DATA GOVERNANCE AND DATA MANAGEMENT: STATE EXAMPLES

2019 AASHTO GIS-T Symposium
Kissimmee, Florida
April 25, 2019
Lots of interest, lots of activities, 60 Slides, 30 Minutes
Mission: Enable and empower the strengthening of a world-class highway system that promotes safety, mobility, and economic growth, while enhancing the quality of life of all Americans.
FHWA FY 2019-2022 STRATEGIC PLAN

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Data governance is 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.
“State your assumptions, so everyone knows where you’re coming from.”

-Me
THE IMPORTANCE OF DATA
THE IMPORTANCE OF DATA

Action

Decision
THE IMPORTANCE OF DATA

Decision

Information

Information

Information

Action
THE IMPORTANCE OF DATA
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States DOTs collect, use, and submit this data to FHWA

FHWA uses data for national priorities

How are States managing their data?

What are States doing with data governance?
DATA GOVERNANCE AND DATA MANAGEMENT CASE STUDIES REPORT
# CASE STUDY PARTICIPANTS

<table>
<thead>
<tr>
<th>Agency</th>
<th>Recent Project(s)</th>
<th>Desired Future GIS-T Content</th>
<th>Total Employees</th>
<th>GIS Employees</th>
<th>Use of Geospatial Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas DOT</td>
<td>Data Governance: Tearing Down the Silos</td>
<td>Organized Asset Data Collection</td>
<td>~3,600</td>
<td>~25</td>
<td>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</td>
</tr>
<tr>
<td>Arizona DOT</td>
<td>Data Supply Chain for ARNOLD</td>
<td>Automated Data Integration</td>
<td>~3,700</td>
<td>4 (2 full-time)</td>
<td>Highway Performance Monitoring System (HPMS); LRS/ARNOLD; Asset Management</td>
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<tr>
<td>Ohio DOT</td>
<td>Data Governance</td>
<td>Cloud Storage &amp; Computing; Data Governance</td>
<td>~5,000</td>
<td>16-18</td>
<td>Improving Operational Efficiencies; Asset Management; Data Collection; Business Analytics</td>
</tr>
<tr>
<td>Texas DOT</td>
<td>Open Data Portal</td>
<td>Statewide Data Warehouse</td>
<td>~12,000</td>
<td>26</td>
<td>Project Tracker; Asset Management, Maintenance; Emergency Response</td>
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<tr>
<td>Agency</td>
<td>Data Governance</td>
<td>Data Management</td>
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<tr>
<td>Arizona DOT</td>
<td>The overall framework that informs daily activities. This is a conceptual definition informed by the Highway Performance Monitoring System (HPMS) reporting requirements.</td>
<td>The daily activities that contribute to the data governance framework. This is a conceptual definition informed by the HPMS reporting requirements.</td>
<td></td>
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<tr>
<td>Arkansas DOT</td>
<td>Unofficially defines data governance as the high-level policies that ensure data is able to be used across the DOT</td>
<td>Unofficially defines data management as the maintenance performed by the data's owner to keep it as up-to-date as possible.</td>
<td></td>
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<tr>
<td>Ohio DOT</td>
<td>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 it monitors performance of technology resources and establishes accountability.”</td>
<td>The daily activities that support the data governance policy.</td>
<td></td>
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</tr>
<tr>
<td>Texas DOT</td>
<td>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…</td>
<td>Data management refers to how work is performed and the daily tactical decisions made by staff.</td>
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</table>
MOTIVATIONS — WHY DATA GOVERNANCE?

Improve the communication of data throughout the agency
Become fluent with modern technology and best practices from other State DOTs
Anticipate problems before they happen
Improve the accessibility of data
BENEFITS OF DATA GOVERNANCE

Communicating value to executive management
Facilitating collaboration between DOT staff
Organizational structures are highly effective implementation tools
Positive impacts are quickly recognized and appreciated by staff
DATA GOVERNANCE CHALLENGES

Agency culture can be difficult to overcome

Bureaucracy between executives and the agency can result in miscommunication

Personnel turnover is a serious obstacle to implementation

Internal departments and teams can have different missions. They are not the same

Administrators’ focus on engineering can prevent them from understanding the value of data governance and data management

- Data is often taken for granted
Definitions of these concepts may differ in language, but they are functionally the same

- Importance of common language

Without a governing body, implementing data governance is very difficult

Data governance and data management have a symbiotic relationship

A GIS-specific Capability Maturity Model would benefit State DOTs
DATA GOVERNANCE PEER EXCHANGE
PARTICIPATING STATES

Arkansas
Connecticut
Iowa
Michigan
Ohio
Tennessee
PEER EXCHANGE FORMAT

Individual State presentations on data governance and management activities. Roundtable discussions on major topics in this area.
STATE DOT ACTIVITIES

Enterprise input and participation (AR, CT, OH, MI, TN)
- Data committees, executive groups, 2 groups (CT)
- Enterprise effort to determine policies and standards

Studying uses of data and data needs (AR, TN)

Document data better (IA, MI)
- Metadata, data glossaries

Executive-level officer
- Chief data officer, chief analytics officer (IA)

They are taking advantage of current priorities/needs to initiate data governance efforts: CT – Safety, OH-Transportation Asset Management
Past attempt at forming Enterprise Data Committee
- Purpose was to identify key data fields for standardization
- Group lacked authority to make changes happen

Data Survey for Safety Mobility Data Business Plan (2016)
- Over 175 responses saying that data governances were not standardized, formalized, or documented
- ARDOT data not always on ARDOT servers

Established Data Governance Committee (2017)
- Includes 7 top-level managers from across ARDOT
- Developing data business plan (document issues and create guidebook for moving forward)
Plans to expand the Data Governance Committee to include IT Liaison

Clean ArcGIS Online databases to remove duplicative and junk data

One person from each division has publishing access to data warehouse
CONNECTICUT DOT

Started with TED

- Transportation Enterprise Data Warehouse
- Manage data as a shared enterprise asset
- Started as collaboration between Planning and Engineering
- Evolved into enterprise data integration effort

Data Governance Council (1)

- Representatives from each section (Policy/Planning, Engineering/Construction, Safety, IT, etc... & facilitator)
- Charged with data management and standardization activities
Executive Oversight Team (2)

- All Agency Bureau Chiefs, chaired by the Chief of Staff
- Secure resources and provide guidance to support all strategic transportation data enterprise planning activities.

Both groups meet 3 – 4 times a year

Create working groups for specific functions that feed back to the formal committees

Executive level support has been key to CTDOT’s successes

Communication and feedback from TED users are important
IOWA DOT

Strongly recommends creating a Chief Analytics Officer

- Determines data to analyze and what data is important
- Charged with beginning data governance process
- Provides an authoritative basis for justifying why data governance issues must be solved and in what way

Issues faced include

- Difficulties finding, accessing and understanding data sets
- Lack of open data for peer review
- Quality of data available to provide in emergency and critical situations.
Metadata is important but has been neglected

- Needs a better way to manage it
- Perhaps hire a person with experience/background in library science (MnDOT does this)

Data standards and services can help bring information together from different sources

- Road condition information from Minnesota DOT and Iowa DOT are integrated and shared with weather (TV) stations for consumer use
• Built an IT Steering Committee with the following sub-groups
  • Data Governance Council with IT agency liaisons
  • Data Governor and Data Stewards
  • Communities of Interest for staff

• Data dictionaries and business glossaries are needed

• Project management office needs to add steps to examine data architecture and data governance questions
Learned that building a data repository should only be undertaken if its composition and uses are well-defined
- These repositories often get built and then torn down because their functions do not align with goals

Cross departmental collaboration between IT and GIS is important

Recommend a Chief Data Officer position
• Formed a committee to set data governance policies and standards

• ODOT leverages asset management to get data governance practices into operations
  • Formalized data collection workflows agency wide
    • Data collection request is submitted to a council who decides
      • Who the data owner is
      • Who collects the data
      • Overall plan for collection
    • Data collection serves multiple purposes
    • Data set is owned, properly maintained, and meets agency quality standards
    • Helps ODOT continually manage data collection requests and data set creation
OHIO DOT

Working on hiring a Chief Data Officer
- Developing a job description
- Developing a staffing plan

Following ITIL practices
- Aligning IT services with business needs

Future efforts
- Establishing an official data governance framework and strategy
- Creating data standards
- Working with IT to get a forward-thinking plan in place
TENNESSEE DOT

• Difficult to foster and facilitate data governance
  • Need business side (versus IT) to govern/manage their data

• Mapped business applications to an organizational chart to learn
  • How are they related?
  • Who is working on them?
  • What can be improved?

• Inconsistent metadata makes it difficult to find the correct data

• Working with data scientists to begin data governance process
TENNESSEE DOT

Trying to document how they manage data
  ▪ Lost large amount of institutional knowledge due to retirements
  ▪ New staff only staying on average of 3 years

A preliminary Data Advisory Committee is being formed
  ▪ Tentative member list
  ▪ Potential data categories to review

Trying to consider the needs of district offices and create buy-in across the agency
ROUND TABLE DISCUSSIONS

Data Governance Policy
Technical Tools for Data Governance
Data Governance Staffing and Strategy
What Can FHWA Do?
DATA GOVERNANCE POLICY KEY POINTS

Data is a business asset

Unified, comprehensive definitions are important

- What is Data Governance?
- What is Data Management?
- What is the relationship between the two?

One executive level officer is more functional than group of executives

- Needs to have dedicated (full-time) staff for data governance activities
DATA GOVERNANCE POLICY KEY POINTS

Do not need to have Chief Data Officer reside in IT
- High enough level to have authority to enforce data standards and to attract experienced and mature staff
  - Difficult to compete with private industry for same positions

Databases should not duplicated and centrally located
TECHNICAL TOOLS FOR DATA GOVERNANCE KEY POINTS

Data Access, Collection, and Storage

- Data access control is necessary in data governance
  - Iowa and Connecticut shared their AGOL user governance documents
- Many use FME to help data integration when no data standards exist
- Data warehousing option should be selected to compatible with all the tools an agency has invested in
TECHNICAL TOOLS FOR DATA GOVERNANCE KEY POINTS

Data Access, Collection, and Storage (cont.)

- It’s possible to have multiple data warehouses or servers, but
  - Minimize number of data formats, tools, and architectures to eliminate duplication of function and reduce complexity of overall system
- Data warehouses must be sole source for reporting
- Warehouse can be fed data by smaller databases that do not have to talk to each other
- Map out system architecture to show how systems are all related and identify owners for each element (Michigan DOT used Neo4j and OrientDB)
- Update warehouse on a regular schedule
  - Meet HPMS reporting deadline
TECHNICAL TOOLS FOR DATA GOVERNANCE KEY POINTS

Valuing Data and Making Investments
- Importance of data should dictate the level of accuracy and detail of data
  - This will direct data governance efforts
- Business drivers can determine which technologies to invest in

Funding
- Look for synergies with other funding priorities
  - Safety and emergency response
  - Transportation Asset Management
  - Transportation Performance Management

Communications Materials
- Executive summaries that explain to leadership the purposes and benefits of data governance programs
- Introductory level material to help familiarize staff with data governance
- Technical information to assist in completing and operating data governance processes and procedures
TECHNICAL TOOLS FOR DATA GOVERNANCE KEY POINTS

Starting the Data Governance Process

- Conduct a capability maturity model (CMM) assessment with data owners and users
- Set realistic targets for development
- Define
  - Standards for each level of performance
  - Tangible actions and resources to move the data through those performance levels
- Designate a “division champion” to demonstrate the value and cost/time savings of data governance processes
- Self-directed training is good but hand-on workshops could be better
- Lead liaison position between top executives and business units help data governance move forward
DATA GOVERNANCE STAFFING AND STRATEGY KEY POINTS

Appropriate staffing structure is important for data governance success

- Create new job series or descriptions with competitive salaried to attract experienced staff
- Need formalized positions who are in charge of data governance and data QA/QC
  - Not a collateral duty
  - Have authority to make policy changes
  - Be able to obtain required resources to be effective

Take advantage of existing training opportunities to get IT and GIS departments on the same page

- Help IT understand GIS system architecture
- Engage IT and GIS with data governance efforts
WHAT CAN FHWA DO?

Provide guidelines/guidebook on

- Providing justification for data governance to State DOT leadership
- Forming working groups

FHWA emphasizing the importance of data governance

- Fact sheets showing benefits

Webinars and other outreach activities on this topic
FOLLOW-UP ITEMS

Share Documents
- Data governance policies, language

Data Governance Sessions at the 2019 GIS-T Symposium

Future peer exchanges and case studies
PEER EXCHANGE PARTICIPANTS

Arkansas
- Linda DeMasi, linda.demasi@ardot.gov
- Sharon Hawkins, sharon.hawkins@ardot.gov

Connecticut
- Joe DiPietro, joe.dipietro@ct.gov
- (Greg Ciparelli, gregory.ciparelli@ct.gov)

Iowa
- Eric Abrams, eric.abrams@iowadot.us

Michigan
- Kevin McKnight, mcknightk@michigan.gov

Ohio
- Ian Kidner, ian.kidner@dot.ohio.gov

Tennessee
- Van Colebank, van.colebank@tn.gov
FHWA DATA MANAGEMENT AND DATA GOVERNANCE RESOURCES
ROADWAY DATA IMPROVEMENT PROGRAM (RDIP) TECHNICAL ASSISTANCE

Office of Safety, Bob Pollack (robert.pollack@dot.gov),

Key Technical Assistance Areas
- Roadway Data Collection and Technical Standards
- Data Analysis Tools and Uses
  - Data Sharing and Integration
- Data Management and Governance
  - Developing and Implementing Safety Data Business Plans
  - Stuart Thompson (stuart.thompson@dot.gov)

Additional examples of data governance efforts

1. Plan for Safety Data Management and Governance
   States the vision, mission, and outcome for the DBP

2. Assess Current State of Safety Data Program
   Summarizes past and current assessment recommendations and identifies gaps between current and desired capabilities

3. Establish a Governance Program
   Defines the core data principles, the governance model, and establishes roles and responsibilities for governance

4. Develop Tools and Technology for Safety Data Management
   Identifies the needs and weaknesses related to information technology tools and establishes a plan for enhancing or replacing those tools

5. Develop Action Plan
   Summarizes the system, technology, and institutional gaps; and identifies actions and priorities

6. Document the Safety Data Business Plan
   Documents the actual Data Business Plan using inputs from Steps 1-5

7. Implement and Sustain the Safety Data Business Plan
   Establishes performance metrics to measure success and feeds to Safety DBP implementation
TPM TOOLBOX

Transportation Performance Management Toolbox

- Office of Stewardship, Oversight and Management, Susanna Hughes-Reck (susanna.hughesreck@dot.gov)
- Guidebook and Assessment Tool
  - Component C. Data Management Assessment
  - Component D. Data Usability and Analysis Assessment
FHWA Office of Preconstruction, Construction and Pavements
- Thomas Van (Thomas.van@dot.gov)

State Data Quality Management Program
- Defines the acceptable level of data quality
- Describes how the data collection process will ensure this level of quality
- Addresses critical areas where errors can occur
  - Data collection equipment calibration and certification;
  - Certification process for persons performing manual data collection;
  - Data quality control measures to be conducted before data collection begins and periodically during the data collection program;
  - Data sampling, review and checking processes; and
  - Error resolution procedures and data acceptance criteria
- Required as part of TPM PM2 (System Performance)
HPMS

FHWA Office of Highway Policy Information
- Chris Allen (chris.allen@dot.gov)

Highway Performance Monitoring System
- National level
- Includes data
  - Extent
  - Condition
  - Performance
  - Use
  - Operating characteristics

HPMS Program Review
Data governance is important for good data.
- Data is a business asset
- Better data leads to better decisions
- Better data needs better data management
- Good and effective data management requires data governance

State DOTs understand the need for good data and are focused on improving data management and data governance

FHWA has resources to help State DOTs with data governance and data management.
OTHER RESOURCES OF NOTE

**NCHRP Synthesis 508**: Data Management and Governance Practices
- [http://www.trb.org/NCHRP/Blurbs/176005.aspx](http://www.trb.org/NCHRP/Blurbs/176005.aspx)

**TRB E-Circular 196**: Improving Safety Data Programs Through Data Governance and Data Business Planning
- [http://www.trb.org/Main/Blurbs/172446.aspx](http://www.trb.org/Main/Blurbs/172446.aspx)

- [http://www.trb.org/Main/Blurbs/173470.aspx](http://www.trb.org/Main/Blurbs/173470.aspx)
MORE INFORMATION

Data Governance & Data Management: Case Studies of Select Transportation Agencies


Contact: Mark J. Sarmiento, mark.sarmiento@dot.gov