Roadway Data Improvement Program Technical Assistance: Final Report

December 30, 2016

U.S. Department of Transportation
Federal Highway Administration

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TECHNICAL REPORT DOCUMENTATION FORM

1. Report No. FHWA-SA-17-027	**2. Government Accession No.**	**3. Recipient's Catalog No.**	
4. Title and Subtitle Roadway Data Improvement Program Technical Assistance: Final Project Report		**5. Report Date** December 2016	
		6. Performing Organization Code	
7. Author(s) Brian Chandler, Omar Smadi, Adil Cheema		**8. Performing Organization Report No.**	
9. Performing Organization Name and Address Leidos, Inc. 11251 Roger Bacon Drive Reston, VA 20190		**10. Work Unit No.**	
		11. Contract or Grant No. DTFH61-10-D-00024, T-13-001	
12. Sponsoring Agency Name and Address Federal Highway Administration Office of Safety 1200 New Jersey Ave., SE Washington, DC 20590		**13. Type of Report and Period** Final Report, 2013 - 2016	
		14. Sponsoring Agency Code HSA	
15. Supplementary Notes The contract manager for this report was Robert Pollack.			
16. Abstract The Roadway Data Improvement Program provides States with a means to assess the quality of their roadway inventory information. From 2013 to 2016 a technical assistance team visited 13 State and Federal entities. They noted findings of current practices and developed recommendations to improve data collection, technical standards, data analysis tools, data management and governance, data sharing, and integration.			
17. Key Words: safety data, roadway data, traffic data, data collection, data quality, technical standards, data analysis, data governance, data integration, technical assistance		**18. Distribution Statement** No restrictions.	
19. Security Classif. (of this report) Unclassified	**20. Security Classif. (of this page)** Unclassified	**21. No. of Pages:** 54	**22. Price** N/A

Form DOT F 1700.7 (8-72) Reproduction of completed pages authorized

ACKNOWLEDGEMENTS

The authors of this document were Mr. Brian Chandler and Mr. Adil Cheema of Leidos, Inc., and Dr. Omar Smadi of the Institute for Transportation at Iowa State University. Mr. Robert Pollack was the Federal Highway Administration (FHWA) Contract Manager for this project.

The project team would like to thank the following agencies for their participation in the Roadway Data Improvement Program (RDIP) technical assistance:

- Alaska Department of Transportation and Public Facilities
- Connecticut Department of Transportation
- Kansas Department of Transportation
- Louisiana Department of Transportation and Development
- Missouri Department of Transportation
- Nebraska Department of Roads
- New Hampshire Department of Transportation
- New Mexico Department of Transportation
- North Carolina Department of Transportation
- Oregon Department of Transportation
- Rhode Island Department of Transportation
- Tennessee Department of Transportation
- The Office of Federal Lands Highway
- Federal Highway Administration Division Offices in each of the participating States

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
	NOTE: volumes greater than 1000 L shall be shown in m^3			
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	$candela/m^2$	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

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ACRONYMS

ARNOLD	All Road Network of Linear-referenced Data
DGC	data governance committee
DOT	department of transportation
FAST Act	Fixing America's Surface Transportation Act
FDE	fundamental data element
FHWA	Federal Highway Administration
GIS	geographic information systems
HPMS	highway performance monitoring system
HSIP	Highway Safety Improvement Program
HSM	Highway Safety Manual
IHSDM	Interactive Highway Safety Design Model
IT/IS	information technology/information systems
LiDAR	light detection and ranging
LRM	location reference methods
LRS	linear referencing system
LTAP	Local Technical Assistance Program
MAP-21	Moving Ahead for Progress in the 21st Century
MIRE	Model Inventory of Roadway Elements
MPO	metropolitan planning organization
NHTSA	National Highway Traffic Safety Administration
PDO	property damage only
QC/QA	quality control / quality assurance
RDIP	Roadway Data Improvement Program
RSDP	Roadway Safety Data Program
SHSP	Strategic Highway Safety Plan
TAP	technical advisory panel
TAT	technical assistance team
TRCC	traffic records coordinating committee

EXECUTIVE SUMMARY

The Federal Highway Administration (FHWA) Office of Safety established the Roadway Safety Data Program (RSDP) to advance State and local safety data systems and safety data analysis and evaluation capabilities. FHWA has a vision of zero deaths and serious injuries on the Nation's roadways and a mission to exercise leadership through the highway community to improve roadway safety. The RSDP supports this vision and mission by advancing the use of scientific methods and data-driven decision making, including the integration of crash, roadway, and traffic data for State safety programs.

The Roadway Data Improvement Program (RDIP) provides States with a means to assess the quality of their roadway inventory information within their roadway and traffic databases, and provides improvement recommendations for the support of roadway safety efforts. The RDIP focuses on agencies' processes, policies, procedures and practices to collect, manage, and use their roadway and traffic data to support safety.

This report covers the period between May 2013 and December 2016, during which time the RDIP Technical Assistance Team (TAT) provided support to 12 States and the Office of Federal Lands Highways. In the RDIP Final Report to each State, the TAT noted their findings of current practices and recommended actions to improve data collection, technical standards, data analysis tools, data management and governance, data sharing, and integration.

The most common finding was a lack of central data governance and management for roadway and traffic data. Most States met their needs for roadway data within each business office (e.g. operations, design, safety, maintenance, etc.), identifying and collecting data needed to do their job without regard for potential uses or collaboration of this data by others. This can result in redundant expenditure of resources and inconsistent data sets within a State department of transportation (DOT).

To help address this deficiency, the most common recommendation in the RDIP State Final Reports was to develop a formal Data Governance Committee (DGC) for oversight of the following:

- Current and future enterprise data activities;
- Regular review of existing business data needs and tools to meet those needs; and
- Development of new policies and procedures as needed.

The RDIP technical assistance has been well-received by States that have participated in the program. Participating agency staff have expressed appreciation for the RDIP process, including the identification of problems and recommendations for improvement. Some States have reported back success in implementing recommendations after the RDIP technical assistance on-site event was completed. Based on the overall findings from the current assessment of the RDIP, FHWA intends to continue this program for additional States.

1. INTRODUCTION

The Roadway Data Improvement Program (RDIP) provides States with an objective means to assess the quality of information in their roadway and traffic databases. It recommends improvements related to data collection, technical standards, data analysis tools, data management and governance, data sharing, and data integration.

In 2011 and 2012 the FHWA Office of Safety conducted the State Roadway Safety Data Capability Assessment Program. From this program it was clear that many States lacked formal roadway data governance structures to oversee their roadway data. Further, States varied significantly in their approaches to roadway data collection, analysis, and interoperability (i.e., data sharing/accessibility within a State DOT and with external agencies). FHWA sought to develop a structured program to assist States to assess and improve their roadway data quality used to support safety and other business functions of a DOT. The program developed was the RDIP.

The RDIP technical assistance effort is intended to provide States with guidance on assessing and improving the following:

- Roadway Data Collection/Technical Standards
- Data Analysis Tools and Uses
- Data Management and Governance
- Data Sharing and Integration

The RDIP Technical Assistance Program was delivered to the following 13 government agencies under a contract between the FHWA Office of Safety and its contractor from 2013 to 2016.

1. Alaska
2. Connecticut
3. Federal Lands Highway
4. Kansas
5. Louisiana
6. Missouri
7. Nebraska
8. New Hampshire
9. New Mexico
10. North Carolina
11. Oregon
12. Rhode Island
13. Tennessee

2. ROADWAY DATA IMPROVEMENT PROGRAM BASICS

Figure 1. Using Data to Improve Safety

As highway safety analysis techniques improve over time, safety-related data become more and more important. Safety-related data include crash, roadway, and traffic, each of which provides value to analysts. In previous years, crash history (e.g. crash frequencies and/or rates) has been considered the most important information to gather and analyze, with less attention being paid to roadway and traffic data. However, as analyses have become more robust, analysts need this additional information to mitigate some of the limitations of crash frequencies and rates.

For example, the systemic safety approach relies on identifying the safety risk associated with particular roadway characteristics and then implementing safety countermeasures to reduce that risk.

The ability to integrate roadway, traffic and crash data opens the possibilities of using the AASHTO Highway Safety Manual (HSM) and related software tools that require crash, roadway, and traffic data to provide more robust and accurate safety data analyses. Using predictive analytic methods, such as those from the HSM, allows States to develop expected crash frequencies for a particular set of roadway characteristics and traffic volumes. States may then further assess those locations that are experiencing higher than expected crash frequencies to determine the most appropriate safety conuntermeasures to correct these problems.

2.1 Legislative Compliance

The Roadway Data Improvement Program (RDIP) is designed to help transportation agencies improve the quality of their roadway and traffic data to better support safety and other improvement initiatives. It focuses on the process and practices used by the agency for collecting, managing, and utilizing their roadway and traffic data. The Moving Ahead for Progress in the 21st Century (MAP-21) reauthorizing legislation required that States have a safety data system that can be used to perform analyses supporting their strategic and performance based safety goals for their Highway Safety Improvement Program (HSIP). MAP-21 acknowledged the importance of using multiple data sources to understand highway safety problems and allocate resources for highway safety. Further, MAP-21 calls for advancing the capabilities of States for safety data collection, integration, and analysis to support program planning and performance management.

The Fixing America's Surface Transportation (FAST) Act continued to support the robust data-driven safety initiatives of MAP-21, with one noteworthy change from MAP-21. The FAST Act allowed States to opt-out of collecting the MIRE Fundamental Data Elements on unpaved roads.

2.2 Roadway Data Improvement Program Focus

To assist States with realizing the benefits of improved roadway and traffic data quality and utilization, the RDIP focuses on four key areas:

1. Roadway Data Collection/Technical Standards
2. Data Analysis Tools and Uses
3. Data Management and Governance
4. Data Sharing and Integration

Each area is described below.

Figure 2. Roadway Data Improvement Program Key Areas

2.2.1 Roadway Data Collection and Technical Standards

Roadway Data Collection And Technical Standards covers the following topics: establishing the roadway network, and data collection technologies. It is vital for any State to know where roads are located in a given jurisdiction. In order to do this, location reference methods (LRMs) are used to identify a particular location with respect to a known point. It provides the distance and the direction from the known point. State and local agencies then use the LRMs to develop a linear referencing system (LRS) which provides a framework to store, manage, and extract information about a specific roadway.

Following are some of the more commonly used data collection tools and methods:

- Field data collection
- Photo-log and video-log
- Light detection and ranging (LiDAR)
- Automated roadway inventory
- Aerial photo & satellite imagery
- Traffic monitoring technology

2.2.2 Data Analysis Tools and Uses

The second area is the Data Analysis Tools and Uses. Once the data have been collected, the RDIP examines the techniques and methods used by the State to analyze the data for safety

purposes. In addition to safety, other business offices with a State DOT are typically analyzing data for their particular business needs. These analysis methods are examined as part of the RDIP process as well.

The RDIP recognizes that different States have different analysis needs and capabilities, but it advocates for more robust analysis. The RDIP recommends that States consider methods, such as those in the HSM, that address some of the limitations imposed by only using crash frequencies or rates for safety analysis.

2.2.3 Data Management and Governance

The Data Management and Governance area focuses on the people, policies, technology, and resources related to the roadway data program. Data management typically includes the following personnel and activities: data administrator; data custodians; data entry and validation; data quality monitoring; data access control/facilitation; metadata development and reporting; and system maintenance and upgrades.

Data governance has multiple meanings, but it typically refers to efforts to implement common standards for all data elements and data collection efforts throughout a large community that may include the State DOT and other stakeholders. It has broad applications across and within State and local agencies. The goals of data governance include the following:

- Increase understanding and coordination among offices, agencies, and systems
- Increase data sharing
- Simplify data integration
- Determine responsibility
- Reduce redundancy
- Prioritize efforts
- Ensure accuracy and completeness

The RDIP examines a State's management and governance, which usually includes State policies and practices, and a governance board of executives and practitioners from all relevant stakeholder offices and agencies. The board's functions may be to set standards, review system designs, assess data definitions and changes, sequentially prioritize major initiatives, and allocate resources for data-related projects, among others.

Following are some prominent advantages of data governance:

- Broadens data usage across stakeholders
- Makes data a strategic asset
- Facilitates sharing of resources

- Encourages sensible allocation & scheduling
- Supports easier data integration
- Establishes an enterprise system for consistency of data and ease of use

2.2.4 Data Sharing and Integration

Data Sharing and Integration of diverse data sets are vital to enhance the utility of the data for decision making. It provides the agencies with richer and more complete source of information, and it can be an additional way to help assure the accuracy of information being used. A number of States have developed centralized systems where the records of all the public roadways are stored in a single location. Centralized systems are useful in theory, but in some cases practical expectations may not be met. For example, some of the data providers may not follow the established data quality procedures or standards, or the State may not have an adequate quality control / quality assurance system to detect problems with the data.

A system can only be truly recognized as centralized when the State has complete control over the data collection and data management processes. Enterprise data systems combine all the typical data sources in a single, centralized application. It can lower costs and lead to an improvement in data integration among the system's various sources.

An example of integration is the use of geographic information systems (GIS) to provide a framework for agencies to integrate with LRS. When done correctly, this can lead to a more comprehensive and more accurate database, and make legacy data easier to visualize.

3. ROADWAY DATA IMPROVEMENT PROGRAM TECHNICAL ASSISTANCE PROCESS AND METHODOLOGY

The Roadway Data Improvement Program (RDIP) technical assistance process begins with a State requesting support from FHWA. A technical assistance team (TAT) of subject matter experts is assigned to work with the State, starting with a comprehensive data quality assessment of the State's roadway and traffic data. The RDIP TAT provides an independent review of practices, policies, and procedures through three phases of the RDIP process, as illustrated in Figure 3.

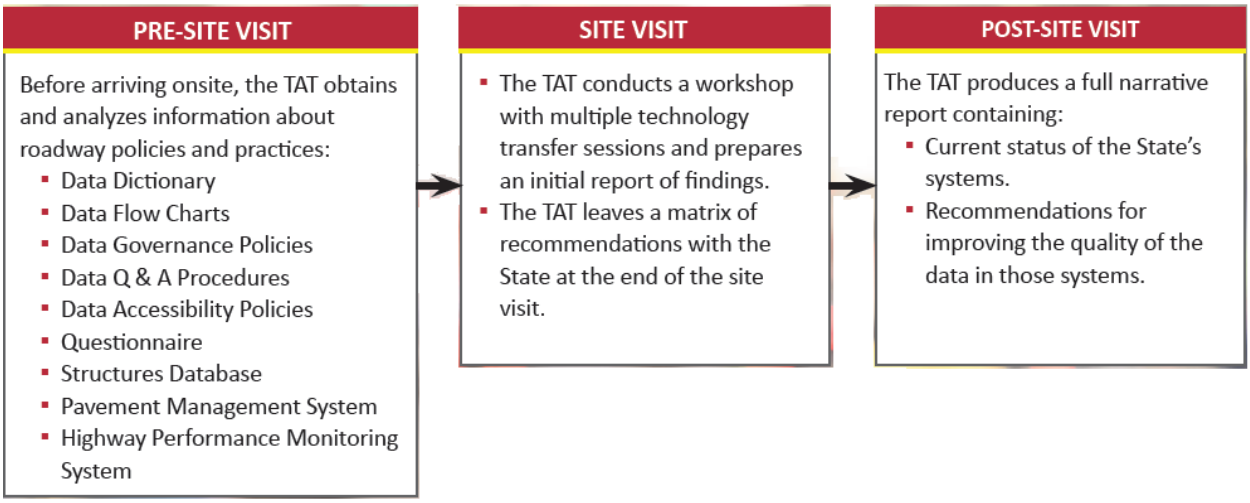

Figure 3. Roadway Data Improvement Program Technical Assistance Phases

3.1 Initial Briefing

The RDIP program manager and contractor meet with the State by phone to introduce RDIP, the RDIP technical assistance process, and solicit the State's participation. This typically occurs via teleconference with the following key attendees:

- State safety engineer
- FHWA Division safety specialist
- State roadway data experts
- Others as appropriate

The anticipated result of this meeting is a confirmation that the State desires to receive technical assistance from the RDIP TAT.

Follow-up Actions:

- ***State:*** Deliver documentation about State policies, practices, procedures and roles in collecting managing, and sharing its roadway data (see Section 3.2 below). The

State will also be expected to complete an RDIP pre-visitation questionnaire and grant permission for the RDIP TAT access to the State's Roadway Data Capabilities Assessment Survey results. The State should also identify potential dates for the on-site portion of the RDIP.

- ***RDIP TAT:*** Send State the Pre-visit Questionnaire to be completed and returned (see questionnaire in Appendix A).

Upon receipt of the Roadway Data Capabilities Assessment Survey results, completed Pre-visit Questionnaire, and other related information, the TAT reviews the information to learn about current policies, procedures, and practices in the State.

The TAT schedules and holds a conference call with the State to ask follow-up questions and gain additional details about current State practices. The meeting also includes a discussion of the logistics for the in-person RDIP event, including confirmation of the event date, recommended attendees and the tentative agenda. Appendix B includes sample event invitations used by States.

3.2 Assess State Standards and Practices

To understand the current state of practice, the TAT first works with the State via documentation exchanges and teleconferences to gain a basic understanding of each of the four areas. The TAT focuses on assessing the roadway and traffic data available, and the practices and procedures that guide data management, use, and analysis. Resources may include the following:

- Response to a consultant-developed Pre-visit Questionnaire
- State answers to the 2011-2012 State Roadway Safety Data Capability Assessment Questionnaire
- Safety Data Action Plans
- Traffic Records Assessment reports
- Draft RFPs for potential roadway data projects
- User Guides for data repositories (Crash, Roadway, Traffic, etc.)
- Data Dictionaries and Item Attribute Lists
- GIS Planning Report
- Road Data Inventory Manual
- All Road Network of Linear-referenced Data (ARNOLD) Plan
- Linear Referencing System ID Format
- Traffic Records Coordinating Committee plans and actions

3.3 On-site Assistance

After weeks of reviewing documentation to become better acquainted with the State, the TAT plans and delivers on-site technical assistance. The RDIP in-person event typically follows this schedule.

Table 1. Roadway Data Improvement Program Technical Assistance Weekly Schedule

Day	Event	Attendees
Monday	TAT travels to the State	n/a
Tuesday	RDIP Overview Workshop (1-day)	All relevant stakeholders (30-50 participants)
Wednesday	RDIP Technical Transfer Roundtables (½-day State; ½-day Local)	Stakeholder leadership (12-20 participants)
Thursday	TAT complies initial recommendations	n/a
Friday	Report out to management (2-hour meeting)	State leadership and RDIP Point of Contact (8-15 participants)

Recommended Attendees. The following offices are recommended to send representatives as invited attendees to the RDIP events:

- Highway performance monitoring system (HPMS)
- Traffic data collection
- Management systems staff:
  - Asset management
  - Pavement management
  - Maintenance management
- Planning
- Data collection
  - Central office
  - District offices
- Information technology/ information systems (IT/IS) staff
- GIS staff
- Traffic safety
- District/Division Offices

- Local agencies (cities, counties, and MPOs)
- Local technical assistance program (LTAP) coordinator

The main activities of the on-site technical assistance are as follows (Appendix C includes sample agendas for these events):

RDIP Workshop. The purpose of the workshop is to provide training to roadway and traffic database managers and other transportation professionals to assist them in identifying, defining, measuring, and ultimately improving the quality of the data within their roadway and traffic databases. Additionally, the workshop provides an overview of data collection practices, transportation planning and coordination, data management, and use of roadway and traffic data for safety initiatives. The workshop is highly interactive. As "good practice" examples are being presented as part of the curriculum, the participants are encouraged to discuss the way the RDIP recipient State is conducting activities.

Technical Transfer Sessions. The purpose of the technical transfer sessions is to build on the TAT's initial review and understanding of the current state of practice by meeting directly with stakeholders in person to focus on the four program areas identified above, as well as other areas of interest. The TAT then uses the findings from the sessions to develop a brief summary report, which describes the current processes and practices within the State. The summary report also includes prioritized recommendations for improving roadway and traffic data, data quality, data interoperability, and management processes.

Presentation to Management. At the end of the on-site visit, the TAT conducts a briefing with agency management to present their findings and discuss recommendations to improve roadway and traffic data collection, analysis, data governance and data quality. The briefing includes submitting a summary matrix of recommendations to the State for review while the TAT begins drafting the Final State RDIP Report.

3.4 Final State Report

The TAT transmits a final report to the State that documents all findings and recommendations from the RDIP technical assistance. The RDIP State Final Report is intended to be a detailed, useful tool for the State to build on their current state of practice and improve their roadway and traffic data. The report summarizes the TAT's approach to assess the State's roadway and traffic data practices, and it provides the State with more details on the recommendations to improve the performance of the components of their roadway and traffic data system.

Helping a State improve its safety analysis capabilities is a key goal of providing RDIP technical assistance. This report is intended to serve as an actionable tool States can use to help improve its roadway and traffic data practices and procedures in support of its safety initiatives and other inventory-related programs.

3.5 Follow Up

The contractor follows up with the State point-of-contact at some point after the technical assistance is complete to obtain feedback regarding their experience with the assistance. Topics may include the following:

- Implementation
  - Have you implemented any of the RDIP recommendations?
  - If so, which ones?
- Barriers
  - What are the biggest obstacles you've experienced in implementing thus far?
  - What challenges do you anticipate in the future?

A full list of follow-up questions is available in Appendix D, *Follow-up Questionnaire*.

4. ROADWAY DATA IMPROVEMENT PROGRAM TECHNICAL ASSISTANCE RESULTS AND FINDINGS

4.1 Participating States

FHWA and its consultant conducted Roadway Data Improvement Program (RDIP) technical assistance for the following agencies as listed below and illustrated in Figure 4.

1. Alaska
2. Connecticut
3. Federal Lands Highway
4. Kansas
5. Louisiana
6. Missouri
7. Nebraska
8. New Hampshire
9. New Mexico
10. North Carolina
11. Oregon
12. Rhode Island
13. Tennessee

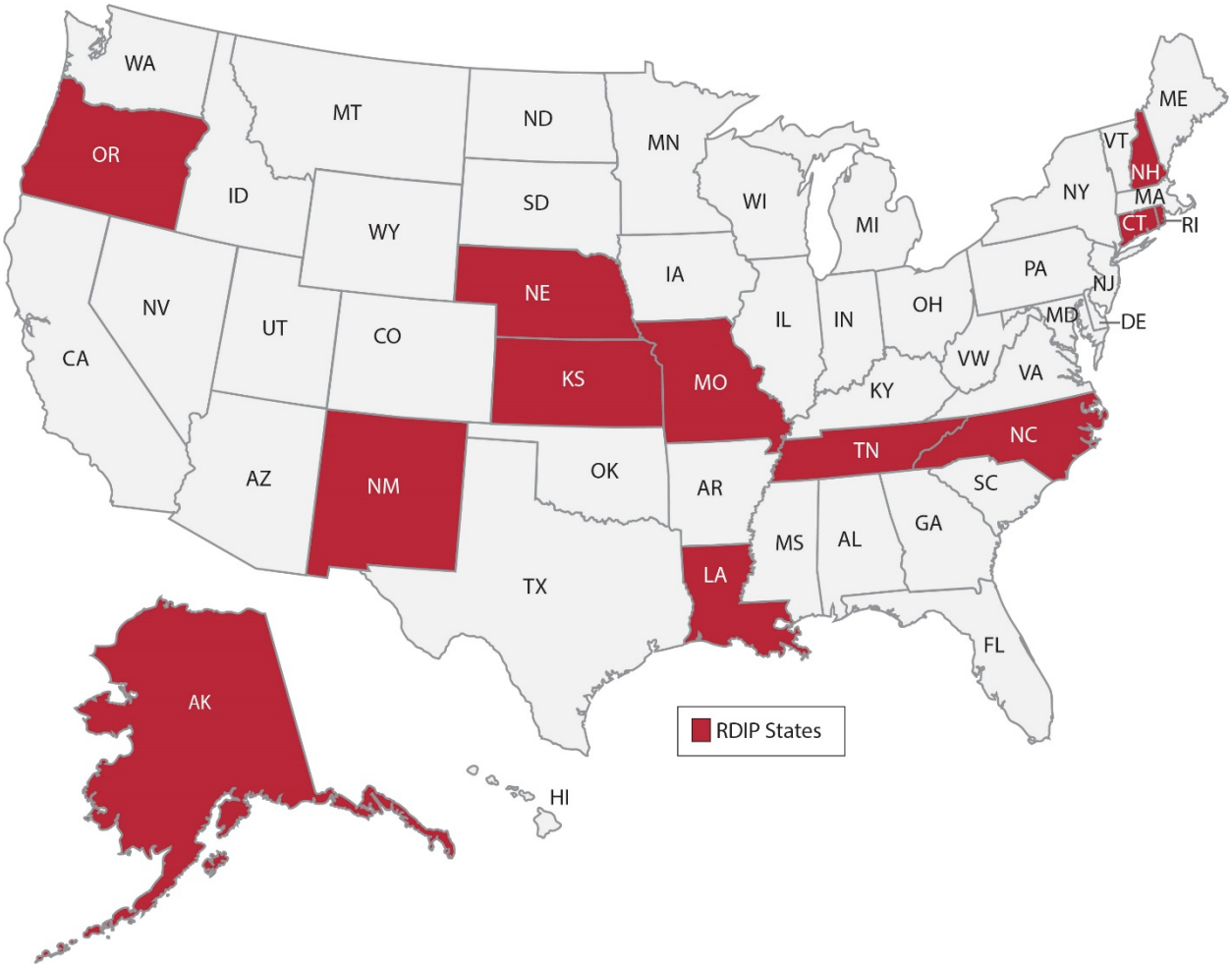

Figure 4. Roadway Data Improvement Program Technical Assistance Agencies, 2013-2016

4.2 Common Findings and Recommendations

In visiting 13 different agencies, the RDIP identified gaps and needs that were common among many of them. The following section describes these findings and recommendations, organized by the RDIP key program areas.

4.2.1 Roadway Data Collection / Technical Standards

Of the States involved in the RDIP technical assistance effort, none were exempt from recommendations regarding the improvement of their data collection, storage, or distribution. Some of the recommendations were natural progressions of in-place processes, while others proposed a paradigm shift for the State. For example, some States will need to take significant steps in the coming months to meet ARNOLD requirements for their LRS on all public roads. Others already meet All Road Network of Linear-referenced Data (ARNOLD) requirements, so the TAT recommendations in those States focused on maintenance and future updates.

Collection Tools. Some States have employed technologies, such as LiDAR, to expedite the collection of roadway asset data, while others have not yet added these tools to their data collection process. Also, some States collect redundant roadway and traffic data from multiple central office divisions and/or district offices. The technical assistance team (TAT) often recommended an enterprise data retention system to help States compile disjointed and scattered asset data to a single database to reduce redundancy and increase availability to all potential users.

Crash Reporting. Several States only report non-injury crashes where the property damage exceeds a minimum monetary threshold (often $1,000), and other States have stopped law enforcement reporting of non-injury crashes altogether, relying on citizen self-reporting for this information. The reduction of reported property damage only (PDO) crashes creates a skewed crash system that does not reflect the total crashes occurring on the system. A better means of collecting all crash types, regardless of personal injury severity, would paint a clearer picture of traffic concerns and roadway shortcomings.

Local Road Data. Data collection is an ever-growing resource challenge as all roadways, regardless of ownership, are now considered part of the safety transportation system for each State. State DOTs have responsibility for the safety of road users on local and all other "off system" roadways. For example, roadway attributes and traffic data are often not collected on local roads due to a number of factors, including the following:

- Data are not collected at all.
- Data are collected and housed at the local level and not shared with the State DOT.
- Data are collected in a manner that is not easily relatable to the State's LRS or GIS systems.

States should explore options to update the basemap for other public roads not on the State system. Examples include integrating major city GIS basemaps, and working with other partners to collect data for remote areas.

Fundamental Data Elements. States are still in varying stages of collecting the fundamental data elements (FDE) on their respective non-State systems, as well as working with FHWA to implement methods for collecting other Model Inventory of Roadway Elements (MIRE) data. The TAT recommended processes for data handling and storage, data file structure, and performance metrics to assess and assure data quality. States must incorporate specific quantifiable and measurable anticipated improvements for collection of MIRE FDEs into their State traffic records strategic plan update by July 1, 2017. States must have access to the FDEs on all public roads by September 30, 2026.

Enterprise Data Warehouse. All States that participated would benefit from developing a centralized process for maintaining and updating roadway data elements for the State-maintained system. It would be helpful if States move towards an enterprise data warehouse that allows streamlined self-service access to multiple datasets without the need for specialized understanding of each individual dataset or specific query tools. The States should utilize the capabilities of an enterprise system to develop tools which allow easy access, information exchange, and data updates by end users. Asset Management may be the managing unit that handles all updates or changes to the roadway inventory in coordination with the State DOT GIS and IT, and the State could allocate resources to add regional GIS support staff to ensure coordination, including:

- Updates to the existing inventory;
- Corrections to the existing inventory; and
- Future expansion to capture new assets (e.g., signs, roadside appurtenances, etc.).

4.2.2 Data Analysis Tools and Uses

Expanded Asset Inventory. The TAT recommended that some States expand their asset inventory to better use advanced safety analysis tools (e.g., HSM), and to better address intersections and roadway alignment. The expanded inventory should follow MIRE guidelines.

Safety Countermeasure Database. Most of the States do not have a safety countermeasures database. Establishing a safety countermeasures database can help to track the location and type of countermeasures to facilitate analyses of effectiveness. RDIP recommended establishing regional databases to track the location and type of countermeasures to facilitate analyses of countermeasure effectiveness. In States where regional databases exist, the State should compile this regional data to improve State-level analysis. It will also be useful to expand the system by uploading safety treatments on non-State-owned roadways.

Enhanced Crash Reporting. All safety analysis starts with the law enforcement- or citizen-developed crash report. States can work toward enhanced crash reporting by developing a tiered approach for data requirements in the crash report by severity, and coordinating the geolocation of crashes between the State DOT and the municipality.

Training. Many States have been slow to incorporate more advanced statistical techniques into their safety analysis. States can increase analysis capabilities to include predictive analytics (e.g., HSM). Strategies include tools and training for headquarters, regional staff, and major city personnel.

4.2.3 Data Management and Governance

All States participating were encouraged to create a formal data governance committee (DGC) made up of executive-level and practitioner-level staff to provide oversight of all current and future business system activities and to regularly review State system capabilities and features. The establishment of standards, policies, and procedures that can be passed onto future managers and users will be essential to the sustainability of the system and corresponding activities. The DGC should communicate those standards, policies, and procedures to partner agencies to promote a data standard across multiple State organizations. The DGC should also communicate to local agency partners to market statewide efforts toward a common data set. Due to the importance of enterprise spatial data integration, the State should consider including GIS technical staff on the DGC to address data integration and LRS requirements. In addition to identifying strategic goals and establishing a related timeline, a data governance strategic plan should identify responsible parties and include performance metrics to measure incremental success.

The DGC should have oversight for all current and future enterprise activities and should regularly review functionality and features to meet business needs. The group should also be responsible for developing and/or assembling policies and procedures for item, such as:

- Data standards,
- Data needs,
- Quality control / quality assurance (QC/QA) processes,
- Training plans, and
- Communication with internal and external users.

4.2.4 Data Sharing and Integration

An accurate and up-to-date basemap and translatable LRS are critical tools for identifying and integrating roadway data. The basemap is the key to all spatially-focused analysis, and it connects a computer's bits-and-bytes to the actual assets on the road. Further, including all

public roadways in the basemap is an important first step to integration and effective analysis of these safety and access management data on all public roads.

Enterprise System. States should facilitate the elimination of duplicate data layers through integration within the enterprise system through communication among central office, region, and non-State staff. They should extend the enterprise system to include local roads and establish a process to allow local agencies to share their existing data. States can start with a localized effort by working on a pilot with a metropolitan planning organization to simulate the necessary steps to integrate local data into the enterprise system.

Integrated LRS Updates. For States that had developed an ARNOLD-compliant LRS, the TAT recommended updating and maintaining it by developing a centralized business process to ensure roadway data (including the basemap, LRS, and roadway attributes) are kept up to date. The State could develop the process at their central office, to be implemented by central office and field staff, and ultimately maintained by GIS and IT departments at the State. Other systems (e.g., design, construction, maintenance) could trigger LRS updates when appropriate to keep the line work updated.

Tools, Documentation and Training. States can utilize the capabilities of an enterprise system to develop tools which allow easy access, information exchange, and data updates by end users. The State should ensure all necessary documentation is available to facilitate data access including data dictionaries and information about data quality processes. Further, States should establish a communication and training plan to make district and local agency personnel aware of what the State is collecting and what additional data and tools they can provide. The Training could include relevant points of contact, and it could lead the development of a data users group forum to support the discussion of user needs and prioritization and development of analysis tools and GIS applications.

4.3 Follow-Up Activities

The RDIP technical assistance team followed up with States using the questionnaire shown in Appendix D. Responses received included the following.

Implemented RDIP recommendations or plans for future implementation:

- Working to establish a comprehensive safety improvement inventory that will be useful in evaluating safety projects. The State will keep track of the safety projects delivered between 2017 and 2021 under an identified program.
- Developing a regional pilot project in a metropolitan area to collect FDEs for signalized intersections. The State will use these FDEs for network screening of hundreds of signalized intersections, and then expand collection to other regions.
- Developed tools that can be used for both State highways and local agency roads. Making these tools accessible to local agencies.

- Expanding the use of Highway Safety Manual methods in other components of the safety program.

Data Governance efforts:

- A strategic plan is currently being created by the newly-developed State DGC.
- Roadway data has always had a strong data governance program, so it is being continued. Some areas have established groups that oversee, manage, and make decisions about the data governance, yet there is still a lack of a strong executive committee overseeing all the efforts.

Data Sharing:

- The State has conducted initial discussions with the local agencies, and stakeholders are planning future meetings to follow-up on topics from the RDIP workshop.
- Primarily crash data and analysis has improved as a result of moving from a primarily State Highway program, to a program looking to improve all public roads.
- Completing an all-roads LRS which will be the basis for new data collection and analysis for all public roads and the collection of the FDEs.

Challenges

- Staff turnover and budget constraints are problematic for many States. With limited staffing and funding, it is a challenge for States to implement some of the recommended activities. Current staff have other priorities and obligations that they must fulfill before committing to additional endeavors.
- A number of efforts to improve asset data (some driven by FHWA efforts) have occurred at the same time. The result is that multiple groups are vying to get the same resources all at the same time.

Improvement recommendations for the RDIP technical assistance:

- Some States recommended providing better information about the workshop prior to the visit itself. With a wide variety of staff attending, State DOT staff received lots of questions prior to the first day.
- Locals wanted the smaller group meetings to be at their offices.
- A State suggested walking through a prioritization process to sort the actions into categories to identify the most beneficial and timely.

Additional FHWA support desired:

- Some States have been in contact with their local FHWA representatives if anything is requested in the future.

- State respondents believe that the continued efforts of FHWA to point out the benefits of safety data and analysis to DOTs may be of help for those of trying to speak up for Safety.
- States asked for additional PowerPoint presentations and examples of the progress other States have made in these areas to help continue their State's efforts in the future.

APPENDIX A. PRE-VISIT QUESTIONNAIRE

The purpose of this questionnaire is to gain additional information about the State's policies and processes related to roadway data in support of the Roadway Data Improvement Program (RDIP).

1. Characteristics of the State's public roadway system

Please characterize your roadway system:

a. Overall miles of public roadway

b. Miles of State-owned roadway

c. Miles of non-State-owned roadway

2. State Basemap

Describe the basemap for your State's roadway network, including:

a. GIS environment and integration with business unit practices

b. Roadways covered (State routes only, non-State routes, etc.)

c. Is there more than one basemap and/or locating system used (e.g., linear referencing system, GIS, etc.) in use?

d. If more than one locating system is used, is there a means to translate the location coordinates between the locating systems?

e. What information is provided for ramps in the basemap?

f. How are the data archived when replaced with updated information? How can the archived data be accessed?

3. Roadway and Traffic Data Inventory

a. Is there a data catalog (metadata) with data definitions, standards, policies, and procedures for the collection and use of data available electronically in the organization and is it accessible to users? Please provide a copy of your roadway data dictionary

b. What are the primary roadway data collection procedures used to collect roadway and traffic information? For example:

   i. Cross section information (e.g., roadway width, shoulder width/type, etc.)

   ii. Traffic counts

   iii. Treatments, assets (e.g., signs, guardrail, rumble strips, etc.)

c. Does the State collect any non-State roadway data in the State database? If so, what data are collected?

d. Does the State gather or integrate any non-State roadway data that is not collected by the State? If so, what data are collected and by whom? How is the information gathered by the State and integrated into the system?

e. Have you identified your State's compliance with the MIRE elements or the fundamental data elements (FDE) subset of MIRE? If yes, please provide assessment results.

4. Data Analyses

a. How are roadway and traffic data elements incorporated into the safety data analysis process?

b. Are they used in network screening?

c. Please characterize your State's capabilities toward supporting analysis linking crash types to roadway geometry or other features (e.g., identifying locations with a propensity for rollovers, run-off-road crashes, or other) and then analyzing the network for similar locations based on similarity of roadway attributes?

d. As it related to roadway and traffic data availability, do you have the ability to support State-of-the-art analyses as described in the Highway Safety Manual (HSM)? Have you conducted HSM-type analyses?

e. Does your State use systemic analyses to identify risk-based problems and implement corrective treatments?

f. Does your State use Safety Performance Functions to assess the relative severity safety problems where crash data can be integrated with roadway and traffic data?

5. Data Governance

a. Does the State have a central roadway inventory system that is commonly available to all data users within the DOT? If so, please identify how this database is structured.

b. How can others gain access to roadway inventory data?

   i. Who has direct access to these data?

   ii. Who can request and be granted information?

   iii. Who is disallowed roadway and traffic information?

c. If there is not a central roadway inventory system, do individual units or sections (e.g., Safety, Asset Management, Pavement, etc.) maintain their own database to meet their needs? Is this information shared between units?

d. Is there a data governance board (e.g., committee, council, organization, etc.) that oversees roadway data activities in your State (above the Traffic Records Coordinating Committee)?

e. Is there a process to coordinate roadway data needs between business units and/or with other agencies? If yes, please briefly describe this process.

f. Does your State have an established safety data improvement plan? If so, please share this document. Which State agency (and unit within the agency) is responsible for this plan? Does the plan represent a joint planning effort of all users of State roadway data?

6. Data Quality

a. Does your State conduct quality control/quality assurance of roadway data elements collected (e.g., what percentage of shoulder width and type data do you expect to match reality in the field?)

   i. Is there a process in place to provide verification and make changes as needed?

   ii. How does this occur?

b. Do you use metrics to assess your roadway data quality, and how are they determined and measured, for:

   i. Completeness

   ii. Timeliness

   iii. Accuracy

   iv. Uniformity/Consistency

   v. Accessibility

   vi. Interoperability/data integration

APPENDIX B. SAMPLE EVENT INVITATIONS

Dear Safety Partners,

You are invited to participate in a workshop and roundtable the week of <DATE> as part of State DOT's participation in the Roadway Data Improvement Program (RDIP).

The RDIP is a Federal Highway Administration (FHWA) program developed to assess a State's roadway and traffic data systems for the ability to use, manage and share the data; and to offer recommendations for improving roadway data. It is intended to help improve the roadway and traffic data the State uses to develop their Strategic Highway Safety Plan (SHSP) which supports the State's Highway Safety Improvement Program (HSIP).

There is a high emphasis in identifying and addressing safety issues on all public roads. The HSIP is intended to be a data-driven program to direct resources where the traffic safety problems have been identified. In December 2012 Guidance on State Safety Data Systems to support the HSIP was issued by FHWA. This Guidance recognizes the need for States to have safety data (e.g. crash, roadway and traffic data) on all public roads in order to have a comprehensive HSIP.

One component of an RDIP is a workshop that features discussions on roadway data collection, data analysis tools and uses, data management and governance, data sharing and integration, and data quality characteristics. Throughout the workshop we will discuss the following six data quality measures: completeness, timeliness, accuracy, uniformity, integration, and accessibility.

The second day of the event includes a technology transfer roundtable discussion with representatives from the State and other stakeholders about these same topics, with a focus on the State's current practices, policies, and procedures; and potential activities to make improvements.

An agenda which lists the topics and issues to be discussed is provided with this invitation.

The RDIP events will be held as follows:

- RDIP Workshop: Tuesday, Date, 8:30am-4:00pm at Location.
- RDIP Roundtable (State-focused): Wednesday, Date, 8:30-12:00 at Location
- RDIP Roundtable (Local-focused): Wednesday, Date, 1:00-4:30 at Location
- RDIP Team Report Out: Friday, Date, 9:00-10:00 at Location

Please respond to State POC by Date regarding your availability to participate in the RDIP events and with any questions.

We hope to see you there.

Sincerely,

Name
State POC

For any other questions regarding the RDIP program or this technical assistance effort, please feel free to contact:

POC, FHWA Division
Title
Phone
E-mail

Robert Pollack, FHWA Office of Safety
Program Manager, RDIP
Phone: 202-366-5019
Robert.Pollack@dot.gov

Omar Smadi, CTRE, Iowa State University
Principal Investigator, RDIP Technical Assistance
Phone: (515) 294-7110
smadi@iastate.edu

Brian Chandler, Leidos
Project Manager, RDIP Technical Assistance
Phone: 206-850-3480
Brian.E.Chandler@leidos.com

APPENDIX C. TECHNOLOGY TRANSFER SESSION SAMPLE AGENDAS

Table 2. Roadway Data Improvement Program Workshop, Day One

TIME	ACTIVITY
Section 1 – Welcome, Introductions, and Overview of RDIP	
8:30 – 8:45	Welcome and Introductions
8:45 – 9:00	Opening Exercise - Participant Use of Data
9:00 – 9:15	RDIP Introduction
Section 2 – Data Management and Governance	
9:15 – 10:15	Roles for People, Policies, Technology, and Resources
10:15 – 10:30	*Break*
Section 3 – Roadway Data Collection and Technical Standards	
10:30 – 11:30	Roadway Data Collection Methodologies
11:30 – 12:45	*Lunch*
Section 4 – Quality Characteristics	
12:45 – 1:30	Completeness, Timeliness, Accuracy, Uniformity, Integration, Accessibility
Section 5 – Crash Data	
1:30 – 2:15	Data Quality and Integration
2:15 – 2:30	*Break*
Section 6 – Data Analysis Tools and Uses	
2:30 – 3:45	Use of Roadway Data in Safety Analyses
3:45 – 4:00	Wrap-Up and Conclusion

Table 3. Roadway Data Improvement Program Technical Transfer Roundtable Meetings, Day Two

State Roadway & Traffic Data: 8:30 – 12:00	
What are we hoping to accomplish today?	
Introductions, Sign-In Sheet	
Topics	**Issues**
Basemap	Coverage (State and local) Location Referencing Standards
Roadway Data Collected and Quality	Completeness Timeliness Accuracy Uniformity/Consistency Minimum Accuracy Requirements
Data Governance and Management	Structure Policies Technology and Tools
Break	
Data Analysis Tools and Uses	Network Screening Diagnosis Countermeasure Selection Evaluation Accessibility
Data Sharing and Integration	Data Interoperability Accessibility Expandability Linkage
Wrap-up	

Local Roadway & Traffic Data: 1:00 – 4:30	
What are we hoping to accomplish this afternoon?	
Introductions, Sign-In Sheet	
Review the current process for collecting local roadway inventory data	
Topics	**Issues**
Basemap	Coverage (State and local) Location Referencing Standards
Roadway Data Collected and Quality	Completeness Timeliness Accuracy Uniformity/Consistency Minimum Accuracy Requirements
Data Governance and Management	Structure Policies Technology and Tools
Break	
Data Analysis Tools and Uses	Network Screening Diagnosis Countermeasure Selection Evaluation Accessibility
Data Sharing and Integration	Data Interoperability Accessibility Expandability Linkage
Wrap-up	

APPENDIX D. FOLLOW-UP QUESTIONNAIRE

RDIP Follow-up Questions

The FHWA Office of Safety would like to obtain feedback regarding your experiences as a State or agency that has received Roadway Data Improvement Program (RDIP) technical assistance. Your input will help us gain a better understanding of how the RDIP may be improved going forward.

We have developed a short set of questions to identify your experiences following the RDIP program. To assist you, we are including a copy of the final RDIP Summary Report from your State. Recognizing that the amount of time the participating RDIP States have had since conducting the program will vary, we would like to ascertain information on the status of post-RDIP activities, including recommended actions conducted or planned to date, successes, challenges, lessons learned, and next steps. Please respond as completely as possible to the following questions. Also, we would like to contact you, or your preferred point of contact, by phone or email to obtain further input on your observations.

State: _____

Agency: _____

Name: _____

Job Title: _____

Phone: _____

Email: _____

1. How have the RDIP Summary Matrix and Final Report been used by your State to address roadway and traffic data needs since completing the program?
2. Have you implemented any of the RDIP recommendations? If yes, which ones?
3. Among the recommendations not implemented, does your State have plans to implement any of these RDIP recommendations? If yes, which ones?
4. Has your State taken steps to create or enhance roadway data governance efforts? If yes, what actions or plans have been developed?
5. Since participating in the RDIP, has your State initiated or improved roadway data sharing with local agencies (i.e. cities, counties, MPO's etc.)? If yes, what has been initiated or changed to improve data sharing?
6. What are the biggest obstacles or challenges you've experienced in implementing or planning to implement the recommendations?

7. Now that there has been some time since the RDIP technical assistance, how could the RDIP process or components (e.g. gathering background information, the workshop, the technical transfer sessions, and RDIP reports) have been improved to better support your State's data improvement efforts?

What additional support could FHWA provide to help your State to continue to make improvements in your roadway data system (e.g., training, document review, additional assessment or technical assistance)?

APPENDIX E. EXAMPLE MATRIX SUMMARY REPORT

State Roadway Data Improvement Processes **State: Example** **Assessment Date:**

Administration - Roadway Database	
Custodial Department	Example Department of Transportation (DOT)
Administering Units	Data Management Transportation Safety
Administrator/ Position Title/Contact Information	
Roadway Data Collection/Technical Standards	
Background	Characteristics of the State's public roadway system: • Overall miles of public roadway – 100,000 • Miles of State-owned roadway – 18,000 • Miles of non-State-owned roadway – 79,000 • Miles of Federal roadways – 3,000

Critical Issue	Current State Practices	Recommendation for Improvement
Basemap	**GIS environment and integration** Currently, the State's Transportation Information Management System is the platform for maintaining LRS. It is not widely used due to the complexity of the process to add attributes or update basemap. This will change with the adoption of an enterprise system which will be completed soon. It only includes State-owned roads and HPMS sample roads in a geospatial environment. The database also includes a tabular component with attribute information for those roads, as well as some county roads. The GIS Section has GIS County road data submitted from most Counties and they also have access to E-911 road data. Public Safety is currently working to develop a network for major roads for oversize/overweight routing. This network includes E-911, Tribal roads, and State database information. This effort does not include an LRS component. The State does not have an ARNOLD network of all public roads completed at this point. The enterprise system implementation will be the tool to manage the ARNOLD network and future roadway data efforts. Neither of the efforts includes a plan for continuing updates to networks established during these initial undertakings. The State has no documented process for updating their basemap.	**Kudos:** • Commitment to implementing ESRI Roads and Highways indicates an understanding of the gaps between current systems and an effective LRS to meet data integration needs assessing with HPMS submittals, ARNOLD network development, and future asset management efforts. **Recommendations:** • Develop a roadmap or strategic action plan for the development of an all public roads LRS that meets ARNOLD requirements, and supports data integration and access for all units within the DOT and external partner agencies such as MPOs, RTPOs and law enforcement. This would result in significant efficiencies for HPMS, HSIP, performance measures and other reporting efforts as well as regular data update efforts. • Determine the best LRS network option to meet State needs: o Continue combining networks from other agencies such as DPS E-911 data with DOT data o Establish the State's own network that fits known requirements as well as its partners including MPOs and RTPOs. • Develop a standardized process for updating the basemap. o For State-owned network, the DOT should develop procedures to trigger changes to the basemap based on standard actions taken by different offices. o For non-State-owned network, collaborate with E-911, MPOs, RTPOs and other agencies to identify changes and update the basemap accordingly.

Critical Issue	Current State Practices	Recommendation for Improvement
		• Be an active participant in these efforts because of the potential impact on the all public roads network establishment effort.
Inventory Databases	The State does not have one master data catalog. They have numerous data collection procedures and documents located on shared drives which are accessible to users. Traffic counts for State-owned roads and HPMS samples are completed by a traffic collection unit and MPOs as per our State Guide. All counts are conducted on a 4 year cycle, except county roads which are on an 8 year cycle. The majority of the new data collected in recent years are in pavement management and maintenance management systems. The remaining inventory data will reside in Roads and Highways. Currently, the State is focused on tracking HPMS related items. They are working toward expanding roadway inventory features to incorporate MIRE elements. This will support their development of a comprehensive asset management system and adoption of advanced safety analysis. Currently they are working on their Pavement Management System and Maintenance Management System.	**Kudos:** • Current data collection efforts moved the State from manual data collection to automated systems and now includes most FDE elements on all State-owned roads, NHS off the State system, and HPMS samples. **Recommendations:** • Establish an enterprise GIS system that facilitates linkage of all business data as well as enhancing access and data sharing internally and externally. • Develop a safety improvement database to enable evaluation of countermeasure implementation, as the State moves to conducting advanced safety analysis activities.
Data Elements	**State Roads** The latest automated data collection effort for all State-owned roads, HPMS samples, and local roads included the elements listed below: • Vertical and horizontal alignments o Radius	MAP-21 recommends collecting the FDEs to enhance the ability to conduct more rigorous safety analysis. In addition, the MIRE should be considered for incorporation into databases. **Kudos:** • The automated data collection effort has replaced manual data collection and improved the quality and quantity of

Critical Issue	Current State Practices	Recommendation for Improvement
	○ Length ○ Begin and end points • Number of lanes • Lane width • Signs • Shoulders • Videolog/photolog • Ramp information **Local Roads** Counties are required to submit certified county mileage to the State each year. However, this data is not integrated into TIMS and is mainly used for comparison analysis situations. Some Counties submit spatial and tabular road data and some just tabular data. This data is used for the annual submittal to the State Treasurer's office and is used for State funding distribution. Counties do not submit any roadway attribute data to the State. Even if local data does exist, there is no mechanism for integrating that data into the State databases.	roadway attribute data available. This moves the State closer to alignment with FDEs which will support enhanced safety analysis. • The State has conducted an assessment of the relationships between existing data elements and MIRE elements. This should guide any future data collection effort to support safety analysis. **Recommendations:** • Clearly identify and communicate responsibilities for updating roadway data elements among the different units responsible for managing the enterprise database (GIS unit, Roadway Data Inventory, etc.) • Develop communications efforts to inform and remind Districts of available data and resources for accessing it. This will encourage the districts to utilize the existing data and can serve as part of the quality assurance process. • Future data systems should include the ability to integrate data from local agencies, including traffic counts. • The State should develop plans to acquire all FDE elements on all local roads, in accordance with FHWA's State Safety Data Systems guidance. • Leverage MPO and RTPO interest in joining data collection efforts to expand coverage of non-State-owned roads.

Critical Issue	Current State Practices	Recommendation for Improvement
Data Archiving	Line work for State-owned roads is updated but there are no formalized processes for archiving changes.	It is imperative to maintain historical data to conduct evaluations of safety improvements. **Recommendation:** • As part of the implementation of Roads and Highways, institute a documented process for archiving changes to roadway inventory, line work, and traffic data.
Data Analysis Tools and Uses		
Network Screening and Spot Analysis	• Approximately 30,000 crashes in the most recent year o 200 fatal crashes o 11,000 injury crashes o 28,000 property damage only crashes Crash reports are submitted to the State from local law enforcement agencies and State Police. A university codes crash reports, geolocates crashes, and produces analysis reports. Although this group geolocates crashes, they do not use the LRS for State-owned roads for this geolocation. This limits the State's ability to integrate crash data with roadway data, which in turn leads to less flexibility in conducting safety analyses. There are concerns expressed by data users regarding the timeliness and completeness of crash data. The State is currently not performing any level of Highway Safety Manual (HSM), or similar advanced safety analysis.	**Kudos:** • Efforts to collect roadway data will allow NMDOT to perform network screening and advanced safety analysis once it is integrated with crash data. • The State organized HSM training for District staff and other stakeholders. **Recommendations:** • Develop a crash data improvement plan to address the following: o Timeliness, completeness, and accessibility of crash data to meet internal and external partner agency user needs. ▪ Continue expanding electronic crash data collection and seamless electronic upload to crash database. ▪ Establish measures for monitoring incoming crash records from individual law enforcement agencies to improve compliance with State law.

Critical Issue	Current State Practices	Recommendation for Improvement
		○ Integration with roadway inventory and traffic data. ○ Spatial analysis capabilities. • Establish an internal safety team that supports advanced safety analysis (segments and intersections) as well as training for internal and external stakeholders. This may include the use of HSM, or other similar advanced safety analysis tools. As part of this, the State should assess existing staff and determine whether additional staff and expertise are required to achieve this objective. • Establish a Technical Advisory Panel (TAP) to coordinate activities between the State and university partners. The TAP should meet with researchers on a regular basis to monitor progress, and provide feedback on existing products. TAP members should include Traffic Records, Roadway Data Inventory, Research Bureau, Data Management Bureau, and Traffic Safety Bureau. • Investigate methods to conduct statewide network screening and policy analysis to support the safety program. • Coordinate engineering and behavioral safety efforts to enhance safety analysis and achieve future performance targets.

Critical Issue	Current State Practices	Recommendation for Improvement
Data Management and Governance		
Data Management / Governance	The State does not have a data governance board for roadway or other data activities. There is currently no process to coordinate roadway data needs. Since there is currently no central roadway inventory process, there is no consistency for data collection, including elements collected and frequency of updates. There is an opportunity to improve this with the implementation of Roads and Highways.	**Kudos:** • Under the current organizational structure, Asset Management and Planning is a centralized location for all data collection (except bridge data), management, and dissemination. This enhances data integration and access, which leads to improved data quality and more effective data/performance based decision making. **Recommendations:** • Create a formal Data Governance Committee (DGC) for oversight of all current and future enterprise data activities and regular review of existing business services and tools. The group should also be responsible for developing and/or assembling policies and procedures when not available. DGC responsibilities and activities may include but are not limited to: o Identify current data being collected and maintained in each of the State roadway inventories at both the Headquarters and district offices o Assess current data standards and coordinate development of new standards o Establish quality control/quality assurance (QC/QA) processes for all data being collected o Assess how to facilitate the interoperability of information within roadway inventory databases o Identify and address data priorities and needed or

Critical Issue	Current State Practices	Recommendation for Improvement
		potential improvements o Design for potential expansion of data elements o Assess current state of knowledge regarding analysis tools (e.g., GIS tools) and consider a training plan and communication with internal and external users o Act as liaison to external efforts that impact data functions • The Asset Management and Planning Division is well positioned to lead the data governance activities and should assemble a team of stakeholders including IT, maintenance, construction, highway safety, and the Districts to guide the process.
Standards	The State lacks a comprehensive data dictionary for all roadway data. There is some documentation available, but it is not comprehensive or updated regularly.	**Recommendation:** • Develop standards and procedures (where they don't already exist) for all data elements and data collection efforts and formalize by producing or assembling documentation in the form of a manual. o Incorporate business rules on how to input data and format specifications into metadata. o Standards can be shared with local agencies, which will facilitate data integration from local agencies into State systems.

Critical Issue	Current State Practices	Recommendation for Improvement
Quality Assurance	The State conducts a QC/QA check of the automated data collection effort, per contract specifications which includes a third party review. Also, the roadway inventory activities will be conducting QC/QA checks on a small percentage of HPMS collected sample panel section data via video.	**Kudos:** • The QC/QA conducted on automated roadway data collection effort is standardized. **Recommendations:** • Establish a process for updating data collected through the automated data collection effort, and maintain a standardized QC/QA approach for updates. • The State should make quality assurance a priority for future data collection efforts (e.g., data submitted by local agencies) by establishing formal QC/QA procedures.
Data Sharing and Integration		
Interoperability	The State is involved with a GIS clearinghouse of State DOT other State GIS efforts. The State is also working with E-911 to incorporate that data into the database. The State has existing relationships with external partner agencies including MPOs and regional planning organizations that includes regular communication with them on a variety of topics.	**Recommendations:** • Leverage relationships to increase two-way communication regarding data needs and opportunities with external partner agencies. • Work with LTAP to educate and market the utility of the expanding roadway and safety data capabilities.
Accessibility	Current access to roadway data is cumbersome and provides limited access to data and analysis tools. The State plans to improve this with updated tools to improve access to datasets within the Department to support multiple units. MPOs and RTPOs expressed interest in being able to access the State basemap and related data to conduct their own	**Recommendations:** • Leverage implementation of Roads and Highways and Agile Assets to improve user access, ease of use, and availability of additional data applications across departments and Districts. Consider the possibility of extending that to external partner agencies as the program matures and relationships develop.

Critical Issue	Current State Practices	Recommendation for Improvement
	analysis and program implementation. They also expressed an interest in becoming partners on automated data collection efforts, including a willingness to contribute financial resources to the effort if it includes information relevant to their jurisdictions.	• Identify opportunities to work within IT frameworks to improve data access, development of tools, and applications for decision support. • Establish a communication plan to make internal and external partners aware of what data the State is collecting and what additional data and services the State DOT will be able to provide as data efforts expand.

For More Information:

http://safety.fhwa.dot.gov/

FHWA Office of Safety

Robert Pollack

Robert.Pollack@dot.gov

(202) 366-5019

U.S. Department of Transportation

Federal Highway Administration

December 2016

FHWA-SA-17-027