# GIS in Transportation

# Data Governance &
# Data Management

Case Studies of Select Transportation Agencies

**July 2018**

Prepared for:
**Office of Planning**
**Federal Highway Administration**
**U.S. Department of Transportation**

U.S. Department
of Transportation
**Federal Highway
Administration**

# Notice

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange.  The United States Government assumes no liability for the contents or use thereof.

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the objective of this report.

# REPORT DOCUMENTATION PAGE

| 1. AGENCY USE ONLY (Leave blank) | 2. REPORT DATE<br>July 2018 | 3. REPORT TYPE AND DATES COVERED<br>Final |
|---|---|---|

| 4. TITLE AND SUBTITLE<br>Data Governance & Data Management Case Study | 5a. FUNDING NUMBERS |
|---|---|
| 6. AUTHOR(S)<br>Michael Green, Anthony Lucivero | 5b. CONTRACT NUMBER |

| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br>U.S. Department of Transportation<br>John A Volpe National Transportation Systems Center<br>55 Broadway<br>Cambridge, MA 02142-1093 | 8. PERFORMING ORGANIZATION REPORT NUMBER |
|---|---|

| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)<br>U.S. Department of Transportation<br>Federal Highway Administration<br>1200 New Jersey Avenue, SE<br>Washington, DC 20590 | 10. SPONSORING/MONITORING AGENCY REPORT NUMBER |
|---|---|

**11. SUPPLEMENTARY NOTES**

| 12a. DISTRIBUTION/AVAILABILITY STATEMENT<br>This document is available to the public through the National Technical Information Service, Springfield, VA 22161. | 12b. DISTRIBUTION CODE |
|---|---|

**13. ABSTRACT (Maximum 200 words)**

To determine how State Departments of Transportation currently define the concepts of "data governance" and "data management," and the formal or informal policies used to implement them within a context of geographic information systems (GIS). FHWA and the U.S. Department of Transportation (DOT) Volpe National Transportation Systems Center interviewed four State DOTs and developed a case study focusing on their experiences:

- Arizona Department of Transportation (ADOT)
- Arkansas Department of Transportation (ArDOT)
- Ohio Department of Transportation (ODOT)
- Texas Department of Transportation (TxDOT)

| 14. SUBJECT TERMS<br>Geographic information systems (GIS), data governance, data management | 15. NUMBER OF PAGES<br>18 |
|---|---|
| | 16. PRICE CODE |

| 17. SECURITY CLASSIFICATION OF REPORT<br>Unclassified | 18. SECURITY CLASSIFICATION OF THIS PAGE<br>Unclassified | 19. SECURITY CLASSIFICATION OF ABSTRACT<br>Unclassified | 20. LIMITATION OF ABSTRACT<br>Unlimited |
|---|---|---|---|

# Contents

# List of Tables

# 1. Introduction

## 1.1 Background

The State DOTs are realizing the importance of good data leading to better transportation decision making. The challenge for them has been in ensuring that the data that is collected, procured, processed, analyzed, reported and shared is done in an efficient and timely manner. Based on the 2017 American Association of State Highway and Transportation Officials (AASHTO) GIS in Transportation (GIS-T) State Survey, State DOTs are working to address this challenge and they are interested in learning what good and noteworthy examples exist among their peers.

The Federal Highway Administration (FHWA) wants to ensure that transportation projects are delivered in a timely manner and that performance measures are available to justify these projects. Transportation decisions based on good information and data is key to all of this, and Geospatial Information Systems (GIS) is the common platform that all State DOTs are using to help make this happen.

FHWA has been promoting the use of GIS to transportation agencies to assist in the effective management and improvement of transportation systems. The GIS in Transportation case study series is a means of conveying best practices and resources, and is informed directly by interviews with State DOT GIS staff. The case studies give participating agencies the opportunity to:

- Identify the state-of-the-practice for the implementation of data governance and data management policies.
- Collaborate with other transportation agencies to further develop and refine these policies and identify opportunities to incorporate them into regular business processes.
- Discuss benefits, challenges, success factors, and lessons learned from implementing data governance and data management policies.

## 1.2 Purpose and Methodology

The topics of data governance and data management were selected based upon the responses to two open-ended questions within AASHTO GIS-T 2017 Survey. This survey is administered each 'year after the GIS-T Symposium in an effort to learn more about what State DOTs are most interested in pursuing. These questions were:

1. Please describe GIS-related projects, applications, and/or issues that are of interest to your organization.
2. Please describe your most recent GIS related projects, and/or applications.

The responses to these questions were classified into categories that best represent the variety of answers. It was determined that the categories of data governance and data management were the most commonly represented topics across the submitted answers.

The participating agencies for this case study included the Arkansas DOT, Arizona DOT, Ohio DOT, and Texas DOT. These four States were among a larger group of potential participants initially contacted. A 30-60 minute telephone interview with each participating agency was held in March 2018. An interview guide, included as Appendix A: Interview Guide, provided the framework for the discussions. Case studies were drafted based on participant responses during the two discussions. Findings from the case studies are included in the Observations section of this report.

Table 1 below presents details on each participating State DOT's workforce, recent projects, and topics they would like to see covered in future GIS-T Symposiums.

**Table 1. Overview of Participating Agencies**

| Agency | Recent Project(s) | Desired Future GIS-T Content | Total Employees | GIS Employees | Use of Geospatial Tools |
|---|---|---|---|---|---|
| Arkansas DOT | Data Governance: Tearing Down the Silos | Organized Asset Data Collection | ~3,600 | ~25 | Outreach; Project-level work; Asset Management; Agency Strategic Direction; Web Map Applications; Linear Referencing Systems (LRS); All Roads Network of Linear Referenced Data (ARNOLD); Cartographic Product Creation; Spatial Analysis |
| Arizona DOT | Data Supply Chain for ARNOLD | Automated Data Integration | ~3,700 | 4 (2 full-time) | Highway Performance Monitoring System (HPMS); LRS/ARNOLD; Asset Management |
| Ohio DOT | Data Governance | Cloud Storage & Computing; Data Governance | ~5,000 | 16-18 | Improving Operational Efficiencies; Asset Management; Data Collection; Business Analytics |
| Texas DOT | Open Data Portal | Statewide Data Warehouse | ~12,000 | 26 | Project Tracker; Asset Management, Maintenance; Emergency Response |

## 1.3 What is Data Governance & Data Management?

In July 2015, FHWA's Data Governance Advisory Council released a Data Governance Primer that defined **data governance** as "the discipline that establishes the criteria and requirements for data; their quality, management, policies, business process; and risk management for handling of data within FHWA. In short, it is a corporate approach to collecting and managing data."[1]

**Data management** is referred to in FHWA's Data Governance Primer as "data stewardship."[2] There is no formal definition given within the document, but it can be best summarized as the activities performed which put data governance policies into action. These activities include maintenance of system

---

[1] FHWA's Data Governance and Stewardship Program Primer, https://www.fhwa.dot.gov/datagov/dgpvolume%201.pdf
[2] FHWA's Data Governance and Stewardship Program Primer, https://www.fhwa.dot.gov/datagov/dgpvolume%201.pdf

architecture and data, the organization of data, upgrading GIS software, improving data interoperability and access, and the interpretation of data from GIS technologies.

In an effort to not lead the participants to an answer, these definitions were not shared beforehand. Instead, the State DOTs were asked to explain their own understanding of these concepts in an effort to see how these definitions might differ across agencies.

## 2. Observations

### 2.1 Agency Definitions

This formal definition of data governance provided in the Data Governance and Stewardship Program was not commonly known by State DOTs, as no participants referenced it in their answers. However, all participants reported a general understanding of data governance and data management that align with the content of the Data Governance Primer. In general, data governance is the framework to apply to the whole agency, and data management is the everyday actions and workflows.

Each case study agency reported that while they do not have official data governance or data management definitions, they are either in development or have plans to pursue development. Informal definitions based on other guidance documents are used on an ad hoc basis, such as Highway Performance Monitoring System (HPMS) reporting requirements or asset management data collection practices adapted to data governance guidelines. Table 2 below shows how each agency responded when asked to define these terms.

**Table 2: Summary of Definitions from Participating State DOTs**

| Agency | Data Governance | Data Management |
|---|---|---|
| Arizona DOT | The overall framework that informs daily activities. This is a conceptual definition informed by the Highway Performance Monitoring System (HPMS) reporting requirements. | The daily activities that contribute to the data governance framework. This is a conceptual definition informed by the HPMS reporting requirements. |
| Arkansas DOT | Unofficially defines data governance as the high-level policies that ensure data is able to be used across the DOT | Unofficially defines data management as the maintenance performed by the data's owner to keep it as up-to-date as possible. |
| Ohio DOT | Official definitions are still being developed. In the interim, Ohio DOT's Technology Council defines "technology governance" as "the ability to direct, measure, and evaluate enterprise technology resources to support the achievement of the organization's vision, mission, and strategic goals. It recognizes technology as a strategic part of the organization's success; it integrates technology, people, and processes; it guides technology investments that generate business value; it steers technology investments to mitigate Ohio DOT risks; and | The daily activities that support the data governance policy. |

| | | |
|---|---|---|
| | it monitors performance of technology resources and establishes accountability." | |
| Texas DOT | Texas DOT does not have official definitions, but there is a general understanding that data governance is the principles applied to the whole agency that guides day-to-day efforts… | Data management refers to how work is performed and the daily tactical decisions made by staff. |

## 2.2 Agency Policies

In general, the participating agencies did not have official data governance or data management policies. Agencies are either currently developing official policies, or using existing data requirement policies in lieu of a new policy.

**Arizona DOT**
Arizona reported that its internal Highway Performance Monitoring System (HPMS) Manual is the closest document it has to a formal policy. Arizona has a State-level data governance policy that mandates all agencies are required to create a chief data officer not within their IT departments. Arizona *does* have an official data management policy, but it is solely for the agency's linear referencing system (LRS) and the naming of roadways. The agency's internal documentation practices have existed for decades, but these practices are not enforced. Arizona also utilizes an antiquated data warehousing system which is used to pull data together in a tabular format. The agency plans on conducted a capability maturity assessment, which will be done either at an agency-wide level or within certain departments.

**Arkansas DOT**
Arkansas DOT is currently developing their data governance and data management policies, as well as a data business plan for safety and mobility. Arkansas also launched its Data Governance Committee in May 2017. The agency's mission statement is "improve data through appropriate structure, methods, and implementation." Their vision statement is "ensure all stakeholders have ready access to coordinated data for the optimization of business processes and decision making." The data business plan for safety and mobility is almost complete. In the interim, Arkansas DOT staff ensure that all data is compatible with ARNOLD, and also make use of a data warehousing SQL server (although this system is still in its infancy). Arkansas would like to develop a one-stop shop system that all data points to.

Arkansas completed a pilot capability maturity model (CMM) in February 2018 that showed they are in the early stages of maturity in terms of how data is managed. The agency's warehousing system needs to be further developed, duplication of efforts is occurring, and they need to have better communication across the department as far as GIS and data is concerned. Arkansas DOT is a highly siloed agency, and staff must know who to ask for access to certain data because they are the only ones who know how to retrieve it.

**Ohio DOT**
Ohio is still developing their official data governance and data management policies. Currently, Ohio DOT utilizes a Transportation Asset Management policy that informs their interim data governance practices for data collection. The agency will also be modernizing a data management strategic plan that was created during an enterprise architectural assessment several years ago, and the agency's GIS Division is developing a data management and life cycle policy. Ohio makes use of multiple data warehouse systems (SQL, Oracle, and GQL), but none of them are organized into an enterprise data warehouse system.

**Texas DOT**

Texas has developed effective, but unofficial, data management guidelines and data model requirements. The agency does not currently have any data officers, but is planning to implement these roles along with a new GIS working group that will inform upper management about the work being completed throughout the agency. It is envisioned that upper management will be able to determine commonalities in these reports and then create official data policies.

Texas also developed a website that helps staff create data models using standardized terms and tools. Additionally, the agency would like to move towards official guidance on the creation of new data sets that define the purpose, users, storage, and maintenance responsibilities for each piece of data. Texas utilizes a variety of data warehousing solutions. A previous attempt was made to create a "one stop shop" for spatial and non-spatial data, but it was not successfully implemented. The agency is attempting to develop another singular warehousing system, but anticipates this taking a great deal of time.

## 2.3 Data Governance Organizational Structures

Organizational structures provide a means of overseeing data governance activities and ensuring accountability when integrating these policies within an agency. Table 3 below shows how the participating State DOTs have implemented an organizational structure for data governance.

**Table 3. Examples of Organizational Structures for Data Governance**

| Agency | Example |
|---|---|
| Arkansas DOT | Formed a Data Governance Committee, but no data officers have been assigned yet. Each data-producing division (Planning Division, Information and Research Division, and Maintenance Division) serve on this steering committee. The chairman is also a senior administrator/ The committee holds quarterly meetings. There are several subgroups that are focused on data related to performance targets and performance reporting |
| Ohio DOT | The Asset Management Leadership Team was formed during Ohio DOT's Data Governance Review. This body has two working groups (Audit Group and District Coordinators). There is also a Technology Council working between the Deputy Directors and Executive Management. Data officer positions will be created. |
| Texas DOT | A GIS work group is being created that will inform management regarding their activities, which will then be used to determine commonalities. Guidelines will be developed data warehousing and data access. |
| Arizona DOT | As of the publication of this report, Arizona DOT does not have an organization structure in place for data governance. |

## 2.4 Motivations for Pursuing Data Governance and Data Management Projects

The concepts of data governance and data management seek to address commonly reported data issues. These include locating consistent data for business uses; identifying data quality issues; identifying and maintaining valuable data that can drive decisionmaking; standardizing data collection and eliminating redundancies; facilitating access to data by all users; and modernizing agency technology systems.[3]

---

[3] FHWA's Data Governance and Stewardship Program Primer,
https://www.fhwa.dot.gov/datagov/dgpvolume%201.pdf

In addition to these needs recognized by FHWA, the participating agencies reported the following motivations for pursuing data governance and data management efforts:

**Improve the communication of data throughout the agency.**
When staff utilize different data formats and software, it disrupts the ability to communicate technical details and collaborate on projects. Fixing this problem would yield the benefits of more cooperation and efficiency. For example, Arizona DOT's recent project of "Data Supply Chain for ARNOLD" to provide an effective way to communicate 911 first responder data. The first phase of the project was to meet the ARNOLD requirements. The second stage focused on an outreach campaign to the emergency response agencies to communicate about data, which was smoother once they had a common data language. Arizona DOT is now seeking to finish the project by implementing a data submission capability for 911 agencies.

**Become fluent with modern technology and best practices from other State DOTs.**
Agencies would like to be able to emulate the high-performing work found in other State DOTs throughout the country. They also expressed the desire to remain relevant in their fluency of modern technology. Arizona DOT foresees that data governance and data management policies will provide the ability to work with other State agencies that are undergoing similar efforts and get advice and strategies that work within the context of State government. Additionally, Arkansas DOT would like to know which other States have formed data governance committees, what those governance structures look like, and what the responsibilities and authority of its members are. They are also interested in the IT best practices of those States as well.

**Anticipate problems before they happen.**
The agencies would like to move towards becoming proactive rather than reactive to issues as they arise. For example, Arkansas DOT's recent project entitled "Tearing down the Silos in Data Governance" was inspired by Arkansas DOT's tendency to be driven by emergencies and reactively addressing problems by applying a quick fix without fixing the underlying issue. They would like to be more proactive and develop a "guard-rail" to catch problems before they occur.

**Improve the accessibility of data.**
Well-governed data means easily-accessible data for users. Agencies would like to make their data repositories more easily searchable with metadata and to improve workflow efficiencies by having a common platform to work on. For example, Texas DOT undertook an open-data portal project to create a search function to quickly find the correct data and the associated metadata. This effort sought to move the agency away from hosting data on their website, and to facilitate the sharing of data via a direct link.

## 2.5 Benefits and Successes

The participating agencies reported a variety of benefits and success stories based upon their individual efforts in data governance and data management:

**Communicating value to executive management.**
Agencies learned that appealing to executive management's desire to save the agency time and money is an important method of gaining traction. While some agencies reported that their administrators were receptive to the idea of data governance and data management policies, they were able to make headway in their efforts by making it clear that the policies will save the agency resources.

Arizona DOT reported that their Director of Planning has started to understand the benefits and importance of data governance and data management, and discussions have started about developing

11

agency-wide policies. Management has also begun offering training on the concepts of data governance, and have been developing a curriculum of classes for State employees.

Arkansas DOT's Data Governance Committee has top-level management as members. This indicates management recognizes how important it is to invest in this effort. The administration, as a whole, is supportive of modernizing the agency's data structures and policies. Even in these early stages, staff members are realizing that the agency has to change in order for it to be successful, and the spreading of knowledge is also a huge benefit across the department.

Ohio DOT's communication with its executive management has also been highly successful. The Transportation Asset Management group meets with the executive group monthly. Multiple executives have become well versed in this topic and are becoming increasingly involved in the data governance initiatives across the agency.

Texas DOT experienced success in communicating with their executive management by emphasizing that data governance and data management policies will save the agency time and money. This approach gets management's attention very effectively.

**Facilitating collaboration between DOT staff.**
Data governance and data management policies facilitate the ability of agencies to work with, and learn from, other State agencies. Cross-compatibilities between State agencies is a huge benefit. For example, Texas DOT's open-data portal project resulted in a highly effective communication tool. Staff are able to have conversations about the data and what it can be used for, and information can be relayed to the public. The open-data portal format also provides staff a common platform to work from.

**Organizational structures are highly effective implementation tools.**
Structures such as steering committees or designated oversight roles have been extremely helpful for agencies in their data governance and data management projects.  These organizational structures fill a need for a feedback loop that can assess the progress of the agency and see the direction it is heading. In some instances, data governance committees have members that are from top-level management.

The Ohio DOT has performed a Data Governance Review, which included a data maturity assessment. The assessment was broken into three phases: Plan/Design, Build, and Implement. The agency's intent for the first phase was to formalize the data governance policy and committee. The second phase involved building a data framework to assess their organizational structure and staff skillsets to determine their next steps. The last phase involves creating the data policies, warehouses, and organizational structures. Ohio DOT was able to create a steering committee, with plans to implement roles for data officers. Additionally, a Technology Council was formed via a Technology Governance policy statement. This group's members are appointed directly by Ohio DOT's Director. The group also established a five year technology implementation.

**Positive impacts are quickly recognized and appreciated by staff.**
Even at early stages, staff begin to realize change is necessary to remain relevant, do meaningful work, and spread institutional knowledge across the agency. Staff also begin to realize that data is a powerful tool and has great intrinsic value, and so are more willing to put the effort into properly maintaining it. For example, the Ohio DOT was able to migrate a great deal of Excel data into an approachable, capability-driven format stored on a SQL server. Staff members began to immediately notice the deficiencies of their data quality, which spurred an overall increase in the data quality. There has been a realization of data being a powerful, valuable asset, resulting in growing support for directing additional resources towards improving data systems.

## 2.6 Challenges

The participants also noted a significant amount of challenges they experienced or anticipate in implementing data governance and data management policies:

**Agency culture can be difficult to overcome.**
Sometimes, staff can have difficulty understanding that data is an asset with a monetary value. Other pain points reported by agencies were asking staff to volunteer to do tasks that are not directed by administrators, or to get them to see why change is needed. Arkansas DOT reported that many staff members do not understand that data is an asset with a monetary value.

The lack of "data ownership" (essentially taking responsibility) for the data process among staff and business owners means that many times staff assume that other staff will be taking care of data maintenance for them, even though it is *their* data. Ohio DOT reported this issue to be their biggest challenge. The agency still has a pervasive mentality of non-ownership among staff and business owners.

**Bureaucracy between executives and the agency can result in miscommunication.**
The value of data governance and data management to upper management can be diluted by levels of bureaucracy. When messengers to upper management do not understand the mission, as it moves up the chain, the importance is not conveyed and key aspects can be miscommunicated. When executives are not in touch with the day-to-day work going on within their agency, it is difficult for them to set policy that will help their staff achieve their goals.

**Personnel turnover is a serious obstacle to implementation.**
When key personnel leave an agency, it has a great detrimental effect on the continuity of effort, results in the loss of institutional knowledge, and hinders follow-through on existing projects. New staff or a new administration will then need to be convinced of the value, which may not be successful. All participants made note of this issue.

**Internal departments and teams can have different missions.**
The sub-groups within a DOT oftentimes have their own mission and goals, and the best way of achieving those goals might not align with the rest of the agency. This makes compromising and moving in a direction that benefits the agency as a whole complicated, and can result in territorial disputes for resources. For example, Arkansas DOT experienced communication challenges with staff, rather than upper management. It was found to be challenging at times because each discipline within the agency has its own mission. An agency-wide policy or action may not be the best thing for their group and they can become defensive. Their initial bottom-up approach was not very successful of getting volunteers to change.

**Administrators' focus on engineering can prevent them from understanding the value of data governance and data management.**
Texas DOT reported that administrators can be intensely focused on operations, maintenance and construction. They can have difficulty in understanding how data governance and management fits into the agency's business operations. They also tend to be engineers who struggle with communication and do not see data as a product. The Planning Divisions are much more of a grey area for them compared to engineering work.

## 3. Lessons Learned

**Definitions of these concepts may differ in language, but they are functionally the same.**

13

The definitions that provided a frame of reference for this case study were also accurate in summarizing how State DOTs define data governance and data management. The creation of official definitions can provide DOT staff with a point of reference when communicating with upper management, and shows it is a concept valued by FHWA.

**Without a governing body, implementing data governance is very difficult.**
A voice of authority and vision is required to truly implement data governance. Without it, implementation becomes exceptionally hard to perform. The people making decisions may not understand the concepts, or what data even is. Steering Committees and similar governing bodies are an essential part of an effective implementation process.

**Data governance and data management have a symbiotic relationship.**
One concept cannot be implemented effectively without the other. Performing data governance without the day-to-day practices of data management results in little to no progress being made towards the goals and policies set forth in a data governance policy. Likewise, data management practices that are performed without the guiding framework provided by a data governance policy will result in haphazard or unorganized activity that is subject to individual workflow preferences, and data collection and maintenance standards.

**A GIS-specific CMM (GIS-CMM) would benefit State DOTs.**
The implementation of a new GIS-CMM to create a national baseline of maturity will lead to FHWA being able to create more effective implementation guidance and assistance programs. This will also encourage dialogue between States to learn from one another.

### Table 4. Summary of Policies and Activities

| Agency | Formal Policies/Definitions? | Informal Policies/Definitions? | Goals | Successes | Challenges |
|---|---|---|---|---|---|
| Arkansas DOT | In Progress | Yes | Become more proactive in GIS data management, be able to foresee problems and fix them | Upper management value data and are members of the Data Governance Committee | Difficult to implement policies without being ordered by an administrator. Staff tend to not understand why change is necessary. |
| Arizona DOT | No governance policy; LRS data management and standardization policy exists | No | Complete a data maturity assessment (CMMI and CMM); Improve data quality. | Working with other States; Some managers understand the benefits and offer training for Data Governance. | Staff typically do not understand or appreciate the importance of data as an asset. |
| Ohio DOT | In Progress | Yes | Improve data quality across the entire agency | Data Governance Review; Communication with upper management; Formed Steering Committee & Technology Council | Quality control and ownership of data collection; Expectations vs reality with new tools |

| Texas DOT | No | Yes | Implement a steering committee; Develop formal policies; Conduct maturity assessment | Communicating with upper management | Reporting requirements, cultural roadblocks |
|---|---|---|---|---|---|

## 4. Summary of Recommendations for FHWA

The participating agencies identified the following assistance, resources, and guidance that could be provided by FHWA:

**Organizational charts for governance structures**
Arizona DOT would like to see a flexible organizational structure framework that could work with either a decentralized or centralized DOT. The agency would also like to see additional guidance on what a State DOT is supposed to do accomplishing with respect to data governance, as well as making a clear list of funding mechanisms for implementing it.

**Additional peer exchanges and workshops.**
The peer exchanges have been highly successful in fostering interstate dialogue. These events are always helpful to assess the direction and activities of other agencies and to learn from them. Ohio DOT reported that the peer exchanges held by FHWA have been helpful in assessing the industry trends and learning from other States. All participants answered they would attend future peer exchanges on this topic.

**An authoritative voice might be beneficial**.
Definitive language is needed to make agencies understand the importance of this work. Texas DOT encouraged FHWA to be more assertive in its messaging, as it would start driving change in the less-forward thinking agencies. Progress in data governance and data management will be difficult without stronger language and requirements,

**Guidance on data requirements, suggested activities, funding, and ways to shift agency culture.**
The participants would like additional information regarding what a DOT should be doing to move towards data governance, and links to the Federal requirements for States. Participants also asked for guidance on funding mechanisms for implementation and urged the usage of those funds to build out data governance and management across agencies. This can result in modernization of out-of-date aspects of HPMS systems. Arkansas DOT reported that the ARNOLD memorandum from 2012 was a great resource, and while some guidelines were provided, there was no supplemental information that went around the other divisions indicating that their data must comply with ARNOLD. They would like more guidance and possibly more rules for this issue, as well as additional peer exchanges and technical assistance opportunities, and standardized data requirements. Ohio DOT would like FHWA's input on what in new HPMS practices are necessary and what is irrelevant, as well as additional resources on how to drive change in the agency culture and mainstream data management practices.

## 5. Conclusion

The information gathered from the participating State DOTs show how critical data governance and data management policies are for a State DOT to function effectively and to develop its capability. Establishing these policies will allow State DOTs to become proactive in preventing problems, provide an agency-common data language and platform, create well organized data warehouses, share data and collaborate, streamline workflows, and create a vision and a set of goals.

# **Appendix A: Interview Guide**

## Background

1.  Agency details:
    a.  What is your role within your agency?
    b.  Approximately how many full-time, non-contract employees work for your organization?
    c.  What is the size of your GIS team, full or part-time, and not including contractors?
    d.  Of the X [insert number from c] people on your GIS team, how many spend at least 50% of their time on GIS-related tasks?
    e.  What is the number of <u>contract</u> staff, full or part-time, that work with your GIS team?
2.  In what ways does your agency currently use GIS or geospatial tools?
3.  Are there other uses of GIS that you would like to employ but currently do not?
    a.  What are they?
4.  What are your agency's biggest challenges or hurdles to using GIS tools and/or limitations to using potential GIS tools?

## Data Policies

*The following questions are related to data governance and management policies related to GIS that might be in place at your agency.*

5.  How does your agency currently define Data Governance?
6.  How does your agency currently define Data Management?
7.  Does your agency have an official Data Governance Policy document?
    a.  If so, please briefly describe this policy at a high level.
    b.  If not, does your agency employ any unwritten and/or unofficial data governance practices?  Please explain.
8.  Are there any designated data officers or a steering committee within your agency to oversee data governance and management?
9.  Does your agency have an official Data Management Policy document?
    a.  If so, please briefly describe this policy at a high level.
    b.  If not, does your agency employ any unwritten and/or unofficial data management practices?  Please explain.

10. Does your agency have an IT Strategic Plan?

    a. If so, please briefly describe this plan at a high level.

    b. If not, does your agency have any guiding IT policies?  Please explain.

11. Does your agency have an official data standardization procedure or policy?

    a. If so, please briefly describe this procedure or policy at a high level.

    b. If not, how does your agency collect, process, and store GIS and GIS-related data?

12. Does your agency utilize a data warehousing system?

    a. If so, please describe this system.

    b. If not, what is your method for data storage?

13. Has your agency conducted a data maturity assessment?

    a. If so, please indicate when it was conducted and briefly describe the high level results of this assessment.

    b. If not, would you be interested in conducting such an assessment?

## Opportunities and Challenges Related to Data Governance

14. What benefits or opportunities has your agency experienced in implementing data governance and data management policies?

15. What challenges has your agency experienced in implementing data governance and data management policies?

## Applications

During our research, we identified a data governance project your agency has worked on called **(insert specific project)**. The following questions will focus on this specific application.

16. What was the motivation for this project?

17. Can you please describe the coordination, planning, and preparation that took place in order to get the project approved and carried out?

18. Was this project successfully implemented?

19. What were the challenges you experienced during this project?

## Additional Resources

20. Have you experienced any **successes** in communicating with your agency's upper management about the importance of investing in data governance and data management?

21. Have you experienced any **challenges** in communicating with your agency's upper management about the importance of investing in data governance and data management?

a. What benefits of Data governance or data management would be most relevant to, or valued by, your agency's upper management?

22. What support from FHWA would be helpful in creating and/or implementing data governance and/or management policies?

a. Would you be interested in attending a Peer Exchange regarding this topic?