Ohio Department of Transportation

Data Governance

Ohio's People, Processes, and Technology

SAFETY DATA CASE STUDY

FHWA-SA-20-059

Federal Highway Administration Office of Safety

Roadway Safety Data Program

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

U.S. Department of Transportation
Federal Highway Administration

Ohio Department of Transportation

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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)

Acronyms

Acronym	Description
ADKAR	Awareness, Desire, Knowledge, Ability, and Reinforcement
CDO	Chief Data Officer
CMM	capability maturity models
DBO	Data Business Owners
DGC	Data Governance Committee
DGO	Data Governance Office
DoIT	Department of Information Technology
FHWA	Federal Highway Administration
GIS	geographic information system
ODOT	Ohio Department of Transportation
PMO	Project Management Office
ROI	return on investment
SME	subject matter expert
TAMAG	Transportation Asset Management Audit Group
TSMO	Transportation Systems Management and Operations

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Executive Summary

This case study documents the institutional advances of the Ohio Department of Transportation's (ODOT's) data governance program. In 2020, ODOT is in the final year of the agency's Data Governance Plan established in 2017; ODOT's latest Data Governance Strategic Roadmap plans activities through 2025. While this effort began as an undertaking by the Division of Planning, the agency has since established an independent Data Governance Office (DGO) that oversees ODOT's Data Governance Committee and Data Governance Framework. The DGO is headed by the newly created Chief Data Officer (CDO) position, and the CDO is responsible for executing data governance policies, strategic planning, and institutional change management. ODOT uses Prosci's Awareness, Desire, Knowledge, Ability, and Reinforcement model for organizational change management related to data governance. ODOT has committed to demonstrating the effectiveness and benefits of data governance to the organization by calculating the return on investment that data governance provides to ODOT's daily business practices. By incorporating people, processes, and technology into its approach, ODOT continues to successfully implement data governance as part of its overall institutional strategy.

Introduction

The Ohio Department of Transportation (ODOT) needed guidelines and rules to develop a formal framework for enterprise data. In order to develop this framework, ODOT formalized data life cycle interactions between people, processes, and technologies to support the agency's broader objectives. ODOT sees data governance as a key driver in its approach to data management.

In 2020, ODOT is in the final year of the agency's Data Governance Plan established in 2017. Beyond 2020, data governance will be a permanent feature of ODOT's data life cycle management process. ODOT made significant progress in data governance efforts in 2019 by establishing the Data Governance Office (DGO), Chief Data Officer (CDO) position, the Data Governance Committee (DGC), and a Data Governance Framework.

At the beginning of the data governance formulation process, ODOT staff held several beliefs and conceptions of what data governance entails. Through this effort, ODOT now defines data governance as establishing guidelines and rules of engagement for business and management activities of enterprise data.

ODOT's data governance activities began in the Division of Planning under Asset Management. Safety data—crash, roadway inventory, and traffic volumes—are also addressed under this agency-wide framework. This ensures accurate, consistent, and timely data for safety analysis and implementation of projects.

Roles and Responsibilities:

The Data Governance Framework includes four levels of responsibilities:

- Strategic
- Tactical
- Implementation
- Support

Target Audience:

- Executive Leadership
- Data Governance Committees
- Information Technology Staff
- Data Managers and Stewards
- Subject Matter Experts

Data Governance Framework

Figure 1 illustrates the three-tiered framework, beginning with the strategic Data Governance Organizational Business Drivers. Governance activities support these strategies through planning and performance monitoring, and Data Life Cycle Management activities form the core day-to-day data management workflows. Each tier reinforces the others to ensure that agency activities meet agency priorities.

Within these tiers, the framework consists of four levels of groups with various roles and responsibilities: Strategic, Tactical, Implementation, and Support.

The **Strategic** level consists of ODOT executive leadership and responsibilities including:

- Setting the overall direction of data governance at ODOT in alignment with core strategies.
- Supporting the data governance policy.
- Providing oversight and accountability.
- Providing human resources and funding.
- Resolving escalated data conflicts.

ODOT's Data Governance Framework, *"establishes guidelines and rules of engagement for business and management activities of enterprise data. It formalizes data life cycle interactions between people, processes, and technologies to support positive outcomes"*
(Ohio Department of Transportation, 2020, slide 2).

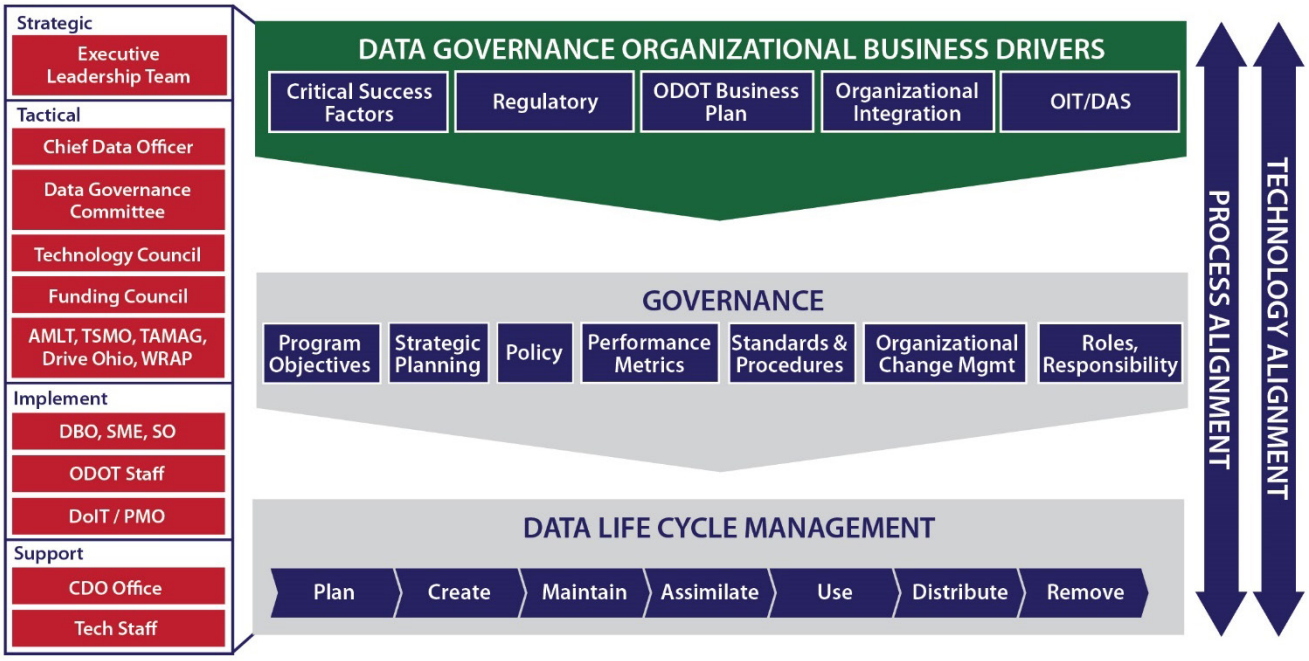

Figure 1. Graphic. ODOT Data Governance Framework.

Members include the Director of ODOT, along with the Assistant Directors of Business and Human Resources, Chief Engineer and Transportation Policy, and Field Operations.

The **Tactical** level consists of the CDO, DGC, Technology Council, Funding Council, and other disciplines like the Transportation Asset Management Audit Group (TAMAG) and Transportation Systems Management and Operations (TSMO). This group plans, develops, implements, supports, monitors, and allocates funding for data governance activities. The Tactical level provides a forum to address critical data issues.

The **Implementation** level consists of Data Business Owners (DBO), subject matter experts (SMEs), ODOT Staff, the Department of Information Technology (DoIT), and the Project Management Office (PMO). This group manages the programs, systems, and technologies that ingest data and practically apply data governance. Groups in this tier are responsible for communicating between SMEs and DBOs, participating in training, and adhering to policies.

The **Support** level consists of DGO staff and technical staff who are accountable for data governance through executing, enforcing, and providing feedback where needed. These staff members are experts in their data and systems; they advise SMEs, DBOs, and the DoIT on data governance policies and formal documentation for business and technical consumption.

Although the framework is new, most of these groups existed prior to a formal data governance structure; the DGO and DGC are the only new organizations created by data governance.

Data Governance Committee

The DGC held its first meeting in May of 2020. It has a leadership role in the oversight and perpetuation of ODOT's data management strategy. The DGC's goals include:

- Fostering a culture of data quality and data-driven decision-making.
- Creating structured roles and responsibilities.
- Facilitating collaboration, education, and standardization where appropriate.
- Ensuring data policies align with ODOT's strategic plans.

The DGC does not replace any existing groups; it assists and streamlines the activities of these existing groups (figure 2).

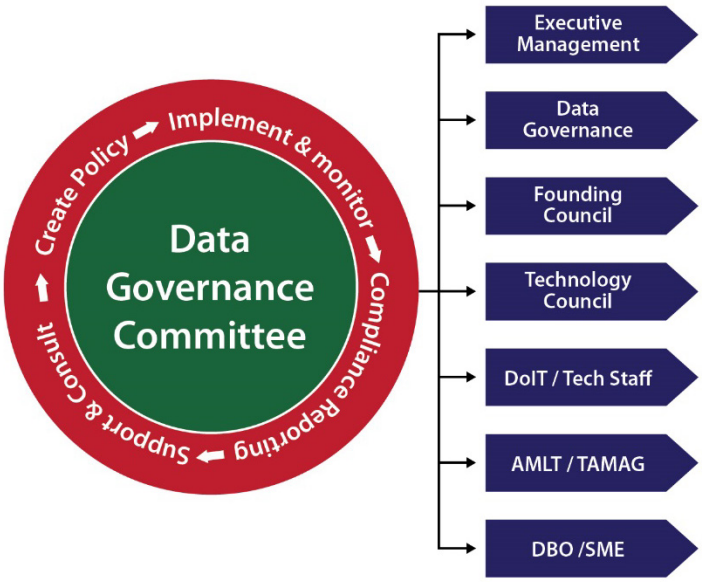

Figure 2. Graphic. ODOT groups that support the DGC.

The DGC meets monthly and on an ad hoc basis as required. The committee consists of 19 core participants, with other business process and data experts engaged as needed. The DGC membership is tiered in four different levels according to their active participation and voting power (figure 3).

- The **Strategic** and **Tactical** tiers, comprised of executive leadership and asset group managers respectively, have voting power and actively participate.
- The **Support** tier, comprised of data experts, division-level experts, the DoIT, and other support staff (e.g., legal, finance, human resources, etc.), involves active members that support the data governance program across ODOT, but do not vote on DGC business.
- The **Advise** tier, comprised of technical members like the TAMAG and TSMO groups, advise the DGC as needed.

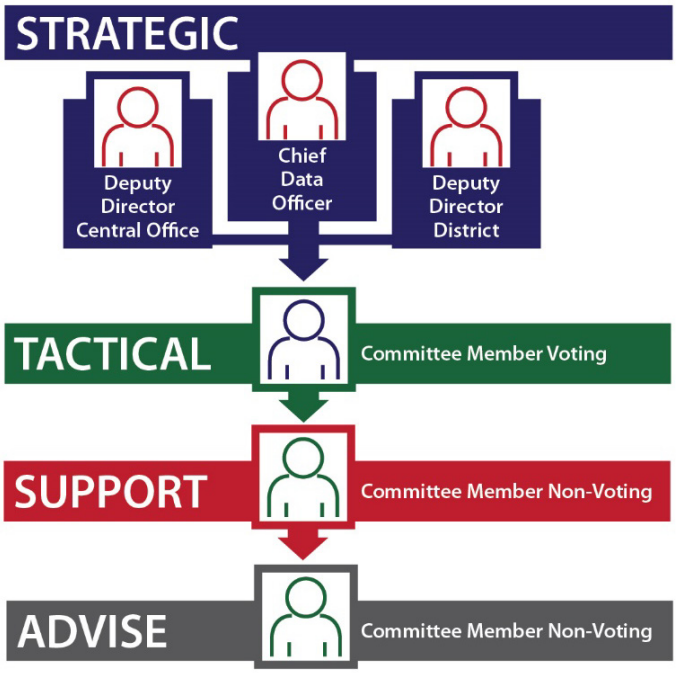

Figure 3. Graphic. DGC membership structure.

The DGC and its relationship to other partner groups, the processes it oversees, and its role in data governance are well-defined and documented in the DGC Charter.

Data Governance Office

Originally a part of the Division of Planning, the DGO exists outside of the DoIT. It is accountable for implementing the Data Governance Framework, allocating resources, and executing governance activities. As of spring 2020, the DGO consists of the CDO and two data analysts. Responsibilities of the CDO include:

- Implementing the Data Governance Framework.
- Executing data governance policies and procedures.
- Developing a multi-year strategic roadmap for data governance activities.

The CDO is responsible for organizational change management through communication, education, and training. The CDO also manages the agenda for the governance portion of the Executive Leadership Team and chairs the DGC.

The TAMAG also exists under the DGO. This allows the DGO to manage both structured and unstructured data systems and provides consistency in the program's implementation. This arrangement provides a direct connection between ODOT's business needs and the overall vision of the program.

Data Life Cycle Management

Ultimately, data governance exists to manage the collection, maintenance, and application of data and data-related technologies. Because data serves multiple purposes and users within the agency, ODOT has formalized an agency-wide data collection workflow. A data collection request is submitted to the TAMAG who decides:

1. **Who is the data owner?**
2. **Who will collect the data?**
3. **How will data be collected?**

This process helps ODOT continually manage data collection requests, develop collection cycles, and ensure standards are enforced.

Training

ODOT uses Prosci's Awareness, Desire, Knowledge, Ability, and Reinforcement (ADKAR) model for organizational change management related to data governance. To raise awareness, ODOT also created marketing materials to communicate data governance principles and policies. ODOT developed one-page flyers and produced television advertisements to play in county garages and offices through ODOT TV. Data governance can be a difficult concept to practically apply and communicate, and these marketing materials explain the importance of data collection and management in non-technical, easy-to-understand illustrations.

Maturity Assessment

In 2017, ODOT hired a contractor to measure the department's maturity in data governance. This survey of data business owners assessed 15 dimensions of data quality, data usability, and data accessibility. Like other capability maturity models (CMM), this assessment assigned a score between 1 and 5, with 1 representing an ad-hoc, informal approach to data management and 5 indicating a streamlined enterprise system that is continually optimizing its procedures. Now, some dimensions of the original assessment are no longer relevant, and the CMM needs to be updated to reflect the agency's progress. ODOT plans to reassess its performance following the implementation at the end of 2020.

Benefits

ODOT identified inefficiencies in their data lifecycle management process that could be addressed through better data management and data governance. These are tangible costs to ODOT, including an annual sync of the Structural Management System to the linear referencing system, where some assets have conflicting standards, regulations, and integration methods. Data integration can also be a challenge when common data codes are recorded inconsistently across different systems. Figure 4 illustrates some of the benefits associated with data governance, including:

- **Implementing standards** ensures data accuracy, consistency, and completeness.
- **Managing data lifecycle** ensures coordination, accessibility, and flow of information.
- **Establishing measures** ensures compliance and reliability and allows ODOT to calculate a return on investment (ROI).

Return on Investment

ODOT recognizes that data are an asset and should be tracked and managed accordingly. The use of data can help make more precise and concise decisions, resulting in added quality, savings, and improved performance. To quantify the management and use of data, ODOT has pursued an ROI approach to performance assessment to reinforce the value of the data governance program. ROI is calculated by dividing the cumulative benefits of an investment by its costs. Examples of quantifiable benefits include reduced labor-related costs, increased productivity with new tools and processes, reduced equipment costs, optimized project delivery costs, and reduced travel time for data collection.

ODOT identified some opportunities for improvement and their cost to the agency in data collection, data management, applications (e.g., mobile business intelligence, preventative maintenance), and others in the realm of construction, legal mandates, and environmental (figure 4). Potential benefits can be in the form of added value to existing processes or as mitigation of existing challenges. ROI can be calculated at the project level, to show the benefits of implementing changes or process improvements, or ROI can be calculated at the program level to show benefits for the whole organization.

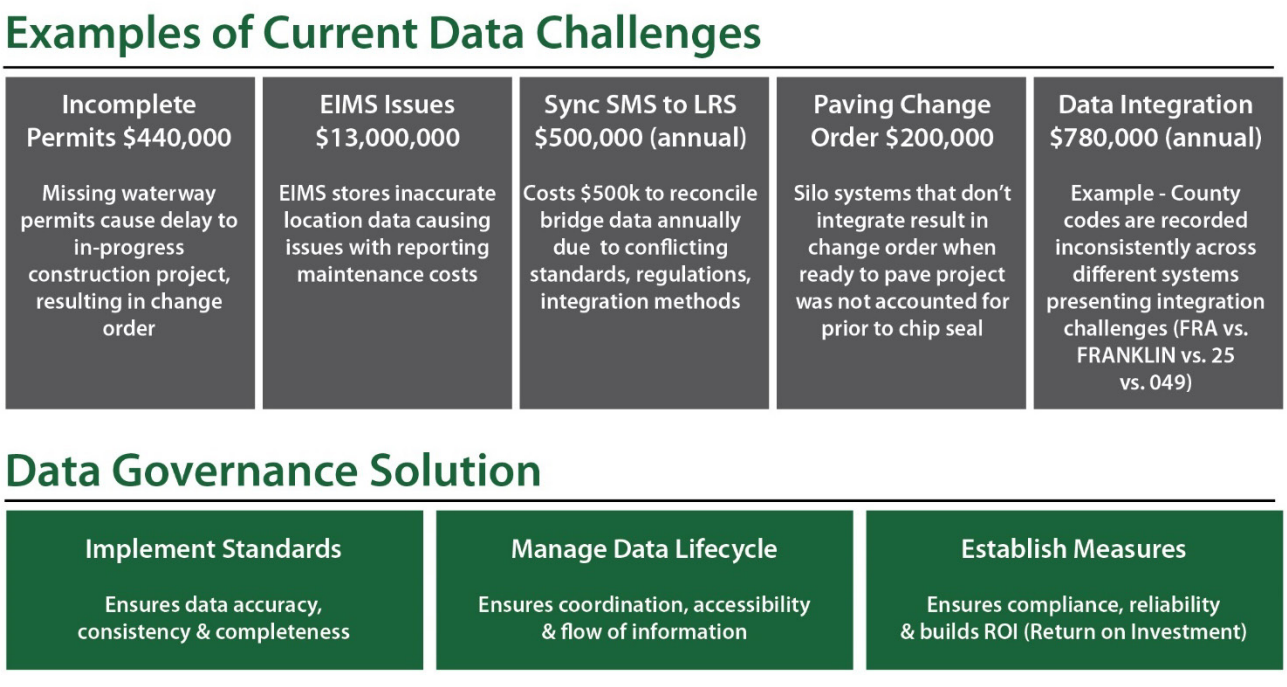

Figure 4. Graphic. Examples of data governance benefits and ROI for ODOT.

Regular self-assessments help ODOT determine opportunities for the highest ROI and increase efficiencies. With the assistance of a consultant, ODOT compiled these findings in a white paper (*ODOT Data Governance: Return on Investment in Transportation Data Governance*) that defined the various types of ROI analyses and their inherent qualitative and quantitative elements and established a potential framework for future ROI calculations within the data governance program.

The white paper provided various examples of how ROI can be used in action to align ODOT's Transportation Asset Management Plan and data governance. For example, annual asset inspections place an emphasis on personnel to adequately and efficiently track the assets and meet inspection requirements. The data collection method is manual, requires a significant amount of staff time, and is not standardized. As a result, collected data may not be consistent. Furthermore, maintenance is often reactionary to declining conditions, as opposed to planned. Implementing a formal, proactive solution will reduce the amount of staff and time required to complete inspections and will increase the quality of the collected data. This can also reduce the amount of unplanned maintenance incidents over time as asset conditions can be more reliably tracked and preventative maintenance can be planned. By automating data conversion from design files to a geographic information systems (GIS) format, ODOT estimates over $2.5 million in savings in a five-year period due to labor and resource costs, with a 238 percent ROI in the first year alone. ODOT will implement this process beginning in July of 2020.

In undertaking the ROI approach to data governance assessment, ODOT can evaluate potential projects, business processes, technologies, and overall data governance programs to prioritize those with the most promising ROI.

Challenges

Executive support has been critical in moving data governance activities forward in Ohio, but institutional changes have occasionally provided barriers to implementation. For instance, staff turnover at the administrative level has led to brief periods of change in the level of support for the program. However, program champions persistently communicated the programmatic benefits of data governance in terms of cost savings, ROI, and alignment with ODOT's broader objectives.

Legacy systems within ODOT have also posed a challenge to data governance implementation. These programs will take more effort to integrate into the Data Governance Framework than newer solutions; business rules already exist, and current data business owners may have a different understanding of data ownership. This challenge illustrates the critical role of the DGO in conducting change management at ODOT.

Next Steps

On a programmatic timeline, ODOT's strategic roadmap for data governance is a coordinated effort between the DGO and the DoIT. This plan currently schedules annual activities through 2025 (figure 5). Key steps for this process include adding new data systems, implementing a new data warehouse, and continual re-evaluation and self-assessment of the program. Additionally, ODOT will conduct regular ROI analyses of the data governance program to ensure cost effectiveness and maintain executive support for the initiative.

On a short-term, project-level timeline, ODOT's data governance priorities involve continuing to map the agency's data systems and building the workforce engaged in the day-to-day data governance (figure 6). A hurdle in data integration will be the processes and technological components that need to be assessed for each data asset. As a result, data business plans are a core function of the current data governance initiative in 2020. This entails DGO meetings with each data business owner to map legacy systems and plan for structured data and policies. These plans will cover all data collected and integrated by ODOT.

In the future, ODOT desires to integrate data from local agencies. Currently, local agencies do not use ODOT's enterprise applications. Local involvement has focused on asset management and data collection. Data governance has not been a core focus of local interaction as of spring 2020.

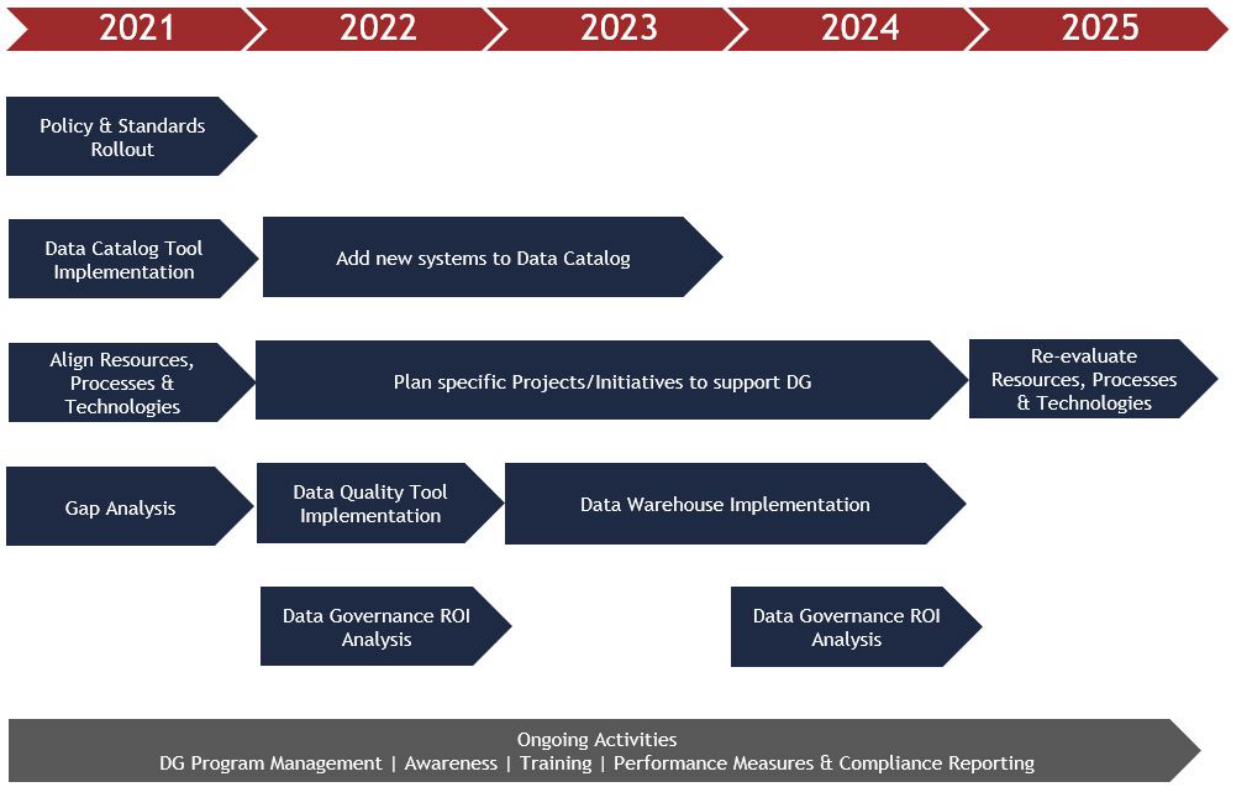

Figure 5. Graphic. ODOT's Data Governance Strategic Roadmap.

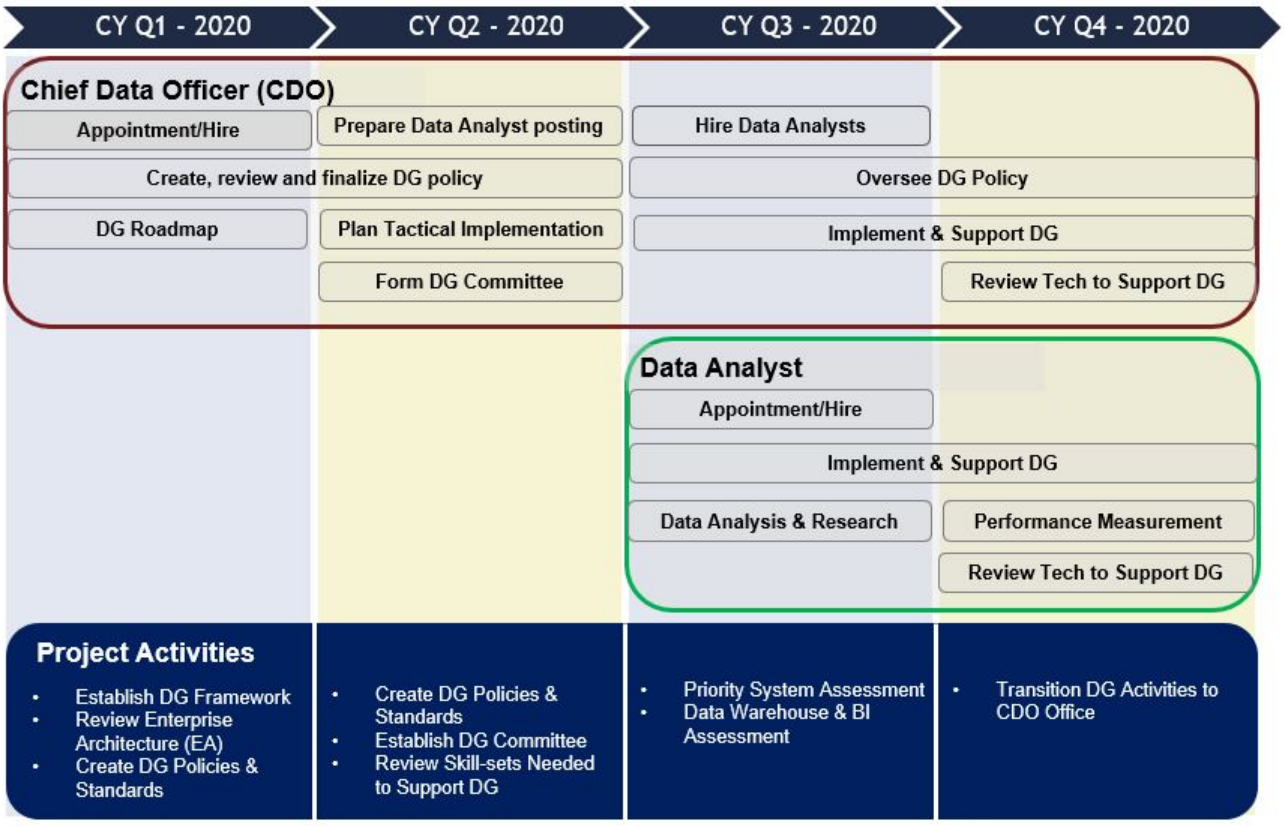

Figure 6. Graphic. ODOT's Task-Level Data Governance Plan (2020).

Conclusions and Lessons Learned

ODOT understands that data and technology are only two components of an effective data governance program; people are the critical link to translate data into enterprise technology (figure 7). This allows the agency to effectively manage the transportation system. ODOT has focused most of its data governance effort to date on aligning the agency's existing data and technology groups, DoIT, TAMAG, Technology Council and others, within the Data Governance Framework. The DGO exists as an independent body, able to negotiate the interaction between these groups in a common forum, the DGC.

Software and technology are not the enablers of good data governance, they are the result of good data governance. As ODOT continues to develop data business plans with individual data business owners, these conversations will allow ODOT to identify solutions that reinforce ODOT's strategic goals, rather than allowing the business rules inherent in purchased software to guide the agency's workflow.

Re-evaluation is another cornerstone of ODOT's data governance program. As ODOT follows its strategic roadmap and new data systems come online, the agency has set clear milestones where it will evaluate its performance and program maturity. This will allow the agency to determine if it is moving from a more ad-hoc and siloed approach, to a program that is working to optimize its practices. It will take time for ODOT to reach the optimizing stage. Steady progress reinforced by change management, training, and a culture of data governance will allow ODOT to be more effective data stewards.

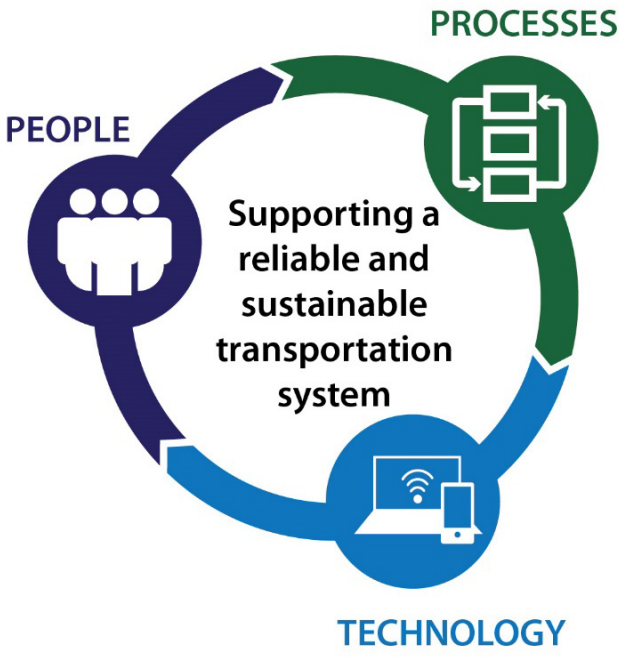

Figure 7. Graphic. ODOT's data governance philosophy.

Finally, to underscore the value of data governance, ODOT plans to regularly conduct ROI analyses to quantify the program's importance to the overall mission of the agency. These studies will allow data managers and business owners to understand the practical and tangible benefits of participating within the Data Governance Framework.

References

- **Ohio Department of Transportation. (2020). *Data Governance Committee Charter*, Columbus, Ohio.**
- **Ohio Department of Transportation. (2020). *Design File to GIS ROI Use Case*, Columbus, Ohio.**
- **Ohio Department of Transportation. (2020). *ODOT Data Governance: Managing Information to Save Lives and Money* [PowerPoint Slides].**
- **Ohio Department of Transportation. (2019). *ROI in Transportation Data Governance*, Columbus, Ohio.**
- **Ohio Department of Transportation. (2014). *Technology Council Charter*, Columbus, Ohio.**
- **Ohio Department of Transportation. (2016). *TAMAG Charter*, Columbus, Ohio.**
- **Phone Interview on May 27, 2020, with Ian Kidner and John Puente.**

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