similar effort, each one needs to consider its traffic safety culture, resources, partnerships, stakeholders, and construction project planning and delivery process. The MnDOT project was built around strengths in Minnesota, strong partnerships between MnDOT and our local units of government, known risk factors, and construction projects that could be planned, administered, and delivered by the local unit of government.

Information on this practice is based on an interview with MnDOT. For more information, see the complete interview summary in Appendix F.

One example of a Minnesota county that has benefited from the CRSP is Dodge County, which is using its CRSP to implement countermeasures within the county, including the installation of chevron signs, guardrails, and rumble stripes. The plan has also made Dodge County more competitive for federal HSIP funding. According to the county engineer, the county now has justification for its improvement projects, estimated project costs, and estimated crash reductions (*20*).

At the 2012 RSDP Peer Exchange in Indiana, practitioners discussed how to get more local agencies involved in network screening. Iowa responded that it performs network screening for the entire state. They are having an issue with getting local agencies involved in applying for funds for which they are eligible. Iowa is working on partnering with counties to help local agencies apply for funding. The state may also group projects from local agencies to make it easier to take advantage of HRRRP funds. It is working on submitting an application to the state fund/Transportation Safety Improvement Program for matching funds (*33*).

California is also providing support to local agencies. The California Department of Transportation (Caltrans)–Division of Local Assistance developed a local roadway safety manual for local road owners to maximize the safety benefits for local roadways by encouraging all local agencies to proactively identify and analyze their safety issues and to position themselves to compete effectively in future Caltrans' statewide, data-driven call-for-projects. The goal of the manual is to provide an easy-to-use, straightforward, comprehensive framework of the steps and analysis tools needed to identify locations with roadway safety issues and the appropriate countermeasures. The manual provides practitioners with an understanding of how to complete a proactive safety analysis and ensure they have the best opportunity to secure federal safety funding during Caltrans calls-for-projects (*34*).

In addition to developing plans and manuals, many states provide data analysis tools to aid the safety decision making local agencies. Alabama DOT uses a data analysis software package, Critical Analysis Reporting Environment (CARE), which was developed by the University of Alabama. CARE is a free, user-friendly, statistical analysis software package designed for problem identification and countermeasure development. Alabama DOT analyzes crash data for the entire road network using CARE. Local agencies can access CARE once they sign a confidentiality agreement. CARE is web-enabled, is being integrated with GIS, and has the ability to analyze data and generate reports and crash diagrams *(2)*.

The New Jersey DOT has also developed a useful tool for local agencies. It contracted with the Rutgers University Transportation Safety Resource Center (TSRC) to develop a roadway safety decision-support tool for safety stakeholders. The resulting tool, Plan4Safety, is a web-based application that enables public agency personnel to quickly analyze safety data (see Figure 31). The tool supports the collection, analysis, and distribution of transportation safety data and has been instrumental in the development and implementation of the SHSP. Approximately 500 agencies use the analysis software and have easy access to transportation safety data to perform analyses that support their local safety initiatives, as well as those at the state level. TSRC also provides engineering, planning, training, and outreach services to local governments and assists with crash data analysis to support SHSP implementation. NJDOT funds TSRC work through the HSIP. Broad dissemination of safety data and the availability of this tool has encouraged participation in the SHSP by safety partners at all levels (*17*).

Ohio is one of the national leaders in the implementation of SafetyAnalyst; however, implementing SafetyAnalyst can be resource intensive (*29*). Ohio has also developed the GIS Crash Analysis Tool (GCAT) to provide a convenient highway safety crash analysis tool for Ohio DOT and local agencies. Although GCAT does not have all of the analytic capabilities of SafetyAnalyst, it does provide a GIS-based tool that allows users to spatially query crash data more quickly and easily. GCAT was developed in-house by Ohio DOT and is available to MPOs, cities, counties, and law enforcement agencies. Users can query crash data by time, attributes, driver and vehicle detail, and location. Users can also search within a specific jurisdiction (e.g., county or city) or within an area defined by a polygon or circle. Although only 80% to 90% of the crashes are geo-located, GCAT contains all reported crashes so the data still show up in queries that are based on non-locational attributes (*29*).

Illinois DOT (IDOT) also provides analysis and tools to support local agencies. IDOT analyzes crash types, severity, and contributing factors on all public roads. In developing its safety analysis methodologies, IDOT faced challenges in communicating the purpose and function of the new methodologies with district staff. In particular, it was important to convey that the methodologies may at first have some shortcomings, but would gradually improve. IDOT offers a benefit–cost tool on its website that districts can use to develop HSIP projects. IDOT maintains a SharePoint site for districts to upload documentation and applications for HSIP projects. In the future, IDOT also plans to use the site to manage funds. IDOT wants to make sure that it has tools in place for its partners at all

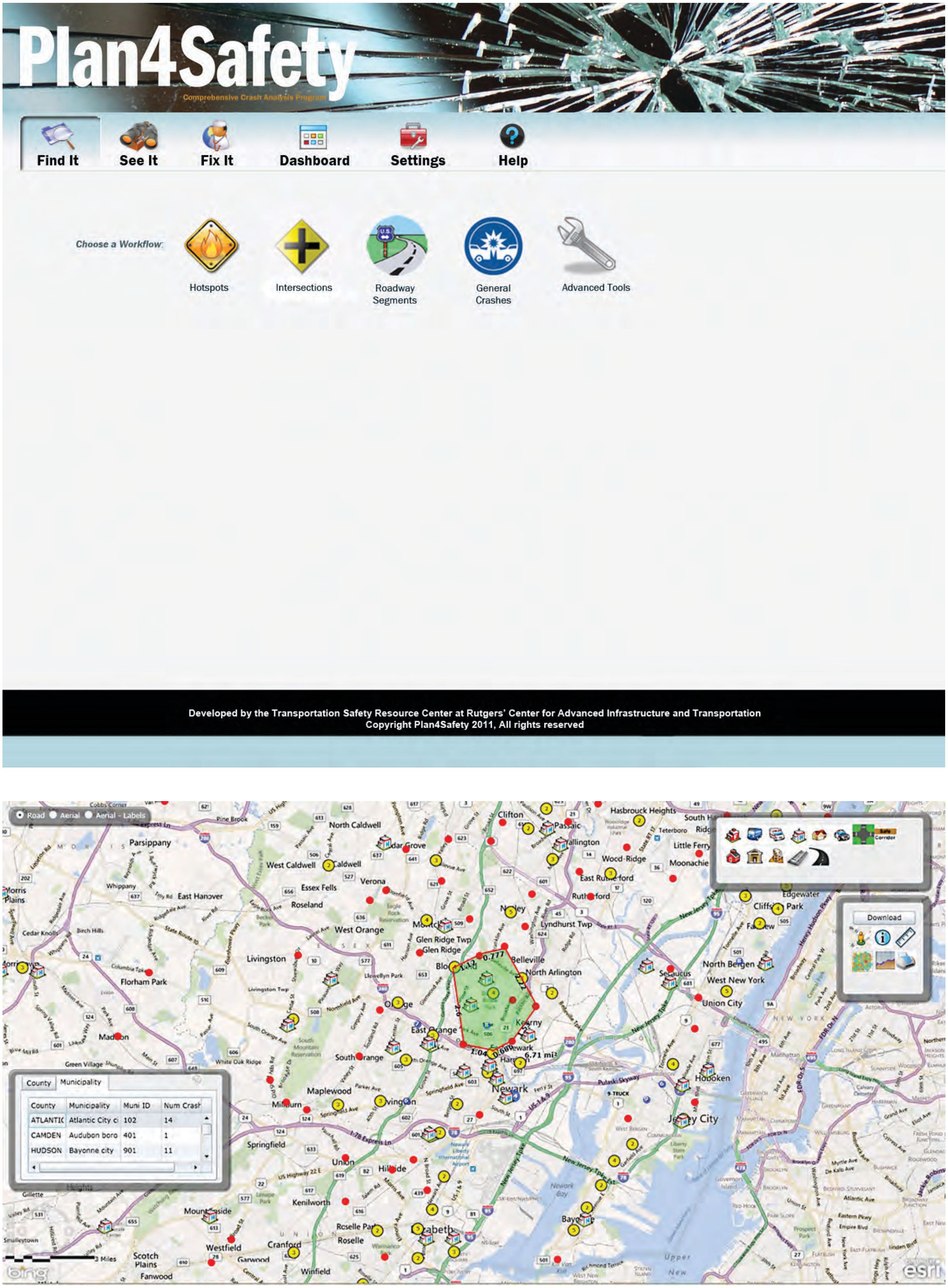


FIGURE 31 Plan4Safety front screen (*top*) and GIS mapping (*bottom*).

levels. IDOT has helped local agencies conduct RSA and, as it implements HSM, it wants to ensure that they understand how it fits in as a tool for analyzing safety issues. IDOT recently conducted a survey among local agencies to assess data accessibility and analysis. It also conducts system-wide data analysis on curves, intersections, and segments, and will assist with safety field reviews upon request. Illinois has local safety committees that are developing local SHSPs, and IDOT is attempting to incorporate safety throughout the agency's business model (*22*).

In many states, LTAP/TTAP centers can also be an important resource. In August 2012, the FHWA Office of Safety sponsored the Northwest Safety Data Peer Exchange in cooperation with the Idaho LTAP in Boise, Idaho. This peer exchange provided a forum for attendees to share information on safety data collection, analysis, warehousing, and access to improve existing data practices and safety on local roads. There were 39 participants, representing FHWA, the Bureau of Indian Affairs, state DOTs, LTAP and TTAP centers, and local and tribal representatives from California, Idaho, Nevada, Oregon, Utah, Washington State, Illinois, Louisiana, and Minnesota. Attendees shared their noteworthy safety data practices. The key take-aways from the peer exchange include (*18*):

- It is much more useful to local and tribal agencies if the raw crash and roadway data are accompanied by an interpretation and recommendations for remedial action. In general, they do not typically have staff capacity and/or expertise to access and analyze the data.
- Surrogate measures of risk on the local and tribal system can help alleviate the issue of a lack of data that may prevent appropriate data analysis that can lead to safety improvements on local and tribal roads.
- Systemic approach to countermeasures implementation within a corridor or jurisdiction needs to be considered when specific crash location information is not available.
- Smaller agencies can jointly pool funds to install similar crash mitigation strategies across multiple jurisdictions using a systemic approach.

In addition to LTAPs and TTAPs, many states have benefited from partnerships and outreach efforts with other regional organizations and between multi-disciplinary groups, including engineering, planning, education/universities, law enforcement, emergency services, and political representatives. Specific existing practices in states include (*2*):

- In New Jersey, Michigan, and Illinois, MPOs are safety champions that provide coordination and public outreach to local agencies.
- In Minnesota, the Minnesota County Engineers Association Highway Safety Committee is uniquely positioned to impact local road safety policies and funding. As a collective group it is able to lobby for policies and programs that address their roadway safety and share information among local agencies. In addition, Minnesota's TZD community coalitions develop safety awareness at the local level through collaboration of multi-discipline stakeholders addressing safety in their communities.

LEGAL LIABILITY CONCERNS

Some states have expressed concerns regarding legal liability issues with safety data, particularly with sharing crash data. Twelve local agencies responded that crash data are available to lawyers and other legal professionals upon request, while six agencies reported that they did not provide access.

Of the 43 state respondents, 31 reported that crash data are available to lawyers and other legal professionals upon request and 12 that they do not provide access to crash records to lawyers and other legal professionals.

At the RSDP Peer Exchanges, several states discussed whether there are any liability issues involved in providing crash data. Alaska took that question to their Department of Law, which responded that if there is a question on a specific crash, then it goes to the regional traffic safety staff. If the information is going to be used for a lawsuit, then the request is sent to the Department of Law. In Nebraska, if someone can name the location and date of a crash or the driver's name, then they will be provided with the report for that crash. However, they would not provide report(s) for more general requests such as for all crashes at a specific intersection (*22*).

Liability concerns were further explored in *Research Results Digest 306: Identification of Liability-Related Impediments to Sharing §409 Safety Data Among Transportation Agencies and A Synthesis of Best Practices* (*35*), which identifies liability risks associated with sharing safety data among transportation agencies pursuant to Section 409 of Title 23, U.S.C.; identifies best practices; reviews the Pierce County, Washington v. Guillen decision and its potential impact on managing state liability risk; and describes strategies for overcoming the impediments to data sharing, specifically those related to liability. Section §409 was enacted to protect from disclosure in litigation data compiled and collected by state DOTs pursuant to Title 23 U.S.C. §152. On January 14, 2003, the U.S. Supreme Court ruled, in Pierce County, Washington v. Guillen, that §409 is a constitutional exercise of Congressional power. Section 409, as upheld by Guillen, seemingly provides significant protection to states in the proper sharing of data. Many states, however, continue to question whether §409 provides sufficient protection, particularly concerning supposedly protected data that eventually finds its way into the hands of the public or the media through the use of freedom of information or public records act requests, and from there, at least indirectly, into court.

Although there are still concerns and questions surrounding this issue, state DOTs and MPOs can use the practices described in *Research Results Digest 306* to immediately review and improve the manner in which they are managing the risk associated with the sharing of safety data. For example, some state DOTs enter into memorandums of understanding with the agency that stores the data regarding how the data will be used and disseminated. Such cooperative agreements also are possible between DOTs and MPOs and local planning agencies. Other states enter into interagency agreements, with MPOs allowing them to use the crash data strictly for planning purposes. Many agencies have developed strategies for mitigating the risks associated with sharing these data, including removing personal identifiers prior to sharing (*35*).

A summary of the documented safety data decision making practices, including contact information and websites when available, is provided in Table 13.

TABLE 13
SUMMARY OF DOCUMENTED SAFETY DATA DECISION MAKING PRACTICES

State	Practice	Description	Contact Information
Alabama	Roadway Safety Training	Alabama requires counties to participate in roadway safety training to be eligible for federal funds.	Waymon Benifield Safety Management Section Administrator Alabama DOT benefieldw@dot.state.al.us 334-353-6404
Alabama	Critical Analysis Reporting Environment (CARE)	CARE is a statistical analysis software package designed for problem identification and countermeasure development. ALDOT analyzes crash data for the entire road network using CARE. Local agencies can access CARE once they sign a confidentiality agreement.	Waymon Benifield Safety Management Section Administrator Alabama DOT benefieldw@dot.state.al.us 334-353-6404 http://caps.ua.edu/care.aspx
Georgia	Funds Off-system	Georgia funds off-system (local) coordinator positions as well as funding for off-system projects.	Kathy Zahul State Traffic Engineer Georgia DOT kzahul@dot.ga.gov 404-635-2828
Michigan	Technical Assistance	Michigan's Local Safety Initiative provides technical assistance to local agencies.	Tracie Leix Safety Programs Unit Manager Michigan DOT leixt@michigan.gov 517-373-8950
Michigan	Partnership with Regional Organizations	MPOs are safety champions that provide coordination and public outreach to local agencies.	Tracie Leix Safety Programs Unit Manager Michigan DOT leixt@michigan.gov 517-373-8950
New Jersey	Local Safety Program	New Jersey's local safety program is administered through regional planning agencies.	Robert A. DeSando Director/Acting Manager Bureau of Transportation Data & Safety New Jersey Department of Transportation 609-530-3474 Robert.DeSando@dot.state.nj.us
New Jersey	Partnership with Regional Organizations	MPOs are safety champions that provide coordination and public outreach to local agencies.	Raymond S. Tomczak, PP, AICP MPO Liaison New Jersey Department of Transportation Division of Statewide Planning, Bureau of Statewide Strategies raymond.tomczak@dot.state.nj.us

(*continued on next page*)

TABLE 13
(*continued*)

State	Practice	Description	Contact Information
New Jersey	Plan4Safety	NJDOT developed Plan4Safety for local agencies, which is a web-based application that enables public agency personnel to quickly analyze safety data.	Dr. Mohsen Jafari Dept of Industrial & Systems Engineering CAIT Rutgers University 848-445-2980 jafari@rci.rutgers.edu http://cait.rutgers.edu/tsrc/plan4safety
Minnesota	County-level Road Safety Plans	Minnesota DOT is developing a roadway safety plan for each of the 87 counties in the state to encourage low-cost countermeasures and creates funding targets for local agencies to use HSIP funding.	Mark E. Vizecky, P.E. State Aid Program Support Engineer Mn/DOT State Aid Division Mark.Vizecky@state.mn.us 651-366-3839 http://www.dot.state.mn.us/stateaid/sa_county_traffic_safety_plans.html
Minnesota	Partnership with Regional Organizations	Minnesota County Engineer Safety Association impacts local road safety policies and funding. Minnesota's Toward Zero Deaths community coalition develops safety awareness at the local level through collaboration of multi-discipline stakeholders addressing safety in their communities.	Kristine Hernandez Statewide Toward Zero Deaths Coordinator MnDOT Public Affairs 507-286-7601 Kristine.Hernandez@state.mn.us
Iowa	Partner with Counties Applying for the Funds	Iowa is trying to evaluate the counties, and suggests requesting counties to partner and they will help them apply for funding.	Terry Ostendorf Program Planner III Office of Traffic and Safety, Iowa Department of Transportation Terry.Ostendorf@dot.iowa.gov 515-239-1077
California	Local Roadway Safety Manual	Caltrans–Division of Local Assistance developed a local roadway safety manual for local road owners to maximize the safety benefits for local roadways.	Jesse Bhullar Chief, Office of Bridge and Safety Programs Division of Local Assistance California Department of Transportation Jesse.bhullar@dot.ca.gov 916-651-8257 http://www.dot.ca.gov/hq/LocalPrograms/hsip.htm
Ohio	GIS Crash Analysis Tool (GCAT)	GCAT is a GIS-based tool that allows users to spatially query crash data. GCAT was developed in-house by the Ohio DOT and is made available to MPOs, cities, counties, and law enforcement agencies.	Michael McNeill Transportation Engineer ODOT Office of Systems Planning Michael.McNeill@dot.state.oh.us 614-387-1265 http://www.dot.state.oh.us/Divisions/Planning/SPPM/SystemsPlanning/Pages/GCAT.aspx
Illinois	HSIP Funds	Illinois provides HSIP funds to local agencies to collect and geo-locate crash data and conducts safety workshops that highlight the application process for safety funds	Priscilla A. Tobias, PE State Safety Engineer Illinois DOT Priscilla.tobias@illinois.gov 217-782-3568
Illinois	Support to Local Agencies	IDOT provides analysis and tools to support local agencies. Illinois has local safety committees that are developing local SHSPs and IDOT is trying to incorporate safety throughout the agency's business model.	Priscilla A. Tobias, PE State Safety Engineer Illinois DOT Priscilla.tobias@illinois.gov 217-782-3568
Illinois	Partnership with Regional Organizations	MPOs are safety champions who provide coordination and public outreach to local agencies.	Priscilla A. Tobias, PE State Safety Engineer Illinois DOT Priscilla.tobias@illinois.gov 217-782-3568

CHAPTER FIVE

DATA MANAGEMENT

Collecting data is just the first step in a comprehensive safety data system. Once the data are collected, it is important to continually manage the data to ensure they remain timely and accurate. Data management includes a discussion of staffing, funding, technology, coordination within the organization, and support from leadership for crash, roadway, and traffic data, both separately and as a system.

CRASH DATA

Local Agency Survey Results

Eighteen of 25 local agencies responded that they maintain crash records. Of these 18, 14 reported that they have staff dedicated to managing crash data and four that they do not have staff to manage the crash data. Only one of those 14 responded that they have full-time staff whose primary responsibility is managing crash data. The remaining 13 noted that they have staff that manages crash data, but it is only part of their responsibilities, as shown in Figure 32.

Twelve of the 18 local agencies that reported that they maintain crash records receive no support on the collection or management of their crash data. For the remaining six agencies, five responded that they are provided with software and/or other tools, four that they are provided with training, three that they receive funding, two that they are provided with format requirements, one that it is provided with a data dictionary, and three that they receive "Other" support but did not provide additional comments. Support is provided by state DOTs (4), universities (2), a Department of Public Safety (1), and LTAP (1).

ROADWAY DATA

Twenty-four of 25 local agencies responded that they maintain roadway data. Of these 24, two responded that they have staff dedicated to managing roadway data as their sole responsibility, 19 that it is only a part of their responsibilities, two that they do not have dedicated staff but need to or would like to, and one that it does have not dedicated staff but does not need to, as summarized in Figure 33. There does not appear to be a direct connection between the size or location of the agency and whether they have dedicated staff to maintain roadway data.

TRAFFIC DATA

Twenty-one of 25 local agencies responded that they maintain traffic data. Of these 21 local agencies, none have staff dedicated to managing traffic data as their sole responsibility, 14 responded that it is only a part of their responsibilities, one that it contracts these services, three that they do not have dedicated staff but need to or would like to, and one that it does have not dedicated staff but does not need to, as summarized in Figure 34.

SYSTEM MANAGEMENT

State Agency Survey Results

Fifteen states responded that they have adequate resources (e.g., staffing, technology, funding) to manage and maintain their safety data. Many states provided additional comments. These comments primarily reflected that states have adequate resources to manage the state data, but collecting additional data—particularly roadway data on local roads—would be a challenge and require additional resources. A sample of these comments follows:

- "We have the resources to maintain and manage, but unfortunately not collect certain data on local roads (i.e., inventories, geometric data on local roads)."
- "Able to meet the minimum requirements at this time. Additional data requirements may require additional resources."
- "Resources are adequate for crash data collection and analysis. If required to collect roadway data on non-state maintained streets resources would need to be identified."

Twenty-five states responded that they do not have adequate resources (e.g., staffing, technology, funding) to manage and maintain their safety data. Many states provided additional comments that primarily reflected that having adequate technology, collecting local road data, and decreasing resources are the most significant challenges. A sample of the comments follows:

- "Need staff and funding, especially for local road efforts."
- "IT resources as well as program area experts have been decimated."
- "Data are difficult to integrate with older technology, data quality may not be as high as we would like, funding competes with other department needs, finding and retaining staff who appreciate data can be difficult."

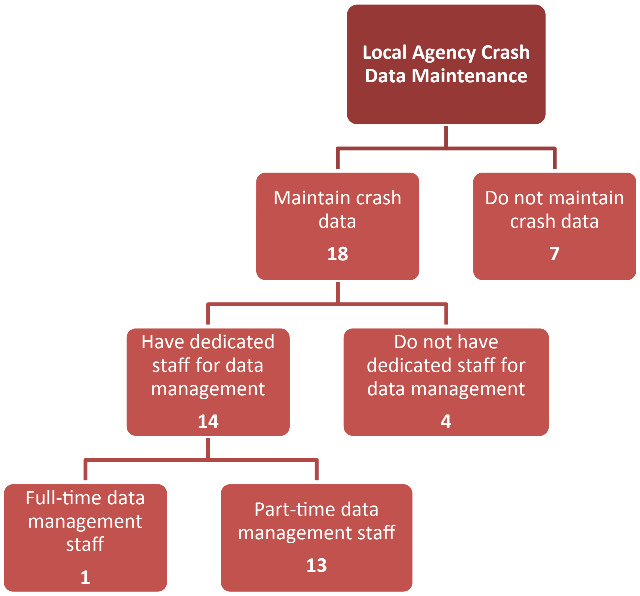


FIGURE 32 Local agency crash data management resources.

- "Obtaining and maintaining safety data continues to be a challenge. There are many agencies involved. Crash reports often require revision, and our resources in this area are decreasing."

Documented Practices

Further, the RSDPCA provided key findings on roadway safety data management (*16*):

- In most states, there is not a common platform to discuss data management or management issues. These terms are not well-defined or understood by the states.
- There is not a firm understanding or relationship between the IT and safety arenas. Each discipline does not necessarily understand the other's language or needs, but training may help to bridge this gap.
- There are strong relationships between people, policies, and technologies. Often the institutional barriers are more important to remove than technological barriers. Relationships affect data linkage at the state level as much as resource issues. Some Traffic Records Coordinating Committees (TRCCs) and safety data improvement plans exist in name only. Some states expressed a sense of frustration related to data management. There is a potential bridge to be built between IT professionals and data stewards.
- It is difficult to identify one way to approach data management. Most states do not have a statewide data governing body and several states said they prefer it that way. They believe that handling data coordination at the state agency level through the TRCC is the most efficient way. They expressed concern that a statewide body would not appreciate or respond to specific needs (i.e., heavy-handed treatment that values policies over the opinions of the agencies that gather and maintain the data).
- Several states described a bottleneck in the delivery of IT resources within the DOT. Roadway safety data improvements were superseded by other DOT priorities.

In some states data management is conducted through a data governance board or council. A data governance board serves as the primary governing body for the management of data systems. This governing body is usually comprised of senior level managers who have the authority to establish policies for the management of data and information on behalf of the agency or state. Governance is not always at the DOT level; in some cases, it might be at a higher Investment

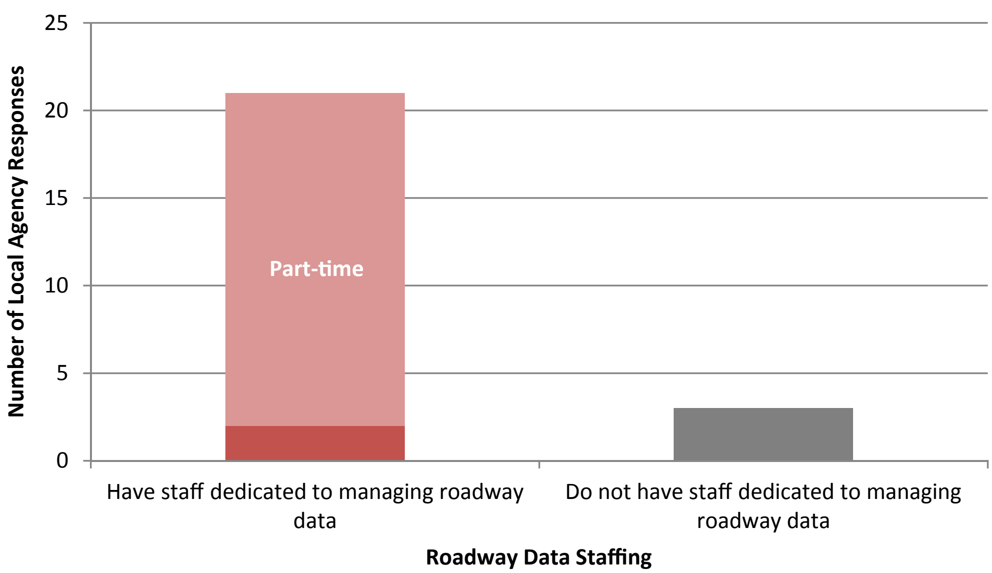


FIGURE 33 Local agency roadway data staffing resources.

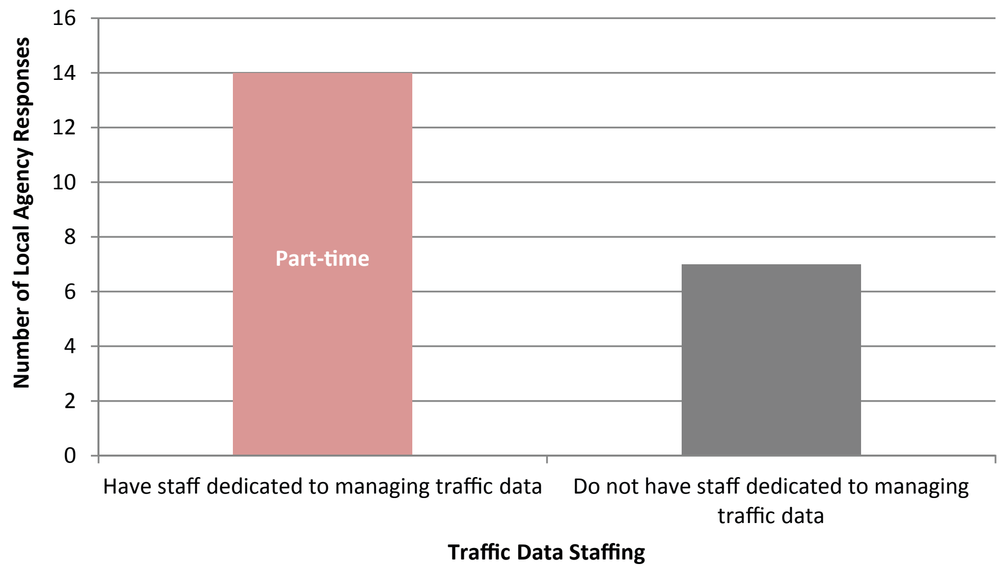


FIGURE 34 Local agency traffic data staffing resources.

Review Board level or chief information officer level (*16*). Twenty-one states reported having a data governance board in the RSDPCA. Of these 21, nine reported that the data governance board is within the DOT, while the remaining states noted that the data governance board is across all state agencies. However, there is no consensus on whether a data governance board either helps or hinders data management.

Based on the responses from the survey and the RSDPCA, it appears data management can be a challenge for states; however, there are some states that are able to manage safety data. The involvement and support from leadership/executives often plays a large role in the development of data management practices. According to a representative from ITD, the deputy director in that state is a safety champion. Similar to Idaho, in Louisiana the current agency secretary is supportive of safety initiatives. This secretary chairs the Subcommittee on Safety Management for AASHTO and has an understanding of the methodology behind the HSM. They have been supportive of moving forward with HSM implementation and acquiring funding for data. The initial focus was on executives; as a result, they are seeing some change toward an increased emphasis on safety (*19*).

This holds true for local agencies as well. The city of Charlotte, North Carolina, has a GIS Enterprise Team that coordinates GIS efforts among the various departments within the city. Any city department that has GIS staff has a member on the GIS Enterprise Team. The city also maintains a spatial data warehouse. Each department maintains its own data layers and then posts them to the spatial data warehouse where everyone has access to each other's data (but no maintenance rights). This type of GIS data management is not standard throughout local agencies within the state. Charlotte credits its success on a small group of data champions who push to showcase the benefits and capabilities of GIS and, as a result, are able to acquire support from management and the local community to maintain such a robust program (*29*).

In addition, several states have developed data sharing agreements to help agencies manage safety data. The state of New York has implemented the *New York State Geographic Information System* (*GIS*) *Cooperative Data Sharing Agreement*, which promotes data sharing and helps reduce the cost of GIS data maintenance. The cooperative agreement in New York has two key features: (1) it establishes data creators (primary custodians) who own and manage the data, but agree to share the data with other agencies; and (2) establishes data users (secondary custodians) who provide updates and revisions back to the data creators, which enhances the quality of the data (*36*). Similar agreements exist in other states, such as Oregon and South Carolina, as well as at the MPO and county level (Palm Beach County) (*29*).

Cooperation with local agencies also largely involves identifying and distributing funding. In 2010, FHWA visited seven states in a local road safety domestic scan to identify and document their practices in the planning, programming, and implementation of efforts to improve local road safety. Most scan states credited financial incentive strategies with increasing local agency participation in the states' safety programs. The funding distribution policies balance the needs and priorities of various stakeholders and help local agencies substantially with projects that address the highest priority issues. All seven scan states allocated all their HRRRP funds to local rural road safety projects. Washington State DOT dedicates 70% of its HSIP funds to the local road network in the state. Minnesota DOT uses a data-driven process based on crash frequencies proportional allocation to distribute their HSIP funds regardless of road ownership. They also streamline the process that local agencies use to obtain safety funds. MnDOT requires only one application for all sources of safety funds (*2*).

TABLE 14
SUMMARY OF DOCUMENTED DATA MANAGEMENT PRACTICES

State	Practice	Description	Contact Information
North Carolina	Data Champions	The city of Charlotte has a GIS Enterprise Team that coordinates GIS efforts among the various departments within the city. Any city department that has GIS staff has a member on the GIS Enterprise Team.	Steven Castongia Senior GIS Analyst Charlotte DOT scastongia@charlottenc.gov 704-336-3816
New York	Data Sharing Agreements	The state of New York has implemented the New York State GIS Cooperative Data Sharing Agreement, which promotes data sharing and helps reduce GIS data maintenance of the costs.	Frank Winters Director, GIS Program Office NYS Office of Information Technology Services francis.winters@its.ny.gov 518.242.5036 http://gis.ny.gov/co-op/
Minnesota	Funding Distribution	Minnesota DOT uses a data-driven process based on crash rate proportional allocation to distribute their HSIP funds regardless of road ownership.	Julie Whitcher Assistant Traffic Safety Engineer Minnesota DOT julie.whitcher@state.mn.us 651-234-7019
Washington	Funding Distribution	Washington State DOT dedicates 70% of its HSIP funds to the local road network in the state.	Kathleen Davis Director, Highways & Local Programs Washington DOT 360-705-7871 DavisK@wsdot.wa.gov

In addition, all seven states that participated in the scan have a local-aid division. Although structure and operation vary among the states, there are some commonalities. The local-aid divisions typically consist of a central office with support from district or regional offices. The central office is generally responsible for developing program applications and guidelines including project selection. The regional or district offices are involved in the day-to-day coordination with local agencies; state liaisons or MPOs provide specific safety-related technical assistance. The local-aid divisions help to establish a formal mechanism for local agencies to obtain state and federal funding (*2*).

A summary of the documented safety data decision-making practices, including contact information and websites when available, is provided in Table 14.

CHAPTER SIX

CONCLUSIONS

The objective of this synthesis was to summarize current practices among local and state agencies that use reliable and current data for effective and accurate safety analysis. There was an emphasis on the interoperability of local and state datasets, particularly crash, roadway, and traffic, as well as on the current practices for merging data between local and state agencies. This synthesis provides a reference to transportation agencies regarding existing practices in safety data management on all public roads. This study also identifies needed additional research.

A multifaceted approach was taken to compile resources for this synthesis. A literature review was conducted, the results of the FHWA Roadway Safety Data Capabilities Assessment and Peer Exchange proceedings were reviewed, state and local transportation agencies were surveyed, and interviews were conducted with agencies that were identified as having existing roadway safety data practices. This synthesis focused on four primary areas: (1) data collection, (2) data interoperability, (3) safety decisions making, and (4) data management. A summary of the results for each of these areas is presented in this section.

DATA COLLECTION

This study found that many states are struggling to obtain safety data for local roadways to meet the new Moving Ahead for Progress (MAP-21) requirements to incorporate local roadway data into a statewide base map and support analysis of that data. Local agencies are collecting some of the data elements states are in most need of and/or most interested in collecting—intersections, curves, and supplemental datasets, such as signs. Collaboration with local agencies may be a good opportunity to populate the states' inventories for these elements.

Results of the synthesis found that there are generally two approaches states can take for obtaining local safety data: (1) develop a mechanism for local agencies to provide the data, or (2) collect the data themselves. One benefit of the first approach is that it minimizes the direct costs for the state. The challenges are getting cooperation from the local agencies and having confidence in the quality of the data, challenges that can be met by a concentrated effort to work directly with local agencies to provide the support needed in terms of outreach, training, and funding. Some states have enacted legislation that requires local agency cooperation. The states that have been able to achieve cooperation from local agencies have developed tools that not only meet the state's needs, but provide a benefit to the local agencies as well. The more benefits the local agencies see, the more likely they are to participate. The benefit of the second approach is it eliminates dependence on local agencies. The state has more control over what data are collected, how the data are collected, the format of the data, etc. They have more assurance over the quality of the data as well. However, this approach can be costly. There need to be mechanisms in place to maintain the data in the long term.

DATA INTEROPERABILITY

This study found that in terms of interoperability between state and local data, agencies are more advanced for crash data than for roadway or traffic data. When asked to rank themselves on a scale of 1 to 10, with 1 being the least advanced and 10 being the most advanced in terms of interoperability with state and local data, states rated themselves an 8.5 for crash data, but only 5.7 and 5.8 for roadway and traffic data, respectively. The findings of the literature review support these assessments.

SAFETY DECISION MAKING

Almost all (41 of 43 states) responded in the survey that they provide some type of assistance to local agencies in terms of safety decision making. However, not all of the local agencies responded that they are receiving assistance. In addition, many of the local agencies (19 of 25) responded that they conduct their own safety analysis and would like to continue to do so. There are, however, several states, including Minnesota and Illinois, that are engaging their local agencies in data-driven safety decision making.

DATA MANAGEMENT

Only 15 states responded that they have adequate resources to manage and maintain their safety data. The most important issues are with staffing and technology, particularly in terms of local data. From the documented practices there does not appear to be one strategy for statewide data management. In addition, for the states that do have established data management procedures, support from leadership plays a significant role.

OVERALL LESSONS LEARNED

There were 13 questions in the survey for which there was at least one conflicting response between the state and local agencies in the same state; the majority of these questions were related to collecting and sharing roadway and traffic data. Conversely, there were also several questions in the survey for which both the state and local agencies responded that they collected a particular type of data on local roads or conducted safety analysis on local roads. These conflicts highlight a lack of coordination and potential duplication of efforts between the local and state agencies.

The cost of developing and maintaining statewide safety data systems could be significant. States will need information and assistance to build the budget justifications for the required projects. Some cost savings may be available if states and local agencies can partner such that the local agencies provide the data to the state in exchange for analytic support. There have been some states that have been able to obtain and make use of local safety data. These states provide examples from which those states that are struggling can learn.

A key lesson learned overall from this effort is the need for support of data improvement efforts from both the local agencies and the state department of transportation leadership. Executives need to understand the value of investing in safety data and local agencies need to believe there will be some benefit to them for participating.

RESEARCH SUGGESTIONS

Additional research is needed to lead to improved coordination among state and local agencies. Based on feedback from the agencies, it is suggested that there be more mechanisms in place to facilitate the access of information between state and local agencies. One agency suggested a "safety data pooled fund" effort would be helpful so that states can have more structured opportunities for collaboration and can combine resources to move all of the states forward. The research and findings of this synthesis effort support the need for this type of structured collaboration.

One of the key themes found was that state safety practitioners need to demonstrate the value of the data to executives and leadership to gain their support for data initiatives. The states that have been able to develop data-driven safety programs on all public roads have had leadership that understood the value of quality transportation data. Although conceptually quality data can help lead to better decisions, make more effective use of the available funding, and improve safety on the roadways, it has not yet been quantitatively proven (*37*, *38*). The FHWA Office of Safety has developed a guidebook to demonstrate a potential methodology for quantifying the value of safety data—*Benefit-Cost Analysis of Investing in Data Systems and Processes for Data-Driven Safety Programs: Decision-Making Guidebook* (*38*). However, further research is needed to explore this concept and provide concrete results to states in terms of tools and resources for communicating the value of investing in data to their leadership. A research needs statement for future research opportunities is provided in Appendix G.

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APPENDIX A

State Questionnaire

NCHRP TOPIC 44-05 SURVEY QUESTIONNAIRE—FOR STATE AGENCIES

The Transportation Research Board (TRB) is preparing a synthesis on *Roadway, Traffic and Crash Data Interoperability between Local and State Agencies Relative to Roadway Safety* (*Topic 44-05*). This is being done for NCHRP, under the sponsorship of the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration (FHWA).

In order to utilize the evolving safety analysis tools and methodologies to more efficiently and effectively address roadway safety issues and meet the MAP-21 requirements, agencies will be looking to improve their data for safety—particularly roadway, traffic, and crash data—on all public roads. The largest challenge will be the collection, storage, maintenance, and integration of safety data for local (non-state) maintained roadways. As agencies move toward improving the quality of data on the local roads, they will be looking for examples from other agencies that have been successful in doing so. The project team is familiar with the recent FHWA Roadway Safety Data Capabilities Assessment; the questions in this questionnaire will not duplicate, but rather expand upon the Capabilities Assessment effort. For any multiple choice questions, please choose the answers that best represent your state practices.

This questionnaire is being sent to U.S. state departments of transportation. Your cooperation in completing the questionnaire will ensure the success of this effort. If you are not the appropriate person at your agency to complete this questionnaire, please forward it to the correct person. Thank you very much for your time and expertise.

Please complete and submit this survey by 03/08/2013. We estimate that it should take less than 30 minutes to complete. If you have any questions, please contact our Principal Investigator Nancy Lefler by phone: (919) 334-5604 or e-mail: nlefler@vhb.com. Any supporting materials can be sent directly to Nancy Lefler by e-mail or at the postal address shown at the end of the survey.

The following definitions are used in this questionnaire:

Crash data: Data contained in the crash reports submitted after a collision (e.g., date, time, location, crash type, severity).

Curves—Data pertaining to the physical and location attributes of vertical and horizontal curves (e.g., curve degree, curve radius, percent of gradient).

Intersections—Data pertaining to the physical and locational attributes of intersections, including general intersection descriptors (e.g., number of legs, traffic control) and intersection approach descriptors (e.g., number of right turn lanes, length of right turn lanes).

Intersection turning movement counts—Data pertaining to the turning movements at intersections (e.g., left turn volume, right turn volume).

Local roads: Non-state maintained roadways.

MAP-21: Moving Ahead for Progress in the 21st Century transportation legislation (http://www.fhwa.dot.gov/map21).

MAP-21 data requirements: “As part of the state highway safety improvement program, a state shall—(A) have in place a safety data system with the ability to perform safety problem identification and countermeasure analysis—(i) to improve the timeliness, accuracy, completeness, uniformity, integration, and accessibility of the safety data on all public roads, including non-state owned public roads and roads on tribal land in the state; The term ‘safety data’ means crash, roadway, and traffic data on a public road” (MAP-21 §1112; 23 USC 130 and 148).

Roadway data—Data pertaining to the physical and locational attributes of a roadway; general categories include segments, curves, intersections, interchanges/ramps.

Segments—Data pertaining to the physical and locational attributes of a section of roadway; includes location/linkage elements, classification, cross section, and roadside descriptors.

Segment traffic flow data—Data pertaining to the traffic volume on roadway segments [e.g., annual average daily traffic (AADT)].

Segment traffic operations/control data—Data pertaining to the operations and control of roadway segments (e.g., speed limits, one-/two-way operations, parking presence).

Supplemental counts—Additional data pertaining to volume counts that is not described above (e.g., pedestrian counts, bicycle counts).

Supplemental data—Additional data collected that does not fit into the above data categories (e.g., signs, signals, pedestrians, bridges).

Traffic data—Data on the traffic volume and operations of roadways and intersections.

Please enter the date:

Your contact information will be kept confidential and only be used for the purposes of this project. In case of follow-up questions and for NCHRP to send you a link to the Final Report, please provide phone number and e-mail address. Please identify your contact information.

First Name:
Last Name:
Position/Title:
Agency/Organization:
Address:
City:
State:
Zip Code:
E-mail Address:
Phone Number:

1. MAP-21 legislation requires an integrated safety data system (roadway, traffic, and crash) with the ability to perform safety analysis on all public roads. How close are you to meeting this requirement?
    a. Do not meet.
    b. Meet somewhat.
    c. Are close to meeting.
    d. Meet.
    e. Do not know.
    f. Do not maintain any data for local roads.

If you do not maintain any data for local roads, please check "f," and you will skip to question #20.

2. On a scale of 1 to 10, with 1 being least interoperable, and 10 being the most, how would you rate the overall compatibility/interoperability of your state and local safety data—for crash, roadway, and traffic data?
    a. Crash:
    b. Roadway:
    c. Traffic:

The following questions pertain to how the state obtains data for local roads for crash, roadway, and traffic data, and if those data are provided back to locals.

3. How does the state obtain crash data for local roads? (check all that apply), and for each checked response please provide what percent is collected using that methodology.
   a. State collects:
   b. Locals collect and provide to state:
   c. Not collected at this time

3.a. If the state collects, do you provide crash data to the locals?
   a. Yes
   b. No

3.b. If the local agencies collect and provide crash data to the state, do you review/revise the data and send back to locals?
   a. Yes
   b. No

4. How does the state obtain roadway data on segments for local roads? (check all that apply), and for each checked response please provide what percent is collected using that methodology.
   a. State collects:
   b. Locals collect and provide to state:
   c. Not collected at this time

4.a. If the state collects, do you provide roadway data on segments to the locals?
   a. Yes
   b. No

4.b. If the local agencies collect and provide roadway data on segments to the state, do you review/revise the data and send back to locals?
   a. Yes
   b. No

5. How does the state obtain roadway data on curves for local roads? (check all that apply), and for each checked response please provide what percent is collected using that methodology.
   a. State collects:
   b. Locals collect and provide to state:
   c. Not collected at this time

5.a. If the state collects, do you provide roadway data on curves to the locals?
   a. Yes
   b. No

5.b. If the local agencies collect and provide roadway data on curves to the state, do you review/revise the data and send back to locals?
   a. Yes
   b. No

6. How does the state obtain roadway data on intersections for local roads? (check all that apply), and for each checked response please provide what percent is collected using that methodology.
   a. State collects:
   b. Locals collect and provide to state:
   c. Not collected at this time

6.a. If the state collects, do you provide roadway data on intersections to the locals?
 a. Yes
 b. No

6.b. If the local agencies collect and provide roadway data on intersections to the state, do you review/revise the data and send back to locals?
 a. Yes
 b. No

7. How does the state obtain supplemental data (signs, signals, pedestrian, etc.) for local roads? (check all that apply), and for each checked response please provide what percent is collected using that methodology.
 a. State collects:
 b. Locals collect and provide to state:
 c. Not collected at this time

7.a. If the state collects, do you provide supplemental data to the locals?
 a. Yes
 b. No

7.b. If the local agencies collect and provide supplemental data to the state, do you review/revise the data and send back to locals?
 a. Yes
 b. No

8. How does the state obtain segment traffic flow data for local roads? (check all that apply), and for each checked response please provide what percent is collected using that methodology.
 a. State collects:
 b. Locals collect and provide to state:
 c. Not collected at this time

8.a. If the state collects, do you provide segment traffic flow data to the locals?
 a. Yes
 b. No

8.b. If the local agencies collect and provide segment traffic flow data to the state, do you review/revise the data and send back to locals?
 a. Yes
 b. No

9. How does the state obtain segment traffic operations/control data for local roads? (check all that apply), and for each checked response please provide what percent is collected using that methodology.
 a. State collects:
 b. Locals collect and provide to state:
 c. Not collected at this time

9.a. If the state collects, do you provide segment traffic operations/control data to the locals?
 a. Yes
 b. No

9.b. If the local agencies collect and provide segment traffic operations/control data to the state, do you review/revise the data and send back to locals?
 a. Yes
 b. No

10. How does the state obtain intersection turning movement counts for local roads? (check all that apply), and for each checked response please provide what percent is collected using that methodology.
    a. State collects:
    b. Locals collect and provide to state:
    c. Not collected at this time

10.a. If the state collects, do you provide intersection turning movement counts to the locals?
    a. Yes
    b. No

10.b. If the local agencies collect and provide intersection turning movement counts to the state, do you review/revise the data and send back to locals?
    a. Yes
    b. No

11. How does the state obtains supplemental counts (pedestrian and bicycle) for local roads? (check all that apply), and for each checked response please provide what percent is collected using that methodology.
    a. State collects
    b. Locals collect and provide to state:
    c. Not collected at this time

11.a. If the state collects, do you provide supplemental counts to the locals?
    a. Yes
    b. No

11.b. If the local agencies collect and provide supplemental counts to the state, do you review/revise the data and send back to locals?
    a. Yes
    b. No

If your state doesn't obtain roadway data and traffic data from local agencies, and you didn't select answer "b" from question 4 to question 11, you will skip to question #20.

12. For the data types the locals collect, do you provide any resources to the local agencies for collection of these data? (check all that apply)
    a. Funding.
    b. Training.
    c. Guidance—data dictionaries, format requirements, collection guidebooks, etc.
    d. Software/tools.
    e. Other, please describe:

13. Are edits to the state database made based on feedback by local agencies?
    a. Yes
    b. No

14. How are the crash data merged (i.e., located) once you receive data from the locals?
    a. Linear referencing system.
    b. GIS.
    c. Linear referencing system and GIS.
    d. Other, please describe:
    e. No, we don't merge with local crash data

If you don't merge with local data, please check "e," and you will skip to question #16.

15. How easily are the local crash data merged with state data?
    a. Data does not require merging; it is all already included in one database.
    b. Very easily, the data are provided in the same format used by the state.
    c. Easily, the data are provided in a format that can be easily transformed to the same format as the state.
    d. Moderately, the data require some manual labor to get them into a useable format.
    e. Difficult, the data require extensive manual labor to get them into a useable format.
    f. Not at all, the data are unusable in the current format they are submitted in and cannot be transformed into a useable format.

16. How are the roadway data merged (i.e., located) once you receive data from the locals?
    a. Linear referencing system.
    b. GIS.
    c. Linear referencing system and GIS.
    d. Other, please describe:
    e. No, we don't merge with local roadway data

If you don't merge with local roadway data, please check "e," and you will skip to question #18.

17. How easily are the local roadway data merged with state data?
    a. Very easily, the data are provided in the same format used by the state.
    b. Easily, the data are provided in a format that can be easily transformed to the same format as the state.
    c. Moderately, the data require some manual labor to get them into a useable format.
    d. Difficult, the data require extensive manual labor to get them into a useable format.
    e. Not at all, the data are unusable in the current format they are submitted in and cannot be transformed into a useable format.

18. How are the traffic data merged (i.e., located) once you receive data from the locals?
    a. Linear referencing system.
    b. GIS.
    c. Linear referencing system and GIS.
    d. Other, please describe:
    e. No, we don't merge with local roadway data

If you don't merge with local traffic data, please check "e," and you will skip to question #20.

19. How easily are the local traffic data merged with state data?
    a. Very easily, the data are provided in the same format used by the state.
    b. Easily, the data are provided in a format that can be easily transformed to the same format as the state.
    c. Moderately, the data require some manual labor to get them into a useable format.
    d. Difficult, the data require extensive manual labor to get them into a useable format.
    e. Not at all, the data are unusable in the current format they are submitted in and cannot be transformed into a useable format.

20. Which of the following types of support do you provide to local agencies for safety improvement efforts (analysis, implementation, etc.)? (check all that apply)
    a. Guidance.
    b. Funding.
    c. Staff.
    d. Training.
    e. Software.
    f. None.
    g. Other, please describe:

If you do not provide any safety support to local agencies, please check "f," and you will skip to question #24.

21. How are safety improvements implemented on local roadways? (check all that apply)
    a. State identifies locations, prioritization, countermeasures, and implements improvements on local roadways.
    b. State identifies locations for improvements, prioritization, and potential countermeasures and provides funding for local agencies to implement the countermeasures.
    c. State identifies potential locations for improvements, prioritization, and funding, but local agency is responsible for identifying countermeasures and installing the improvements.
    d. State identifies potential locations for improvements, and prioritization, but local agency is responsible for identifying countermeasures, securing funding, and installing the improvements.
    e. Locals identify locations for improvements, prioritization, and potential countermeasures, and submit applications to the state for funding.
    f. Locals are responsible for safety improvements on roadways in their jurisdiction; state is not involved in safety improvement implementation on local roadways.
    g. Other, please describe:

22. (For those that checked a–d on Question 21) How are safety improvements identified for urban and rural roadways? (check all that apply)

Methodologies	Urban	Rural
Crash-based analysis of frequency, rate, or similar.		
Crash-based comparison of expected crashes to observed using Safety Performance Functions or similar methods.		
Risk-based method that considers the location (e.g., intersection, segment, curve, etc.) characteristics instead of crashes such as an intersection index or risk score.		
Road safety audits or other proactive review of a location.		
Concerns of citizens, law enforcement, or other members of the community.		
Other method, please describe:		

23. Do you have adequate resources (staffing, technology, funding) to manage and maintain your safety data?
    a. Yes, please describe.
    b. No, please describe.

24. Are crash data accessible/available for use for legal or liability concerns?
    a. Yes, the crash data are available to lawyers and other legal professionals upon request.
    b. No, we do not provide access to crash records to lawyers and other legal professionals.

Please feel free to provide any additional feedback on this question.

Thank you for taking our survey. Your response is very important to us!

APPENDIX B

Local Questionnaire

NCHRP TOPIC 44-05 SURVEY QUESTIONNAIRE—FOR LOCAL AGENCIES

The Transportation Research Board (TRB) is preparing a synthesis on *Roadway, Traffic and Crash Data Interoperability Between Local and State Agencies Relative to Roadway Safety* (*Topic 44-05*). This is being done for NCHRP, under the sponsorship of the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration (FHWA).

In order to utilize the evolving safety analysis tools and methodologies to more efficiently and effectively address roadway safety issues and meet the MAP-21 requirements, agencies will be looking to improve their data for safety—particularly roadway, traffic, and crash data—on all public roads. The largest challenge will be the collection, storage, maintenance, and integration of safety data for local (non-state) maintained roadways. As agencies move toward improving quality of data on the local roads, they will be looking for examples from other agencies that have been successful in doing so. The results of this survey will help local and state agencies looking to improve their safety data interoperability. For any multiple choice questions, please choose the answers that best represent your agency's practices.

This questionnaire is being sent to local agencies across the U.S. responsible for managing the transportation system in their municipality. Your cooperation in completing the questionnaire will ensure the success of this effort. If you are not the appropriate person at your agency to complete this questionnaire, please forward it to the correct person. Thank you very much for your time and expertise.

Please complete and submit this survey by 03/15/2013. We estimate that it should take less than 30 minutes to complete. If you have any questions, please contact our principal investigator Nancy Lefler by phone: (919)334-5604 or e-mail: nlefler@vhb.com. Any supporting materials can be sent directly to Nancy Lefler by e-mail or at the postal address shown at the end of the survey.

The following definitions are used in this questionnaire:

Basemap: A basemap provides geospatial information on the roadway network.

Site specific countermeasures. Countermeasures that are identified for individual locations based on the risk factors at that specific location.

Systemic countermeasures: Countermeasures implemented at multiple locations with similar risk characteristics.

Safety Performance Functions (SPF): A statistical model used to estimate the average crash frequency for a specific site type (with specified base conditions), based on traffic volume and roadway segment length.

Road Safety Audits (RSA): Formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users.

Segments—Data pertaining to the physical and locational attributes of a section of roadway; includes location/linkage elements, classification, cross section, and roadside descriptors.

Curves—Data pertaining to the physical and location attributes of vertical and horizontal curves (e.g., curve degree, curve radius, percent of gradient).

Intersections—Data pertaining to the physical and locational attributes of intersections, including general intersection descriptors (e.g., number of legs, traffic control) and intersection approach descriptors (e.g., number of right turn lanes, length of right turn lanes).

Interchanges/Ramps—Data pertaining to the physical and locational attributes of interchanges and ramps (e.g., type of interchange, ramp length, number of ramp lanes).

Traffic data—Data on the traffic volume and operations of roadways and intersections.

Segment traffic flow data—Data pertaining to the traffic volume on roadway segments [e.g., annual average daily traffic (AADT)].

Segment traffic operations/control data—Data pertaining to the operations and control of roadway segments (e.g., speed limits, one-/two-way operations, parking presence).

Intersection turning movement counts—Data pertaining to the turning movements at intersections (e.g., left turn volume, right turn volume).

Ramp counts—Data pertaining to the traffic volume on interchange ramps (e.g., ramp AADT).

Please enter the date:

Please identify your contact information. Your contact information will be kept confidential and only be used for the purposes of this project. In case of follow-up questions and for NCHRP to send you a link to the Final Report, please provide phone number and e-mail address.

First Name:
Last Name:
Position/Title:
Agency:
Address:
City:
State:
Zip Code:
E-mail Address:
Phone Number:

General

1. How many miles of roadway does your agency maintain?

2. Does your agency have a basemap of the roadway network?
   a. Yes, based on a linear referencing system.
   b. Yes, based on GIS
   c. Yes, based on link/node.
   d. Yes, other (please describe):
   e. No

If no, skip to question 4.

3. What percentage of roads in your jurisdiction is included in the basemap?

Crash Data

4. Does your agency store records of crashes that occur in your jurisdiction?
   a. Yes, paper only.
   b. Yes, electronic.
   c. No.

If yes, paper only, skip to question #7.

If no, skip to question #11.

5. Are the crashes located to your basemap (if you maintain one)?
   a. Yes, all.
   b. Yes, most.
   c. Yes, some.
   d. No.

6. What format are the data in?
   a. Microsoft Excel or Access.
   b. Geographic Information Systems (GIS).
   c. SQL.
   d. Oracle.
   e. Other format, please describe:

7. Does your agency have staff dedicated to managing the crash data?
   a. Yes, it is their sole responsibility.
   b. Yes, but it is only part of their responsibilities.
   c. No, but we need to/would like to.
   d. No, but we contract these services.
   e. No, we do not need to.

8. Are crash data accessible/available for use for legal or liability concerns?
   a. Yes, the crash data are available to lawyers and other legal professionals upon request.
   b. No, we do not provide access to crash records to lawyers and other legal professionals.

Please feel free to provide any additional feedback on this question.

9. What type of support does your agency receive on the collection or management of the crash data? (check all that apply)
   a. Funding.
   b. Training.
   c. Data dictionaries.
   d. Format requirements.
   e. Guidebooks.
   f. Software/tools.
   g. Other, please describe:

If your agency does not receive any support, skip to question #11.

10. Who provides this support? (check all that apply)
    a. State Department of Transportation.
    b. State Department of Public Safety.
    c. Universities.
    d. Local Technical Assistance Program (LTAP).
    e. Others please describe:

11. If you receive crash data from the state, how easily are the data merged/interoperable with your local data?
    a. Very easily, the state's data are provided in the same format as our data.
    b. Easily, the state's data are provided in a format that can be easily transformed to be in the same format as our data.
    c. Moderately, the state's data require some manual labor to get them into a useable format.
    d. Difficult, the state's data require extensive manual labor to get them into a useable format.
    e. Not at all, the state's data are unusable in the current format they are submitted in and cannot be transformed into a useable format.
    f. We do not receive crash data from the state.

12. Do you have the ability to access the state crash database in addition to any locally maintained data? (Select the situation that best applies.)
    a. Yes, the state provides us a copy of their electronic database on a regular (e.g., annual) basis.
    b. Yes, the state will provide their electronic database upon request.
    c. Yes, we have web-based access to the state data.
    d. We do not have access to the database but the state will provide reports or other outputs (e.g., crash maps) of the data either on a regular interval or on request.
    e. There is no access to any of the crash data maintained by the state.
    f. Other, please describe:

13. Does your agency engage in safety for your roadways; i.e., implement countermeasures/treatments on your roadways for the purpose of improving safety?
    a. Yes.
    b. No.

If no, skip to question #21.

14. How are the countermeasures/improvements predominantly implemented?
    a. Site specific.
    b. Systemic.
    c. Some of both.

15. How are safety improvements funded?
    a. The state provides all of the funding through their HSIP program or similar.
    b. Our agency funds the entire improvement.
    c. The funding is split between the state and our agency.
    d. Other, please describe:

16. For each of the different types of safety analysis, please indicate how they are conducted at your agency (check all that apply):

Level of State Support	Location/Project Identification	Project Prioritization	Countermeasure Selection	Countermeasure Evaluation
State conducts and provides results				
State provides assistance to our agency				
We conduct our own analysis and would like to continue doing so				
We conduct our own analysis but would like assistance from the state				

17. If you conduct your own analysis for location identification, what methods do you use to identify locations? (check all that apply)
    a. Crash-based analysis of frequency, rate, or similar.
    b. Crash-based comparison of expected crashes to observed using Safety Performance Functions or similar methods.
    c. Risk-based method that considers the location (e.g., intersection, segment, curve, etc.) characteristics instead of crashes such as an intersection index or risk score.
    d. Road safety audits or other proactive review of a location.
    e. Concerns of citizens, law enforcement, or other members of the community.
    f. Other method, please describe:

18. What software, tools, resources are used in these analyses? (check all that apply)
    a. Geographic Information System (GIS).
    b. Highway Safety Manual.
    c. State provided tools, please describe:
    d. Other, please describe:

19. If you indicated in the previous question #16 that the state provides assistance in safety analysis, how would you characterize that assistance (check all that apply):
    a. Guidance.
    b. Funding.
    c. Staff.
    d. Training.
    e. Software.
    f. Other, please describe:

20. Does your agency have staff dedicated to conducting safety analysis/implementing safety improvements?
    a. Yes, it is their sole responsibility.
    b. Yes, but it is only part of their responsibilities.
    c. No, but we contract these services.
    d. No, but we need to/would like to.
    e. No, we do not need to.

Roadway

21. Do you maintain a database of any of these roadway elements? If so, please indicate what data are available, and who (local agency or state) conducted the collection. (check all that apply)

If none, there are no further questions in this section.

Roadway Elements	Agency Collects Only for Internal Use	Agency Collects and Provides to the State	State Collects and Provides to Agency on Regular Basis
Roadway Segment Descriptors			
Segment Location/Linkage Elements			
Segment Roadway Classification			
Segment Cross Section			
Roadside Descriptors			
Roadway Alignment Descriptors			
Horizontal Curve Data			
Vertical Grade Data			
Roadway Junction Descriptors			
At-Grade Intersection/Junctions			
Interchange and Ramp Descriptors			

Roadway Elements	Agency Collects Only for Internal Use	Agency Collects and Provides to the State	State Collects and Provides to Agency on Regular Basis
Supplemental Datasets			
Signs			
Signals			
Pavement			
Pedestrians and/or Bicycles			
Safety Improvements			
Other, please describe:			

22. If you provide roadway data to the state, does the state perform quality assurance/quality control and return the cleaned data back to you?
    a. Yes.
    b. No.

23. If you receive roadway data from the state, are the data easily merged/interoperable with your local data?
    a. Very easily, the data are provided in the same format as our data.
    b. Easily, the data are provided in a format that can be easily transformed to be in the same format as our data.
    c. Moderately, the data require some manual labor to get them into a useable format.
    d. Difficult, the data require extensive manual labor to get them into a useable format.
    e. Not at all, the data are unuseable in the current format they are submitted in and cannot be transformed into a useable format.
    f. We do not receive roadway data from the state.

24. If you do not receive roadway data directly from the state on a regular basis, do you have the ability to access the state roadway database in addition to any locally maintained data? (Select the situation that best applies.)
    a. Yes, the state will provide their electronic database upon request.
    b. Yes, we have web-based access to the state data.
    c. There is no access to any of the roadway data maintained by the state.

25. Does your agency have staff dedicated to managing the roadway data?
    a. Yes, it is their sole responsibility.
    b. Yes, but it is only part of their responsibilities.
    c. No, but we contract these services.
    d. No, but we need to/would like to.
    e. No, we do not need to.

26. Which of the datasets are readily linkable with the crash data? (check all that apply)
    a. Segments.
    b. Curves.
    c. Intersections.
    d. Interchanges/Ramps.
    e. Curves.
    f. Supplemental data.
    g. None.

27. Do you use roadway data in safety analysis?
    a. Yes.
    b. No.

28. Would guidance/training on how to use roadway data in safety analysis be helpful?
    a. Yes.
    b. No.

Traffic

29. Do you maintain a database of any of these types of traffic data? If so, please indicate what data are available, and who (local agency or state) conducted the collection. (check all that apply)

If none, there are no further questions.

Traffic Elements	Agency Collects Only for Internal Use	Agency Collects and Provides to the State	State Collects and Provides to Agency on Regular Basis
Segments			
Segment Traffic Flow Data			
Segment Traffic Operations/ Control Data			
Junction Counts			
Turning Movement Counts			
Ramp Counts			
Supplemental Counts			
Pedestrian Counts			
Bicycle Counts			
Other, please describe:			

30. If you provide any traffic data to the state, does the state perform quality assurance/quality control and provide the cleaned data back to the agency?
    a. Yes.
    b. No.

31. If you receive traffic data from the state, are the data easily merged/interoperable with your local data?
    a. Very easily, the data are provided in the same format as our data.
    b. Easily, the data are provided in a format that can be easily transformed to be in the same format as our data.
    c. Moderately, the data require some manual labor to get them into a useable format.
    d. Difficult, the data require extensive manual labor to get them into a useable format.
    e. Not at all, the data are unusable in the current format they are submitted in and cannot be transformed into a useable format.
    f. We do not receive roadway data from the state.

32. If you do not receive traffic data directly from the state on a regular basis, do you have the ability to access the state traffic database in addition to any locally maintained data? (Select the situation that best applies.)
    a. Yes, the state will provide their electronic database upon request.
    b. Yes, we have web-based access to the state data.
    c. There is no access to any of the traffic data maintained by the state.

33. Does your agency have staff dedicated to managing the traffic data?
    a. Yes, it is their sole responsibility.
    b. Yes, but it is only part of their responsibilities.
    c. No, but we contract these services.
    d. No, but we need to/would like to.
    e. No, we do not need to.

34. Which of the traffic datasets are readily linkable with the crash data? (check all that apply)
    a. Segments.
    b. Intersections.
    c. Ramps.
    d. Supplemental data.
    e. None.

35. Do you use traffic data in conducting safety analysis?
    a. Yes.
    b. No.

36. Would guidance/training on how to use traffic data in safety analysis be helpful?
    a. Yes.
    b. No.

Thank you for taking our survey. Your response is very important to us!

APPENDIX C

List of States that Responded to the Survey

Alabama–Completed

Alaska–Completed

Arizona–Completed

Arkansas–Completed

California–Completed

Colorado–Completed

Connecticut–Completed

Delaware–Completed

District of Columbia–Completed

Florida–Completed

Georgia–Completed

Hawaii–Partial

Idaho–Completed

Indiana–Completed

Iowa–Completed

Kansas–Completed

Kentucky–Completed

Louisiana–Completed

Maine–Partial

Maryland–Completed

Massachusetts–Completed

Michigan–Completed

Minnesota–Completed

Mississippi–Completed

Missouri–Completed

Montana–Completed

Nebraska–Completed

New Hampshire–Completed

New Jersey–Completed

New York–Completed

North Carolina–Completed

North Dakota–Completed

Ohio–Completed

Oklahoma–Completed

Oregon–Completed

Pennsylvania–Completed

Rhode Island–Completed

South Carolina–Completed

South Dakota–Completed

Tennessee–Completed

Texas–Completed

Utah–Completed

Vermont–Completed

Virginia–Completed

Washington–Completed

Wisconsin–Partial

APPENDIX D

List of Local Agencies that Responded to the Survey

Elmore County, AL–Completed

Mobile County Engineer Office, AL–Completed

City of Irvine, CA–Partial

City of San Jose DOT, CA–Completed

Trinity County, CA–Completed

Ventura County Public Works Agency, CA–Completed

City of Centennial, CO–Completed

St. Johns County, FL–Completed

Macon County Highway Department, IL–Completed

McHenry County Division of Transportation, IL–Completed

Monroe County Highway Department, IN–Completed

Iowa LTAP–Partial

Woodbury County Secondary Road Department, IA–Completed

City of Topeka, KS–Completed

Kent County Road Commission, MI–Completed

Somerset County, NJ–Completed

Madison County, OH–Completed

Deschutes County, OR–Completed

Jackson County Roads, OR–Completed

Lane County Public Works, OR–Completed

Anderson County, SC–Partial

Charleston County Government, SC–Completed

Charleston County Public Works, SC–Completed

City of Charleston, SC–Partial

Greenville County Public Works, SC–Completed

Horry County Engineering Dept., SC–Completed

Lexington County Public Works, SC–Partial

Sandy City, UT–Completed

Thurston County Public Works, WA–Completed

APPENDIX E

Interview Guide

NCHRP 20-05/44-05 INTERVIEW QUESTIONS:

1) Please briefly describe your program/effort/initiative.
2) What was the reasoning behind starting your program/effort/initiative?
3) Did you have a champion(s) for this effort? If so, in what department were they from?
4) Were you able to get support from leadership? If so, how?
5) How long did it take to get it established?
6) How much did it cost (approximately)?
7) How were you able to get funding?
8) How were you able to get cooperation/support from locals?
9) What percentage of local agencies comply?
10) What percentage of local roadways does this cover?
11) What are the benefits/advantages to the local agencies for participating?
12) What are the penalties to the local agencies for non-compliance?
13) What benefits have been realized by the state?
14) Did you develop the program/effort/initiative in-house, or did you seek support from contractors, universities, etc.?
15) What were the biggest challenges?
16) How did you overcome them?
17) What were the major lessons learned/what would you have done differently?
18) Is there any other information you think would be helpful for other agencies to know that may want to develop a similar program?
19) Please provide any graphics/images that will help to demonstrate the program/effort/initiative.

Contact:

Name

Title

Organization

E-mail

Phone

APPENDIX F

Overview of Interviews

TENNESSEE: AUTOMATED INVENTORY PROJECT AND TENNESSEE ROADWAY INFORMATION MANAGEMENT SYSTEM (TRIMS)

1) Please briefly describe your program/effort/initiative.

   Tennessee has several data initiatives:

   Tennessee Roadway Information Management System (TRIMS)—TRIMS is a client/server application, Linear Reference System Database (Oracle) that contains roadway inventory, structures, pavement, photolog, traffic, and crash data. It contains data for 95,492 miles of state maintained (13,877), additional classified roads (21,615), and local roads (60,000).

   TDOT GIS Mapping and Facilities Data Office updated existing local road inventory and collected GPS center lines on the local roads to complete the LRS spatial network used by the TRIMS database. The LRS spatial network is used for accurate mapping and reporting of HPMS data, crash data, bridge data, and asset management. TDOT collected 67,500 miles of local road inventory and GPS center line, which added to the existing 30,000 miles of Interstate, State Highway, and functional route roadway inventory and GPS centerline data. Information collected included linear reference points, lane widths, shoulder widths, intersections, speed limits, etc. Data were collected using an instrumented vehicle.

   TDOT Safety Office identifies crash data on 30,000 miles of state and functionally classified routes. They are working toward inputting the backlog of local road crash data into the newly obtained local road inventory data. Tennessee passed a new legislation bill that all police agencies shall submit crash reports electronically by 2015.

   TDOT provides roadway data to the locals. TDOT uses crash data to identify safety issues and works with locals on how to address.

2) What was the reasoning behind starting your program/effort/initiative?

   Safety—There are approx. 90,000 miles of roadway in Tennessee; the majority of fatal and incapacitating crashes were occurring on local/rural roads. They needed to have the data to determine how to improve safety on these roads.

   Stewardship—In order to be better stewards of the roadways in the state, needed to have data on entire roadway system.

3) Did you have a champion(s) for this effort? If so, in what department were they from?

   Yes, champions from GIS Mapping and Facilities Data Office, Safety, and HPMS all worked together on this effort.

4) Were you able to get support from leadership? If so, how?

   Safety is TDOT's #1 priority; executives recognized the importance of being able to address safety issues on all roadways in the state.

5) How long did it take to get it established?

   From 2007–2012

6) How much did it cost (approximately)?

   $11,900,000

7) How were you able to get funding?

State Planning and Research (SPR) funds

8) How were you able to get cooperation/support from locals?

Through the MPOs/RPOs, informed local agencies that they had access to roadway data.

Through direct contact with local agencies, worked with them on the safety issues the state identified, also helped to address safety issues the local agency had identified.

9) What percentage of local agencies complies?

N/A

10) What percentage of local roadways does this cover?

The Automated Inventory Project covered 100% of local roads.

11) What are the benefits/advantages to the local agencies for participating?

Local agencies do not always have the funding they need. By working with the state, the state is able to help provide funding to address safety issues.

12) What are the penalties to the local agencies for non-compliance?

N/A

13) What benefits have been realized by the state?

Local/rural road fatalities have decreased since the project was completed. Rural fatalities are down 49% since last year.

14) Did you develop the program/effort/initiative in-house, or did you seek support from contractors, universities, etc.?

There were contractors involved in collecting data for the Automated Inventory Project and developing the TRIMS.

15) What were the biggest challenges?

Funding and proving the value—showing how this was going to benefit and when the benefits were going to be realized, proving there was a "bang for the buck."

16) How did you overcome them?

A study was performed by the University of Tennessee Transportation Research Center on the existing method of collecting roadway inventory and GPS data collection compared to an automated method and it proved very beneficial.

17) What were the major lessons learned/what would you have done differently?

There were several:

- Do your homework and draft RFP to include all requirements
- Test procedures in pilot county
- Automation needed for QA/QC
- Expect and be ready to address unforeseen hurdles

18) Is there any other information you think would be helpful for other agencies to know that may want to develop a similar program?

    Need support from the bottom-up and the top down. Both practitioners and leadership/executives need to understand the importance of addressing safety for local roads, and the importance of data in being able to do that.

19) Please provide any graphics/images that will help to demonstrate the program/effort/initiative.

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WISCONSIN: WISCONSIN INFORMATION SYSTEM FOR LOCAL ROADS (WISLR)

1) Please briefly describe your program/effort/initiative.

    Wisconsin Information Systems for Local Roads (WISLR) is a web-based GIS application with a multi-tier implementation:

    Stage 1: comply with inventory and certification of local roads statute. WISLR data supports the distribution of approximately $400 million in general transportation aids (GTA) to local governments.

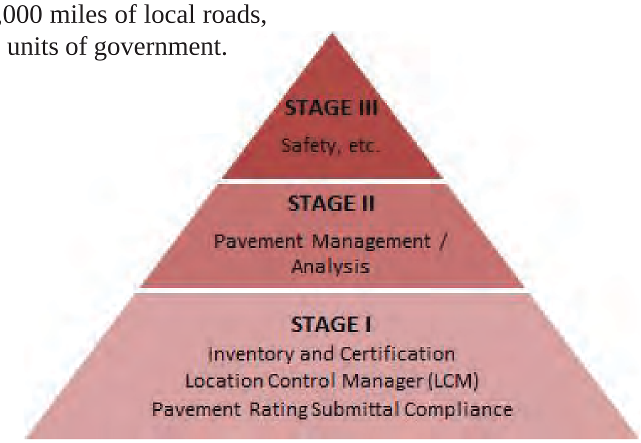
    Stage 2: provide local government with a tool that provides location-specific estimates of pavement needs that are prioritized and placed within a 5-year budget plan. The tool contains a mechanism to measure effectiveness of a budget plan by providing an assessment of system pavement condition before and after the plan's proposed improvements, along with an estimate of the unmet backlog of needs associated with that budget.

    Stage 3: improve decision making for safety initiatives using WISLR's statewide data and location network. Recent federal requirements, along with the need to more efficiently manage limited safety improvement resources, data driven approaches to supporting operations and planning decisions are key. The Wisconsin DOT has recently completed a project to geocode multiple years of state and non-state crashes to a single statewide network. The crash map was subsequently leveraged to develop an automated approach to identifying a statewide list of high risk rural roads (HRRR) for potential HSIP projects.

    The Department of Transportation created the WISLR database in 2002 that offers local governments and the Department convenient access to statewide local roadway data and network to help enhance local transportation and related planning decision making. There are approximately 100,000 miles of local roads, streets, and county highways administered by over 1,920 units of government.

    WISLR offers users access to:

    - Statewide local road network
    - Physical and administrative local roadway data; e.g., surface type, surface condition, surface width, functional classification, owner, etc.
      - Tabular format
      - Mapped to location
    - Querying, analytical and spreadsheet tools to organize and analyze data
      - 5-year pavement analysis tool
      - GIS querying tool



The Vision

2) What was the reasoning behind starting your program/effort/initiative?

Wisconsin Statute requires local agencies to submit local roadway changes annually. Wisconsin's Local Roads and Streets Council (LRSC) recommended to the Secretary of the Department of Transportation that the former database needed redesign to improve:

- Data quality
- Methods to access local data
- Efficiency
- Timeliness of data
- Reduce duplication of activities between local and state government

3) Did you have a champion(s) for this effort? If so, in what department were they from?

Support from WisDOT Management, the WISLR Development Team and Local Roads and Streets Council comprised of local officials, Regional Planning Commissions, Metropolitan Planning Organizations.

4) Were you able to get support from leadership? If so, how?

Strong partnership between the Department Secretary's Office and the LRSC

5) How long did it take to get it established?

Process and data modeling activities began in 1997 with a 2002 production implementation

6) How much did it cost (approximately)?

Multi-year/multi-million dollar project

7) How were you able to get funding?

Unknown at this time (contact came on board to the project after funding decisions had been made)

8) How were you able to get cooperation/support from locals?

Outreach and education continues today.

- Provide training, education, informational hand-outs, training CD early-on
- Bi-annually offer five face-to-face training sessions statewide
- Bi-annually offer Webinar training sessions on multiple topics
- WISLR user group forum for outreach, solicit their input, and additional training
- Provide locals access to Help Line 24/7
- Be present at local government annual conferences/meetings

9) What percentage of local agencies complies?

98%

10) What percentage of local roadways does this cover?

WISLR has 100% coverage of reported roads

11) What are the benefits/advantages to the local agencies for participating?

Many local agencies do not have the resources to maintain a roadway inventory; WISLR provides a repository for statewide local roadway data and a statewide local road network (GIS).

Provides locals ability to access statewide roadway inventory data 24/7; includes 5-year pavement analysis tool, interactive mapping capabilities, various reports, maps, querying tools, etc.

12) What are the penalties to the local agencies for non-compliance?

There are none

13) What benefits have been realized by the state?

- Meet ongoing federal requirements; e.g., Highway Performance Monitoring System (HPMS), High Risk Rural Roads (HRRR), MAP-21, All Roads Network of Linear Referenced Data (ARNOLD).
- WISLR network selected as the Incident Locator Tool map used in law enforcement vehicles. WISLR coverage contains statewide local road network and includes state highways for visual reference and continuous lines.

14) Did you develop the program/effort/initiative in-house, or did you seek support from contractors, universities, etc.?

Initial WISLR design, development, and implementation were largely done in-house with a WisDOT staff and a small number of contractors.

Recent safety initiatives leveraging WISLR's coverage; e.g., Crash Mapping and HRRR are being built by a team of universities and WisDOT staff.

15) What were the biggest challenges?

- Multi-year projects encounter software upgrades that have to be tested/incorporated into the final deliverables
- Parallel conversion of former database while supporting current day production
- Limited business experts and IT staff

16) How did you overcome them?

A strong, dedicated, and knowledgeable team is key. Having good business experts, staff with the right technical skills, and using solid project management methods was critical.

Keep the team focused through constant communication, identify core functions, deploy deliverables in stages, identify high risk activities, etc., through the use of an implementation and test plan.

17) What were the major lessons learned/what would you have done differently?

Several factors played a part in the successful development and continued success of the tool:

- The outcomes from the WISLR development met a real need.
- Identifying core stakeholders and communicating with them regularly on the status of the project helped to keep them engaged.
- Having support from both the DOT management and the local agencies.
- Being able to show progress.
- Solid project management methods. This includes a Business Model Report from the user perspective that demonstrated how the design will fulfill the scope and objectives.

18) Is there any other information you think would be helpful for other agencies to know that may want to develop a similar program?

It's important to consider not only the initial data collection but also how to maintain the data in the long term. This includes considering what is the current structure of the relationship with local agencies, and developing something that not only benefits the state, but that benefits the local agencies so they will continue to use it and maintain their data in the future.

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MICHIGAN: ROADSOFT

1) Please briefly describe your program/effort/initiative.

RoadSoft is a roadway asset management system for collecting, storing, and analyzing data associated with transportation infrastructure maintained by Michigan Technological University with funding from the Michigan DOT. It includes crash data, bridges, culverts, driveways, guardrails, intersections, linear pavement markings, point pavement markings, roads, sidewalks, signs, and traffic counts. It provides tools to conduct safety analysis, mobile data collection, maintenance management, pavement management strategy evaluation, asset management reporting to the DOT, and sign retroreflectivity management.

It is a cooperative project with local agencies since 1992. It includes a unified map of the state. They are able to push data back and forth between the state and 412 Michigan agencies, these include:

- 83 county road commissions
- 175 cities
- 52 villages
- 22 townships
- 23 planning organizations
- 31 MDOT regional offices and transportation service centers
- Four Native American tribes
- Two federal agencies
- 20 other (police agencies, GIS departments, etc.)

Each of the agencies maintains their own version of the software. The state collects crashes on all local roads and provides this down to the locals through an annual export. The local agencies collect roadway data on local roads, use these data for their own purposes, and then uses the same data to meet reporting and planning requirements to regional and metro planning organizations in the state. Any data that are included in RoadSoft can be shared between local, regional, and state agencies through RoadSoft. Currently there are the following datasets that are routinely shared between Michigan local, regional, and state agencies:

- crash data
- pavement type and number of lanes
- traffic counts
- road map data including functional classification
- culvert data including aquatic organism passage information
- bridge data including inspections
- planned construction projects
- completed construction projects
- aerial photography

2) What was the reasoning behind starting your program/effort/initiative?

It was started in 1991 as a “proof of concept” when ISTEA legislation came out. There was a mandate that states had to have an asset management system. At that time the DOT had its own asset management system, but local agencies did not. RoadSoft was started as a tool to meet the requirement. The legislation was later rescinded but MDOT and the local agencies decided it was something they should have anyways.

They developed a fledgling asset management system. They needed to be able to locate roads so they used the crash LRS as the backbone. The tool slowly evolved from there adding more and more capabilities.

3) Did you have a champion(s) for this effort? If so, in what department were they from?

Strong local agency support

Strong DOT support from traffic, safety, and asset/pavement management

4) Were you able to get support from leadership? If so, how?

They understand the value of the tool

There are legislative requirements that high level executives need to meet on asset management and reporting

Asset Management and Safety Management are closely related, specifically in the data and systems necessary.

5) How long did it take to get it established?

Began in 1991, and has been continually evolving

6) How much did it cost (approximately)?

Initial development costs were approximately $200.

The current RoadSoft project has grown to include support activity necessary to allow users to gain the most benefit from the program. The majority of the annual budget for the project is dedicated to user support. The current total annual budget for RoadSoft is $699,000. User support activities include one-on-one software technical support for several hundred users, engineering technical assistance for using advanced features like pavement modeling, user data migration, user training, and development of tutorials and help files.

7) How were you able to get funding?

Fed-aid money from the state of Michigan

8) How were you able to get cooperation/support from locals?

By providing a service they find value in. It's data they would have needed themselves anyway.

It's their tool, its user driven, local agencies tell the state needed revisions/upgrades.

Hold user group meetings to get feedback from the locals—the local agencies define the functions.

9) What percentage of local agencies complies?

Approx. 412 out of a total of 635 local agencies—72%. Users include use by nearly all of the "big 124" (83 counties, MDOT, and 40 largest transportation owning cities) agencies that own 91% of the total road mileage in Michigan.

10) What percentage of local roadways does this cover?

Approx. 93% of the local road system.

11) What are the benefits/advantages to the local agencies for participating?

Efficiency in daily operations.

Access to crash and other data in a format they can use.

Tools that streamline safety analysis

12) What are the penalties to the local agencies for non-compliance?

There are some penalties written into state laws on pavement data requirements; however, this has not been an issue, all of the major agencies participate. Use of RoadSoft is totally voluntary.

13) What benefits have been realized by the state?

Ability to pass data back and forth from state to local agencies.

Reduce data collection cost—collecting all of these data on local roads would be a huge cost for the state and conversely the state has data that is of great benefit to the local and regional agencies.

Having data on a vast majority of public roads—if you want to impact safety, have to have local data.

14) Did you develop the program/effort/initiative in-house, or did you seek support from contractors, universities, etc.?

University—Michigan Tech was involved since the beginning

15) What were the biggest challenges?

Keeping the software current and flexible enough to meet the needs of all agencies.

The ability to react and develop features quickly.

It has to fit into the business process of the local agencies, if it doesn't they won't use it

16) How did you overcome them?

Developed the tool to be "one-stop shop" for local agency's data needs, make it part of the process of the business they do.

Locals drive development of the software through quarterly users' group meetings to recommend changes.

17) What were the major lessons learned/what would you have done differently?

- Local agencies need to feel they "own" the software and the data.
- Tools, data, and training—need all three to be successful.
- Get a strong, committed user base developed early.
- Have continuous contact with the users.
- The software is only part of the battle; the bigger issue is user support. Keeping users supplied with the knowledge, data, and tools they need leads to success.
- Be able to react and add new features quickly.

18) Is there any other information you think would be helpful for other agencies to know that may want to develop a similar program?

Functionality, tutorials, and more screenshots of the software at www.roadsoft.org

19) Please provide any graphics/images that will help to demonstrate the program/effort/initiative.

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MINNESOTA: COUNTY ROADWAY SAFETY PLANS

1) Please briefly describe your program/effort/initiative.

   Minnesota's County Roadway Safety Plans—The primary objective of the County Road Safety Plans is to identify a specific set of low cost systematic safety projects that are linked directly to the causation factors associated with the most severe crashes on the county's system of highways.

2) What was the reasoning behind starting your program/effort/initiative?

   The idea was born out of necessity, during the development and implementation of the Comprehensive Highway Safety Plan (CHSP), now Strategic Highway Safety Plan (SHSP) and Highway Safety Improvement Program (HSIP).

   The CHSP and SHSP highlighted the need to apply a greater share of state safety funds to local roadways in a data driven system-wide approach if we were truly committed to eliminating fatal crashes. Because of these findings, MnDOT began sharing its safety funding based on number of fatal and serious injury crashes.

   At the time (2004), the concept of low cost, data driven safety solutions funded with federal monies on the local system cut adjust nearly all practices for safety project development and funding. It quickly became apparent that additional resources, training, and education were needed to help implement this revolutionary approach to advance highway safety. MnDOT created a new position dedicated to traffic safety on the local system. This position was responsible for developing and delivering safety related training, meeting with the local units of government (LUG) on safety related issues and building a greater connection between MnDOT's functional groups and the LUGs.

   This person received similar comments, concerns and requests during all HSIP outreach and training meetings. The LUGs felt the process for requesting funds was difficult, crashes were few in number, low cost project types were different and federal monies required a lot of project administration compared to other funding sources. MnDOT used several different approaches to address these items including modification to the solicitation process to reduce paper work and consolidating multiple safety funds into one solicitation, streamlining environmental review and funding more than 30 Road Safety Audits.

   As these RSAs were being completed the need for something more advanced was realized; evolving into a "hybrid" RSA evaluating. This proof in concept focused on more intersections and segments (50+) in each county and crash data and research at a regional and/or state level. Next a pilot county was evaluated using the idea of risk factors based on crash data trends at the regional and state levels and applied to segments, curves, and intersections across the entire system of county roads. In addition to the risk based approach a larger group of stakeholders were involved in the plan. This group was composed of the "Four Safety Es," enforcement, education, and emergency services in addition to the more traditional engineering.

   Finally, this concept [County Roadway Safety Plan (CRSP)] was then applied to the remaining 86 counties.

3) Did you have a champion(s) for this effort? If so, in what department were they from?

   Yes. There were multiple champions within state DOT and county engineers.

4) Were you able to get support from leadership? If so, how?

Yes. Toward Zero Deaths (TZD) is a flagship initiative for MnDOT and this project provided clear and concise direction for increasing safety projects on local roadways, allowed for the prioritization and evaluation of safety investments, and strengthened relationships with our local units of government and their understanding of crash data, crash modification factors, and the use and application of low cost systemic safety improvements.

5) How long did it take to get it established?

6.5 years: 3 years ground work prior to plan development, 3.5 years to develop CRSP for each county.

6) How much did it cost (approximately)?

The project cost approximately $3.5 million.

7) How were you able to get funding?

The project was funded using NHTSA 164 Funds.

8) How were you able to get cooperation/support from locals?

MnDOT created a new position dedicated to traffic safety on the local systems. This person was responsible for developing and delivering safety related training, meeting with the LUGs on safety related issues, and building a greater connection between MnDOT's functional groups and the LUGs.

The traffic safety engineer received similar comments, concerns, and requests during all HSIP outreach and training meetings. The LUGs felt the process for requesting funds was difficult, crashes were few in number, low cost project types were different, and federal monies required a lot of project administration compared to other funding sources. MnDOT used several different approaches to address these items including modification to the solicitation process to reduce paper work and consolidating multiple safety funds into one solicitation, streamlining environmental review, and funding more than 50 Road Safety Audits.

As these RSAs were being completed the need for something different was realized; evolving into a "hybrid" RSA evaluating. This proof in concept focused on more intersections and segments (50+) in each county and the use of more data and research at a regional or state level. Next a pilot county was evaluated using the idea of risk factors based on crash data trends at the regional and state level and applied to the segment, curve, or intersection level across the its entire system of roads. In addition to the risk based approach a larger group of state holders were involved in the plan. This group was composed of the "Four Safety Es," enforcement, education, and emergency services in addition to the more traditional engineering.

Final, this concept [County Roadway Safety Plan (CRSP)] was then applied to the remaining 86 counties.

9) What percentage of local agencies complies?

100% of counties (87) participated in this project.

10) What percentage of local roadways does this cover?

The project evaluated all county roadways, which is 34% of local roadways. Unpaved roadways were evaluated, but the analysis determined that gravel roads make up approx. 42% of the system but fewer than 15% of all severe crashes occur on these roads. In addition, one-third of the counties have no severe crashes on their gravel roads.

11) What are the benefits/advantages to the local agencies for participating?

This project gives the counties risk based assessments of their intersections, curves, and segments providing flexibility for prioritizing and implementing safety projects as they see fit. "Project Sheets" were also created, allowing for the direct submission of safety projects and greatly reducing time required to complete safety project applications.

12) What are the penalties to the local agencies for non-compliance?

    There were no direct penalties if a county did not participate, but future solicitations for safety funds utilize this methodology.

13) What benefits have been realized by the state?

    A complete list of benefits would be difficult to provide, but several key benefits that the state has realized are an increase in the quality and quantity of submitted and funded HSIP projects, a risk based assessment of all county roadways allowing for the prioritization, and evaluation of safety investments. This project also strengthened relationships with our local units of government and their understanding of crash data, crash modification factors, and the use and application of low cost systemic safety improvements.

14) Did you develop the program/effort/initiative in-house, or did you seek support from contractors, universities, etc.?

    The idea and framework was developed in-house and tested and refined using consultants. The completion of the statewide effort was completed by a consultant team.

15) What were the biggest challenges?

    The statewide development required buy in from a vast majority of the counties prior to moving forward with the project; developing this critical mass was challenging.

16) How did you overcome them?

    We slowly worked with the safety champions at the county level to gather support, the agency “assured” there would be benefits to completing the plan (i.e., safety funds for implementation) and consistent messaging related to the plans and following through on agreed to obligations.

17) What were the major lessons learned/what would you have done differently?

    There is a need for technical support regarding safety at the local level, but not all of the counties need the same level or type of support; because of this, some counties have chosen not to implement their plan. Future efforts will include a cost participation requirement.

18) Is there any other information you think would be helpful for other agencies to know that may want to develop a similar program?

    Each state should consider its traffic safety culture, resources, partnerships, stakeholders, and construction project planning and delivery process. Our project was built around the in place strengths in Minnesota, strong partnerships between MnDOT and our local units of government, risk factors that could be explained in plain English or with a photo, and construction projects that could be planned, administered, and delivered by the local unit of government.

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APPENDIX G

Research Needs Statement

PROBLEM TITLE

Benefits of Roadway, Traffic, and Safety Data for Data Driven Decision Making

RESEARCH PROBLEM STATEMENT

Quality data are the foundation for making important decisions regarding the design, operation, and safety of roadways. With the development of more advanced safety analysis tools, such as the *Highway Safety Manual* (*1*), *SafetyAnalyst* (*2*), *Interactive Highway Safety Design Model* (*3*), and the Crash Modification Factor Clearinghouse (*4*), many agencies are realizing the value of better roadway data. With the passage of the Moving Ahead for Progress in the 21st Century (MAP-21) transportation legislation, the importance of safety data is further enhanced, particularly for local roads.

MAP-21 legislation states that "a state shall have in place a safety data system with the ability to perform safety problem identification and countermeasure analysis" (MAP-21 § 1112) (*5*). It defines safety data as roadway, traffic, and crash data. MAP-21 further clarifies that this system should include all public roads. In addition, MAP-21 requires the Secretary to establish a subset of the Model Inventory of Roadway Elements (MIRE) that are useful for the inventory of roadway safety data and ensure that states adopt and use the subset to improve data collection (MAP-21 § 1112). MIRE is a recommended listing of roadway and traffic elements critical to safety management.

Many agencies lack the data or the data management systems needed to meet these requirements. Collecting, storing, and maintaining data for non-state maintained roads is a challenge for many states. NCHRP Synthesis 20-05/Topic 44-05 explored the state of the practice regarding the interoperability of state and local safety data. One of the key findings of the synthesis is that there is a need by state and local agency leadership and practitioners to clearly demonstrate the value of continuing to enhance safety data. There are several methods that could be used to accomplish this objective.

There is a need to develop tools and resources that can demonstrate the effectiveness or benefits of enhanced roadway safety data. The audience for the content of these of tools and resources will range from state and local agency leadership and management, elected officials, and safety practitioners. FHWA Office of Safety has developed a guidebook to demonstrate a potential methodology for quantifying the value of safety data—*Benefit-Cost Analysis of Investing in Data Systems and Processes for Data-Driven Safety Programs: Decision-Making Guidebook* (*6*). However, the methodology has not yet been tested. Additional research is needed to further explore the methodologies and develop tools and resources for communicating the value of investing in data.

RESEARCH OBJECTIVE

The objective of this research would be to develop tools and resources that state and local agencies can use to encourage investment in and enhancement of their safety-related data and data collection and analysis programs. The tools can also be used to encourage the participation of local agencies in similar programs. The research would be accomplished in two phases.

Phase I: Test and modify the existing benefit-cost analysis to quantify the value of safety data; i.e., that the use of predictive tools and roadway safety data leads to better safety decisions and reduces crashes. This would involve obtaining the participation of lead states to test the FHWA methodology in a real-world scenario using the participating states' data and refining the methodology based on the results.

Phase II: Develop tools and resources for practitioners to gain support of both leadership and participation of locals. The tools and resources would be developed from further research, case studies, and the results of Phase I. They would be specific to the varying needs of the users and target audience. These tools could include, but not be limited to, guidance documents, spreadsheets for applying the refined methodologies, presentations, hand-outs, talking points, etc.

ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Recommended Funding: Phase I $250,000 and Phase II $250,000

Research Period: 4 Years

URGENCY, PAYOFF POTENTIAL, AND IMPLEMENTATION

There is an immediate need for this research with MAP-21 data requirements.

PERSON(S) DEVELOPING THE PROBLEM STATEMENT

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NCHRP Synthesis 20-05/Topic 44-05 Project Panel

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