Notes by Garrett Wheat, Amanda Holland and Frances Harrison

TRB 2025 Workshop: The Convergence of Data Governance, Information Management and Knowledge Management

WHEN: Sunday, January 5th 9 AM – 12 Noon

WHERE: Convention Center, 152A

Note: *This was an in-person workshop only.*

SPONSORS:

- AJE45 (Information and Knowledge Management),
- AJE15 (Workforce Development and Organizational Excellence)
- AJE10 (Strategic Management)
- AJE35 (Research Innovation Implementation Management)
- AED10 (Statewide/National Transportation Data and Information Systems)
- AED30 (Information Systems and Technology)

OVERVIEW:

The combination of workforce challenges, new opportunities for applying artificial intelligence and the desire to better share and leverage data for decision making are contributing to growing interest in data governance, information management and knowledge management. This workshop featured presentations from agencies taking a unified approach to these activities and a facilitated discussion of organizational models and processes for tackling these efforts holistically for maximum impact.

The first part of the workshop provided participants with a common understanding of the three disciplines and current transportation agency practices.

The second part of the workshop involved discussion of future directions for improving how these three disciplines are carried out to take advantage of synergies.

The workshop concluded with a summary of key takeaways – both ideas for immediate implementation as well as initiatives that TRB committees can pursue to improve the state of the practice.

RECOMMENDED ATTENDEES:

- Agency Data Leads/CDOs
- Agency HR/Training Leads
- Agency Knowledge and Information Management Leads
- Agency Librarians

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AGENDA

9:00 AM Welcome and Introductions

Part I: Understanding Current Practices

The workshop began with a discussion of what Data Governance (DG), Information Management (IM) and Knowledge Management (KM) have in common and how they are connected.

9:20 AM Overview Presentation: Connecting DG, IM and KM (Frances Harrison, Spy Pond Partners, LLC)

This presentation provided working definitions of Data Governance, Information Management and Knowledge Management, and reviewed points of connection.

Workshop Motivation

- 60-70% of the DOTs have data governance methods underway
- For KM, over half have some kind of program underway or are actively exploring
- IM – everyone is doing it, but a growth in techniques (AI, search, etc.)
- All require change in behavior and more standardization, along with sharing
- Analogy – Reese's peanut butter cups
    - Knowledge = peanut butter (people know what they need to do their job)
    - Information = chocolate (Data and information organization has is fully exploited/used)
    - Data Governance = wrapper holding everything together (roles and responsibilities for data)
    - All three work together, support each other to provide the complete experience

Definitions

- Data Governance:" The exercise of authority, control, and shared decision-making (planning, monitoring, and enforcement) over the management of data assets."
- Information Management: "The means by which an organization efficiently plans, collects, creates, organizes, uses, controls, stores, disseminates, and disposes of information and ensures that the value of that information is understood and fully exploited."
- Knowledge Management: "An umbrella term for a variety of techniques for building, leveraging and sustaining the know-how and experience of an organization's employees"

Useful models

- Data-Information-Knowledge-Wisdom pyramid
- Information and Knowledge Cycle (see NCHRP Report 813)
- Enterprise Architecture – inclusive of business, people/knowledge and information (as well as data, applications and technology)

Challenges and Opportunities to Improve

- Siloed management and governance processes
- No clear guidance on what to store/where to find
- ROT = redundant, outdated, trivial

9:35 AM Transportation Agency Perspectives:

Four speakers presented on their agency's current practices related to DG, IM and KM, how they are currently connected, and the potential for strengthening coordination and collaboration among practitioners responsible for each area.

Michael Ulrey, Data Program Manager, Virginia DOT – "The Glue of Governance: Connecting Data, Information and Knowledge at VDOT"

- Models are needed to allow us to tie data/information together – e.g. standard coordinate systems for land navigation
- VDOT is standing up a DG framework:
    - Communities of Interest (data collectors/managers) and Communities of Practice (data users) at the bottom
    - DG Board in the middle,
    - Data Council at the top – formalizes participation of data managers.
    - Board resolves conflicts, Council deals with resourcing
- VDOT's Enterprise Data Management Program supports this
- VDOT uses enterprise architecture (EA). Have business capability model but not yet sufficiently complete or at right scale to make it useful. Technology part is easier to map and it is used by IT to prioritize.
- Challenge: decoupling data and systems. They are independent – when the system goes away, you still need the data
- Have defined 8 primary data domains – environment, financial, network, etc. and built a logical data model – organized by domain. Purpose is to assign responsibility from individuals to data. Need other models, connected to get to the goal of using data to make better decisions.
- Another big initiative: Master Data Management (MDM) – metadata, lifecycle, context, quality, use cases, etc. Build knowledge about the data set. Metadata is just another

model – to capture contextual information. Context bubble: relationships, proximity, frequency of interaction

- We need more standardization! Example: ISO 19115 – need to anchor to it, use it, anchor to other models, etc. ISDFID
- Lack of common models prevents us from benchmarking against other DOTs. Only way to learn and build on each other is if we adopt and build out standards and commonality
- To get there, need governance. Need to raise attention to our managers/leaders, begin adoption

Alyson Tamer, State Value Management Engineer, North Carolina DOT – "NCDOT's CLEAR Program: Managing Information and Knowledge to Fuel Innovation and Continuous Improvement"

- Started CLEAR in 2018 thru a research project, rolled out 2020 – tool for knowledge capture and sharing – intended to address silos, provide feedback loops – design, construction, maintenance
- Parts of CLEAR:
    - Post construction assessments
    - Database for accessibility
    - Opportunities for sharing with Technical Advisory Groups and Lunch and Learns
    - Job Transfer Guides (now rolling out)
- Data Governance connection – helps us to get the consistency needed to answer questions like: how much $ was spent in my division, what work is upcoming? What is our pipe inventory? – DG helps to manage risk. Need an integrated strategy to address these questions.
- Strategy and Organization Evolution (2024):
    - Data, Technology and AI Strategy and Governance Plan – completed 2024, involved documentation review, survey, interviews, data/system inventory – found that 56% of employees didn't know or were unsure about the source of truth for their data. Starting rollout. Important for people to have the same definition of data to foster communication and understanding
    - Office of Strategic Initiatives & Program Support (SIPS) – includes Data & Information, Research and Forecasting, Programs & Projects. CLEAR program is in Value Management, now under Data & Information Branch (combines data management and KM). Emerging Technologies and Innovation, Research, Data and Technology, Performance and Operations, and Programs and Projects. Responsibilities include: data driven problem/gap identification,

modeling/scenario planning, strategy, transparency and accountability, governance .

- AI is driving the need for stronger governance to make sure data/content is up to date. Using AI to improve CLEAR database search, assist estimate generation for structures, invoice processing, public sentient analysis, chatbots for app help desks, pavement image classification, chat bots for program FAQs, data extraction and organization for traffic incidents.
- Looked at models from IN, FL, and AR state DOTs – setting up three committees: data governance, technology governance, AI governance – report up to executive committee. SIPS provides support. Also have working groups & subcommittees, collaborate with state-level IT organization.

Lorri Economy, Chief Learning Officer, Utah DOT – "Integrating Data, Information, Knowledge Management, and AI Search for Employee Success"

- The Knowledge-Data-AI Nexus
  - UDOT has been working over the past decade to put stepping stones in place for data governance, organizational KM, data quality, AI-powered search
- Data Governance
  - UDOT has had DG in place in the past, but hasn't been sustained
  - AI is driving a renewed focus on data governance – need to make sure the right content is in place to be found – otherwise AI search doesn't work.
  - Have a data and analytics group – lead on data governance, support from employee development
  - Need to emphasize training on data governance practices for new employees
- Info Management
  - Multiple systems feed into a data lake, creating curated data for query/reporting
  - Google resource sites
  - Document management – moving forward
  - Content collection
  - Records management
  - Information mapping
  - PII identification and protection
- KM
  - Connect, Share, Learn Innovate (don't use the term "KM") – emphasize how to connect the right info to the right people, learn from each other to innovate forward and become the transportation agency we want to be.

    - 2017 consultant study: found 36% of employees spent most of their time looking for data; 44% couldn't find what they needed
    - Knowledge governance is biggest challenge
- AI – Have 3 different projects
    - Parcel Detection: use of OCR + Google AI to identify parcels from plan sheets – was able to review 90K plan sheets and identify 56K parcels, significant time savings over a manual process.
    - Engineering Manuals: early stages of building knowledge base, working with project development group
    - Policy and Procedures chatbot – effort started in 2017 with compilation into single google drive, standardization, ownership, update process. Then, piloted AI tool for search. Found inconsistent answers to same prompts across testers. Reorganized the drive (to make sure archived versions weren't included), trained the LLM – consistency improved.
    - Take away: If you control the parameters of what AI is looking at and have governance, it is safe. Garbage in garbage out, need complete and accurate data, intentionally curated, data should be consistent, timely and relevant
    - Guiding principles for AI ethics: fairness and accountability, transparency, privacy and security, explainability, human involvement and decision making, resource impact
- Establishing truth is key and very important (tied back to previous presentations)
- Remember to include KM and DG in onboarding experience so all new employees understand how and where data/information/knowledge works in the organization
- Underscored Michael U's point about how many people conflate systems with data – need to break this perception.
- As AI comes into the picture, highlights how the silos are doing a lot of duplicative, unnecessary work. Need to bring the silos together and collaborate earlier on in the process

Erin O'Meara, Director of Data and Knowledge Management, Sound Transit – "Sound Transit's Journey towards Information Governance – how our Data, Knowledge, Records and Library Team is Taking Shape"

- Recent reorg: Leads team with data, knowledge, records, and library services + recent addition: design technology (CAD, BIM, As-Builts + dotted line to district document control function)
    - Staffing: 2 records, 1 each for KM, records, library, design tech 6

    - Services: standards, guidance, training, risk mitigation (work with IT, legal, infosec)
    - Vision: enable managing info and knowledge assets, agencywide strategies to improve ability to capture, transfer, surface and reuse content across lifecycle, foster innovation, transparency, collaboration and informed decision making. End goal: less time looking for info, find data we can trust
- Have business glossary, data catalog – partnership between data governance and KM. Consolidated existing glossaries.
- KM and Risk Management (RM) partnership: What goes where (KM), compliance (RM)
- Business toolkit – DIY version – common templates, how to's – collecting in one place, people can contribute. Trying to get people to build templates that can turn into enterprise tools.
- Have playbooks for each program– how it operates: training, outreach, reporting. Creates consistency, common practices. Also have job books for positions.
- Have an AI governance group, building a governance function
- Approach focused on content, context, and structure
    - This is the formula/foundation for all information
    - Helped to establish the common ground between siloed data
- A lot of the team's work is getting people to use the tools and systems already in place
- Need to go back to basics – what do we actually have, is this what we need? Gaps between info requirements to support business (use for a business capability model). Figure out distinction/relationship between data management, records management, document management + have complementary tech map
- Connections: all of these capabilities are foundations to support knowledge workers.
- Challenge – getting an accurate inventory of everything in the organization (data, records, knowledge, etc.)

10:50 AM Break (10 minutes)

- During the break, workshop participants were asked to put a dot on the IM, KM and DG functions their organization is currently performing (see Dot Exercise Results at the end of these notes).

Part II: Identifying Future Directions

Facilitator: *Amanda Holland, Holland Enterprise Resource Solutions, LLC*

11:00 AM Interactive Discussion on Opportunities for Improvement

- **How are you currently coordinating your data governance, knowledge management and information management activities?**
    - **Shared Models/Business Architecture** – glossaries, ontologies, topic areas, domains, knowledge graphs, process maps – helps us to find people, data, content of interest, opportunities to increase the usefulness of AI search.
    - **Roles & Communication** – building connections across defined roles (internal and external): records manager, innovation coordinator, IT customer relationship manager, data steward, team web content manager, state-level liaisons for HR, IT – enables identification of ways to work together, take advantage of synergies.
    - **Strategic Planning** – engaging IT, data management, knowledge management, library, records in an effort to recognize shared goals & define complementary + collaborative initiatives.
    - **Joint Initiatives** – training, data catalogs, web redesign, BI/reporting development, records retention schedules updating, content management practices (repositories & policies for using them, getting rid of ROT)
    - **Other**
- **Discussion: Why is it important to "connect these dots"?**
    - Miscommunication
    - Findability (hard to find relevant and up-to-date information) – lost time searching
    - Lost data/information/knowledge (especially when employees leave the agency or a critical position)
    - Inefficient onboarding (of new employees, consultants, contractors)
    - Data silos
    - Duplicative processes

11:15 Breakout Groups

Assignment: Write a "Wish" or a "Real" example of how to better connect data, information, and knowledge management in your organization (or your client organization(s)) and coordinate. Discuss with your group members and pick the top idea(s).

11:35 AM Report Out

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Synthesis of what we heard from the report out and subsequent discussion:

Need to Further Clarify and Describe the Problem

- All of this is an elephant – how do we identify and optimize it for everyone's purposes?
- Clarity of purpose and function – first figure out: what is the function or purpose within the agency to which these things are to be applied. Then, scope a project to guide the effort.
- Connect to real problem(s)
- Identify the specific use cases – what are the problems we are trying to solve?
- Focus on the WIIFM (What's in it for me?)
- Connect to employees
- Identify the knowledge debt that exists as well as the consequences when critical knowledge is lost
- Everything we've talked about end in the term "management" – Instead, change the message: what level of performance do you want to report to the governor. Show the benefit. From I need new tool/process to I can help you be successful. More on the benefit side. Good groundwork, knowledgeable people.

Messaging to Motivate Action

- Need to advocate for a radical shift – hey, you have this fancy megaproject for systems, but this is foundational. You have knowledge workers in your organization. The mountain of technical, data, info debt – need to resource it. Not just a "nice to have."
- TXDOT example: frame the DOT as an "information company" – we provide information to guide decisions and actions – improving and integrating these efforts are key to success
- Create a single source of truth and a single place to find it.
- Connecting the dots is critical to fulfilling the agency's mission of being a good steward of the public's money.
- Need for efficiency – not going to expand staff; make employees more productive.
- If you want to use AI, you need to have data that meets certain standards.
- Declaration: We will have a single searchable space where everyone will save their stuff.

Need for an Organizational Change Management (OCM) Approach

- Include OCM professionals in these conversations – from assessment to training, beginning to end.
- Conduct a thorough assessment of current and desired future state; assess stakeholder buy-in/change readiness.
- Get employees informed and ready to act.

- Be intentional – initiatives can falter once the pain point is gone.
- Keep initiative/program going – how sustain the effort?
- Education – engaging management and business units.
- Education about available data, pilot projects to reenergize data stewardship, focusing on business and benefits. Use asset management as an example. Show how data can impact people and lead to more efficiency (e.g. snow removal.)
- Marketing, communications around being good stewards to the public (includes being good stewards of data/information/knowledge).

Strategies for Connecting the Dots

- Integrate into strategic plans – build buy-in, consensus.
- Create a roadmap
- Focus on compliance, automation and support from leadership (make it impossible for people to fail to comply)
- Integrate into employee onboarding
- Use libraries as clearinghouse for collecting and sharing
- Use pilot projects for quick wins that energize business
- Create a searchable, central, department-wide GIS-based resource for all construction-related data from plans and concepts to construction
- Reorganize to establish chief data office and strategize project management office to better cross silos

11:45 AM Workshop Wrap-Up

Ideas for Implementation

- Prepare, learn, plan for change management
- Discuss: how to balance retirement ready workforce with change management (which may push them out)?

Research needs

- Create an actionable playbook or guide for connecting KM, IM, and DG . Cover how to assess each, guidance/checklist on what to look at, what steps to take.
- Identify models for organizational effectiveness that are applicable to public sector – e.g. Baldrige, Cotter, help leadership understand components that are important.
- Study of common enterprise mandates, enterprise use cases applicable to HR.
- Synthesis of success stories that we can use to tell our own stories (as well as cautionary tales).
- Study of best practices in applying AI for KM.

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12 Noon Adjourn

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Transportation Agency Functions related to KM, IM, DG (Dot Exercise)

- Data Governance
    - Data Governance Committees (5)
    - Data Stewardship Roles/Responsibilities (7)
    - Agency Data Policies and Standards Development/Approval (3)
    - Data Inventories/Catalogs/Business Glossaries (8)
    - Data Acquisition/Intake Processes
    - Metadata Management (Standards, Policies, Technologies) (3)
    - Data Sharing Policies/Agreements (4)
    - Data Access Policies/Controls (3)
    - Data Publication Processes (1)
    - Other
- Information Management
    - GIS/Spatial Data Management (9)
    - Document and Content Management Policies, Processes, Tools (2)
    - Data Analytics/Business Intelligence (7)
    - Search Tools – including use of LLMs, chatbots, etc. (4)
    - Business and Information Architecture
    - Master Data Management
    - Records Management Training and Systems (1)
    - Public Records Request Processes (6)
    - Library Services (3)
    - Other
- Knowledge Management
    - Communities of Practice/Learning Communities (4)
    - Knowledge Portals/Collaboration Spaces (3)
    - Knowledge Interviews (4)
    - Job Books/Desk Manuals/Continuity Books (1)
    - Lessons Learned/Best Practice/After Action Reviews (3)
    - Knowledge Audits or Maps (identifying critical knowledge and where it resides)
    - Knowledge Graphs/Semantic Networks
    - Business Process Maps (3)
    - Policies, Procedures and Manuals Update Processes and Access/Search Tools (6)
    - Expertise Directories
    - Other

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Sticky Note Exercise – Ideas for Connecting IM, KM, DG

Top Ideas (each table chose their top idea)

- Assessing current state
- Inventory of current system
- Evaluate data quality
- Optimization of technology to do our jobs better, easier, more efficiently
- Missed: need to integrate library as clearinghouse for information
- Identify the real-life problems so organization can connect those to the strategic plan
- Clarity of purpose and function ("Lighthouse" project)
- Asset management pilot – transferable to others (current initiative)
- Communication about stewardship – "break down the why"
- Get buy-in from agency leadership – find wedge/lighthouse issue
- Focus on people and automation to get to quality
- Searchable, central, department-wide GIS-based resource for all construction-related data from plans and concepts to construction

Other Ideas (aka, runners-up)

- AI
- What standards support "connecting the dots"? – i.e., ISO 19195
- How duplicative are our silos/existing data management processes within an agency?
    - How does that impact cost?
    - How does that impact transparency?

- Wish we had a working shared repository for unit information (information not found)
- Risk: Time spent finding the staff member who knows where the information is found
- Can't find information
- New employee training
- AI driving change
- Securing data
- Shared models
- Wish: that those working in BIM (better information management) on the business side be better connected to the data governance and knowledge management efforts at their agency
- Motivation: increased efficiency and more informed decision making
- Risks: potential discord
- Strategic planning
- Roles and communications
- Support enterprise application modernization
- Establish source of truth
- Be data driven
- Corral many duplicative initiatives
- Reorganize to establish chief data office and strategize project management office to better cross silos
- Desire: how to share the potential risks to highlight actual costs in order to support moving forward in these areas

- Desire: clearly articulate the need and return on investment in organizing work in these areas – how to start the conversation?
- Motivators: different people in different divisions created duplicative efforts to create data sources of truth (that conflict)
- Risks
    - Inefficient work
    - Information hard to find
    - Inconsistent results/data to answer business questions
    - Managers don't know detailed processes of team
- Impacts: loss of information when people retire, inconsistent onboarding
- Doing: strategic planning & leveraging data and technology advancement (Michigan DOT)
- Wish: searchable, central resource for all processes for our business tasks
- Motivation: move away from decentralization
- Shared model: ADCMS grant – BIM/3D design model
- Plans, roadmaps, blueprints
- GIGO (garbage in, garbage out)
- Must be strong leadership around compliance and automation
    - Need people to make it real
    - People and automation to get to quality (to produce outcomes)
- Authoritative data identification and consumption – efficiency gained
- Leadership buy-in and sponsorship needed
- A roadmap to prioritize and implement the activities
- Helping build FHWA MDODE blueprint (based on all "data spaces") model to enable national sharing of disruptions data (including organizational and technical components)

- Need to be able to collaborate across agencies/jurisdiction; understand national opportunities for efficiencies and emergency response – outcomes focused
- AI strategic plan at TxDOT to set vision, governance, risk management, use case prioritization
    - Created from 14 focus groups from 90+ people
- Improve capability to answer questions quickly and accurately
- Motivation (consulting firm): information is hard to find – we rely on the senior staff to pass knowledge to others
- Developing a data visualization tool that collects project data from multiple applications and presents them in a geolocated tool (consulting firm)
- Enterprise DQMD to support AI implementation
- Enforcement of policies and roadmap implementation
- Enterprise policy governance
- Pain transparency
- AI
- AI strategic plan
- Motivation: so much wasted time to find what we need and who is responsible for data
- What are effective models of enforcement (of standards, policies)?
- Succession planning very important for us
- We have a knowledge strategist at WSDOT who coordinates/collaborates KM activities
- Data governance
- Have an office of data governance
- Risk mitigation

- I would like to see data inventories for all data sources, including list of data elements/definition and data quality measures
- Motivation: AI deployment
- Eliminating fears of “what is AI”
- NYSDOT – build common data environment
- NYSDOT – joint AI committee
- Deputy Director said figure something out about knowledge management
- Data rich but information poor (DRIP)
- Re-energize data stewardship – focus on business benefits
- Do a pilot – quick wins that engage business – de-emphasize IT
- Request strategic plan – pull together “as is” relationship map
- Educate managers about business
- Revisit CDO role – priority and scope
- Strategic planning – records is an effort to reorganize
- Motivation: lack of data-dependent communication between silos or regions (divisions and districts)
- Why (VTDOT)
    - Employee turnover
    - Data silos
    - Huge amount of time lost searching
    - Duplicative processes
    - Modernization (both chosen and involuntary)
- Motivation: need to reorganize employee efforts due to low employee pool. Need to sift through data and reporganize.
- Connections doing it
    - Shared roadmaps

        - Assessments
            - Data completeness
            - Data owners
        - Data models – future state information flow
        - Data literacy
    - What (VTDOT)
        - New Bureau of Innovation, Learning, and Development
        - Houses our continuous improvement, training and Data/BI team
        - Next focus on KM and data literacy
    - Motivation
        - Staffing IT properly
        - Getting the agency information to flow (it's stuck)
        - Making decisions with right data
            - Missing data – data management
            - Business context – level of support – convey context
    - Why
        - Bring efficiencies
        - Better decision making
    - How Promote?
        - Strategic Data Plan
    - GIS data catalog = joint initiative between GIS, Bridge, IT, and business
    - Joint initiative: universities and department
    - Wish: more robust data analytics
    - Wish: agency records access and ownership policy with contractors and subcontractors
    - Actual: communities of practice across departments in certain subject areas
    - Strategic planning: BIM/Digital delivery – many states are working on short/long term plans
    - I wish the work in this area was being communicated
    - Involvement, connection with business units early

- Proactively get employees ready to implement the initiatives
- Missed opportunities:
    - Miscommunication
    - Using “old ways”
    - Systems not connecting
- Wish
    - AI standards/use policy
    - Integrate library with content management
    - Central repository or connected location

OTHER THOUGHTS/IDEAS:

- Systems in place, but will the hand-off continue effectively
- “Lose sight when the pain point is gone”
- Try to remember the “WIIFM” for the employees
    - Connect the ideas to the employees
- Organizational change management – include in the conversations and training from beginning to end – help with roadmaps and context
- As leadership changes, stakeholder management becomes important for buy-in
    - Along with employee retention
    -

Selected Related National Cooperative Research Studies

Report/Study	Year	Link
Knowledge Management		
NCHRP Report 813, A Guide to Agency-Wide Knowledge Management for State Departments of Transportation	2015	**Report and online version:** http://www.trb.org/Publications/Blurbs/173082.aspx http://sites.spypondpartners.com/kmdemo/
TCRP Report 194, Knowledge Management Resource to Support Strategic Workforce Development for Transit Agencies	2017	http://www.trb.org/main/blurbs/176944.aspx
ACRP Research Report 258: The Evolution of Knowledge Management at Airports	2022	https://doi.org/10.17226/27399
Information Management		
NCHRP Report 754, Improving Management of Transportation Information	2013	http://www.trb.org/Publications/Blurbs/169522.aspx
NCHRP Report 829, Leadership Guide for Strategic Information Management for State Departments of Transportation	2016	https://www.trb.org/Publications/Blurbs/174182.aspx
NCHRP Report 846, Improving Findability and Relevance of Transportation Information	2017	http://www.trb.org/NCHRP/Blurbs/176113.aspx
Data Management & Governance		
NCHRP Report 814, Data to Support Transportation Agency Business Needs: A Self-Assessment Guide	2015	http://www.trb.org/Main/Blurbs/173470.aspx
NCHRP Synthesis 508, Data Management and Governance Practices	2017	https://www.trb.org/Publications/Blurbs/176005.aspx
NCHRP Web-Only Document 419: Implementing Data Governance at Transportation Agencies	2024	https://nap.nationalacademies.org/catalog/28837/implementing-data-governance-at-transportation-agencies-volume-1-implementation-guide
NCHRP Research Report 1099: Business Intelligence Techniques for Transportation Agency Decision-Making	2024	https://nap.nationalacademies.org/catalog/27819/business-intelligence-techniques-for-transportation-agency-decision-making
NCHRP Project 23-27, Strategies for Developing and Using Data Ontologies for Data-Driven Decision-Making	Active Project	https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=5215