The National Academies of
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TRANSPORTATION RESEARCH BOARD

Governing Data to Improve Transportation Asset Management

October 1, 2020

@NASEMTRB
#TRBwebinar

PDH Certification Information:

- 1.5 Professional Development Hour (PDH) – see follow-up email for instructions
- You must attend the entire webinar to be eligible to receive PDH credits
- Questions? Contact Reggie Gillum at RGillum@nas.edu

The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Providers Program. Credit earned on completion of this program will be reported to RCEP. A certificate of completion will be issued to participants that have registered and attended the entire session. As such, it does not include content that may be deemed or construed to be an approval or endorsement by RCEP.

RCEP

REGISTERED CONTINUING EDUCATION PROGRAM

#TRBwebinar

Learning Objectives

1. Identify effective data governance techniques

2. Discuss data governance and how it applies to all modes of transportation

#TRBwebinar

Transportation Asset Management Conference Webinar
October 1,2020
1:00 – 3:00 PM Eastern

Governing Data to Improve Transportation Asset Management

Jack Stickel
Tempestas Enterprises
Alaska DOT&PF (retired)
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Calendar > Blurbs > 13th National Conference on Transportation Asset Management - Abstracts due October 9, 2020

13th National Conference on Transportation Asset Management - Abstracts due October 9, 2020

Convened by Transportation Research Board, the 13th National Conference on Transportation Asset Management will be held on August 7-10, 2021 in Boston, MA. The conference is expected to cover a broad range of asset management topics, including transit state of good repair and adaptation to extreme weather and climate change.

Both practical and innovative presentations for the five technical tracks and two cross-cutting issues will be accepted through **October 9, 2020**. In addition to abstracts describing highway applications, abstracts that highlight topics featuring transit applications and transportation asset's resilience to extreme weather events are of particular interest. Selected abstracts will be featured in either poster sessions or technical podium sessions.

This conference was originally scheduled for July 2020.

http://www.trb.org/Calendar/Blurbs/178208.aspx

Possibilities of Strong Data Governance in Asset Management*

- Provides standards for data transparency and protection
- Establishes trusted, certified data
- Offers a chance to channelize and consolidate data
- Establishes business information and data ownership model
- Establishes short and long-term data agility

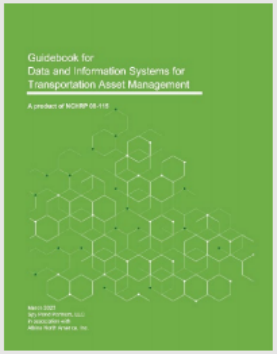
* CIO Review, 31 July 2019, https://www.cioreview.com/news/possibilities-of-strong-data-governance-in-asset-management-nid-30078-cid-114.html



NCHRP Project 08-115

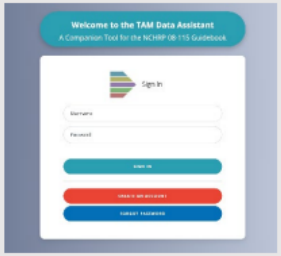
Guidebook for Data and Information Systems for Transportation Asset Management

Is your agency effectively using data and information to support its transportation asset management (TAM) program? Two new products of NCHRP Project 08-115 can help you improve.



The *Guidebook for Data and Information Systems for Transportation Asset Management*

The guidebook provides a structured approach to assess current practices and improve use of data and information for TAM. Apply this approach in a comprehensive fashion, target particular assets or focus on a specific topic area – such as data collection or data integration.

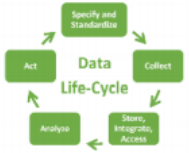


The TAM Data Assistant www.dataassessment.tam-portal.com

A companion digital application – available on the AASHTO TAM Portal. Complete a guided workflow to capture and record results of current practice assessment, improvement identification, and improvement evaluation exercises. Review summary and communication materials and export detailed results.

About the Guidance

The Guidebook provides detailed technical guidance and step-by-step techniques addressing common TAM data needs and uses.



Five-Step Improvement Process. Focus assessment activities using the guidebook's comprehensive data life-cycle framework, organized around five steps for making efficient and effective use of data and information for TAM.

Detailed Practice Benchmarking and Improvement Identification. Evaluate the current and desired state of agency practice against benchmarks and identify gaps for improvement. Select from potential improvements to close gaps and move the agency TAM program to the desired state.

Improvement Evaluation. Analyze and prioritize selected improvements. Characterize individual improvement impacts, level of effort, and potential organizational challenges.

Communication and Implementation Support. Secure funding and resources with automatically generated materials describing assessment results. Review case studies for ideas on scoping, resourcing, and execution of improvements. Use documented organizational practices to overcome institutional challenges.

NCHRP Project 08-115

Guidebook for Data and Information Systems for Transportation Asset Management

About the TAM Data Assistant

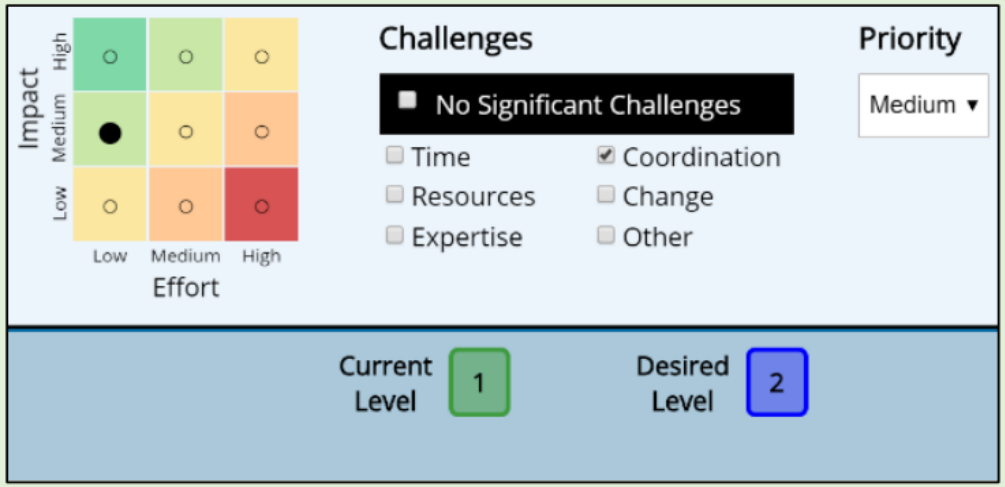
The TAM Data Assistant is a web-based application designed to complement the printed guide. The TAM Data Assistant provides tools to support performance benchmarking, prioritization of improvement actions, and the development and communication of your own improvement plan.

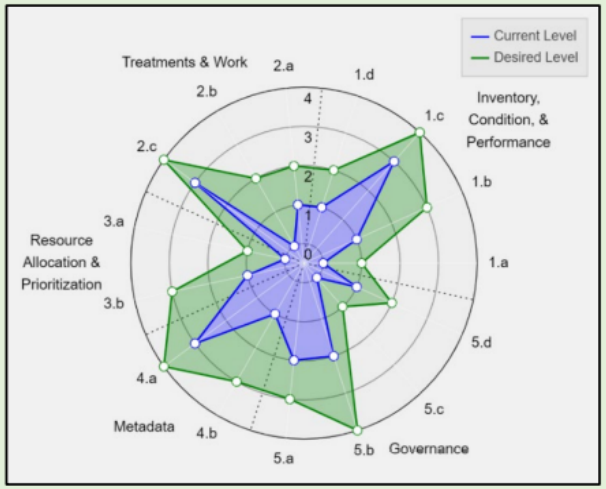
Benchmark Practices and Select Improvements

Benchmark Practice Level Description	Current Level	Desired Level	Improvement 1	Improvement 2
The agency has not defined any consistent definitions or methodologies for tracking inventory information for a given asset or asset type.	0	0	Define the "asset" and determine how the asset inventory should be recorded to support current/desired practice.	Coordinate with field and office staff to identify current inventory data collection practices and standards.
The agency has defined the "asset", documented how this asset's inventory should be tracked (e.g. modeling vs. true inventory) and defined the general form for inventory data (e.g. asset points, lines, or polygons, or roadway segments, general asset counts).	1	1	Develop the "asset breakdown structure", providing clear criteria for identifying various asset "sub-types" and "components". Selected	Evaluate existing inventory standards to identify gaps or inconsistencies in current standards for improvement.
The agency has established an asset breakdown structure for the asset, defining various asset subtypes and components. Clear and comprehensive criteria for evaluating these assets into these sub-types and identifying various components are established.	2	2	Specify detailed inventory data elements for each asset, sub-type, and component. Set required, recommended, and optional inventory data.	Specify minimum levels of inventory data coverage to meet decision-making, communication, and reporting needs. Selected
The agency has identified a minimum set of standard inventory attributes to be stored for the asset (e.g. unique identifier, location, install date, asset subtype, size/measure). Required, recommended, and optional data elements are identified. Desired extent of collection is established.	3	3	Document a detailed asset information model facilitating direct integration of asset inventory with maintenance work orders and project files.	
The agency has defined a detailed asset information model that supports direct integration with project and maintenance information, contracts and/or design files.	4	4	**Assessment Stats:** # of Selected Improvements: 2 # of Custom Improvements: 0	

Select from candidate improvements to address identified practice gaps.

Evaluate and Prioritize Improvements and Communicate Outcomes





Prioritize selected improvements based on implementation impact, effort, and challenges. Export summary materials directly from the tool to communicate to executives and advocate for priorities.

Visit www.dataassessment.tam-portal.com to create an account and begin using the Data Assistant today.

Questions or Comments?

Contact William Duke at: wduke@spypondpartners.com.

Presenters

- John Puente, Ohio Department of Transportation: *Data Governance and Organizational Change*
- Tamara Haas, New Mexico Department of Transportation: *Taking the Next Step for TAM With Data Governance*
- Margaret-Avis Akofio-Sowah, WSP USA: *Decision Making in Transit Asset Management Investment Prioritization*
- Yun Bai, Rutgers University: *Development of an Asset Management Tool for the Maritime System*

Data Governance

OHIO DEPARTMENT OF TRANSPORTATION

JOHN PUENTE, CHIEF DATA OFFICER

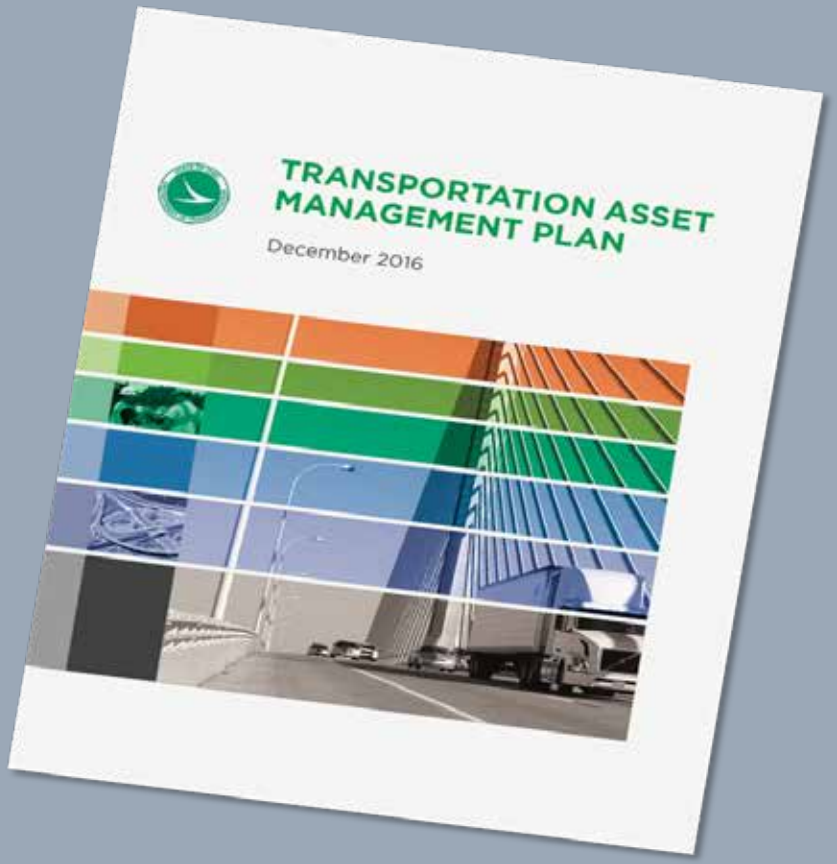
WHERE WE STARTED - TAMP

The TAMP Documents:

- ODOT's preservation strategies
- Planned investments using anticipated funding levels

Goals for the Transportation Asset Management Plan (TAMP):

- Outline the short- and long-term plans for investments in people, technology, and process improvements.
- Drive investment decisions.
- Hold the agency and its employees accountable.
- Lead to a more reliable, sustainable transportation system.



- Performance Based
- Data Driven

- 850,000 Active Assets
- Collector
- Unique IDs
- TAM Audit Group Standards

TRANSPORTATION ASSET MANAGEMENT

- **Gap Assessment**
- **Level of Confidence**
- **Users and DBOs**
- **Established Current/future Goals**

CAPABILITY MATURITY MODEL


The Office of Data Governance
Managing information to save lives and money

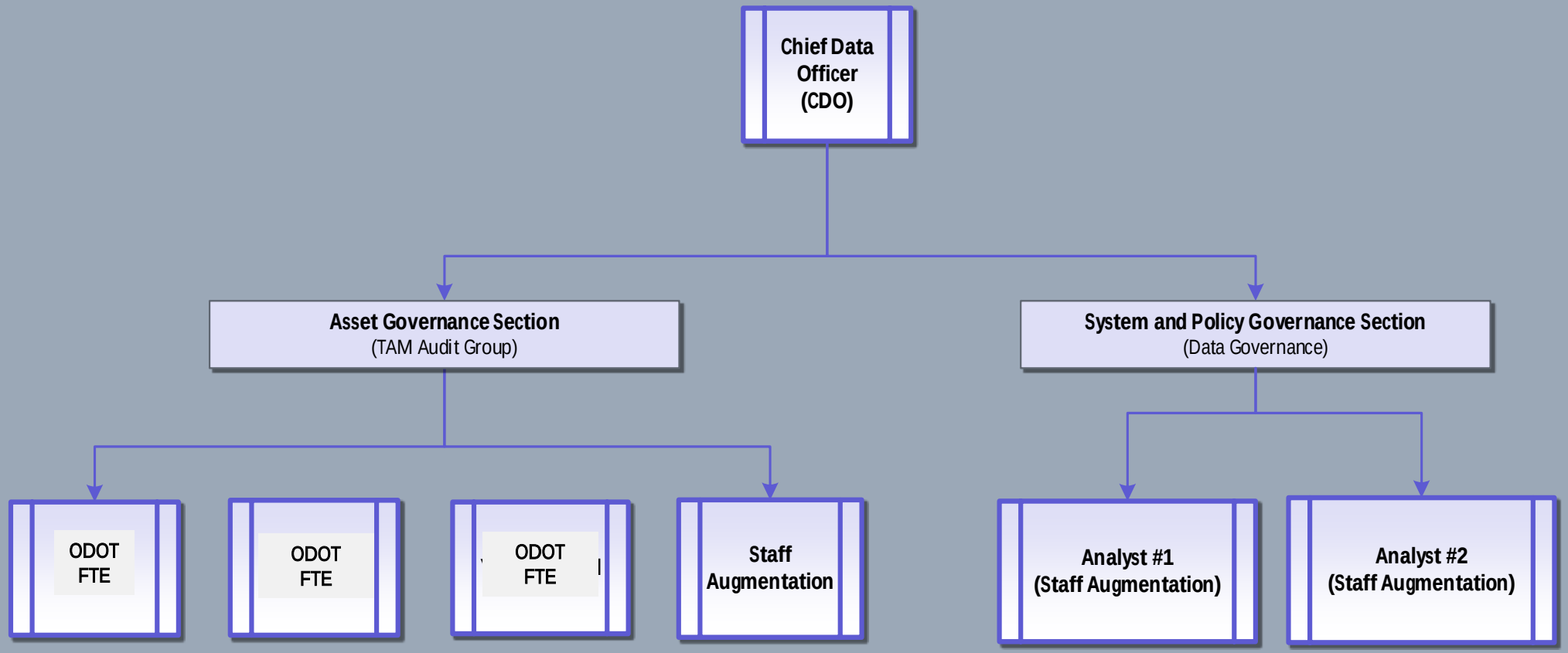
THE MESSAGE

Data Governance

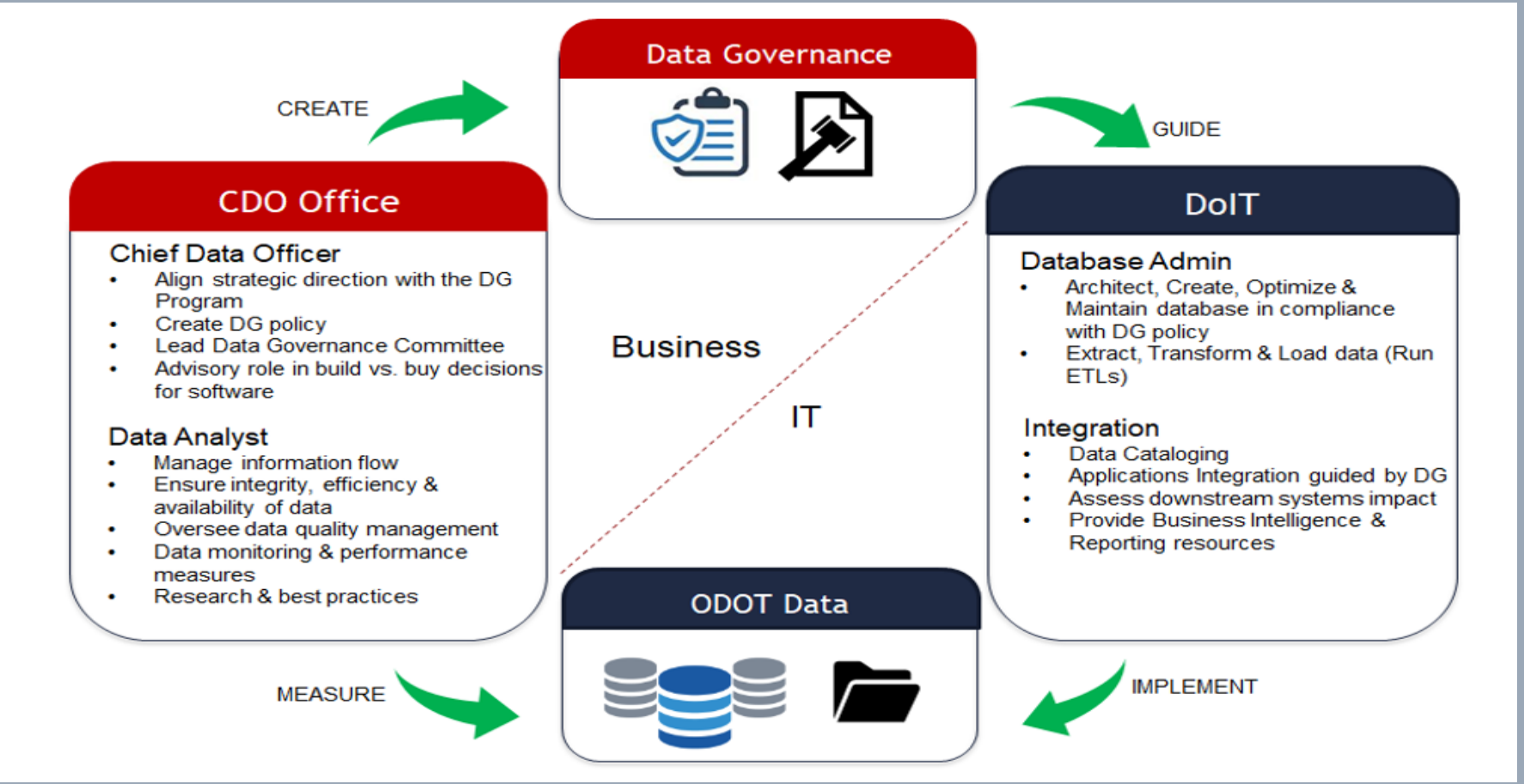
Overarching policy and procedures to maximize the availability, integration, usability, quality and security of data

It is a business competency that engages ODOT's workforce at Executive, Strategic, Tactical, and Operational levels to create, implement and maintain data standards for making better decisions

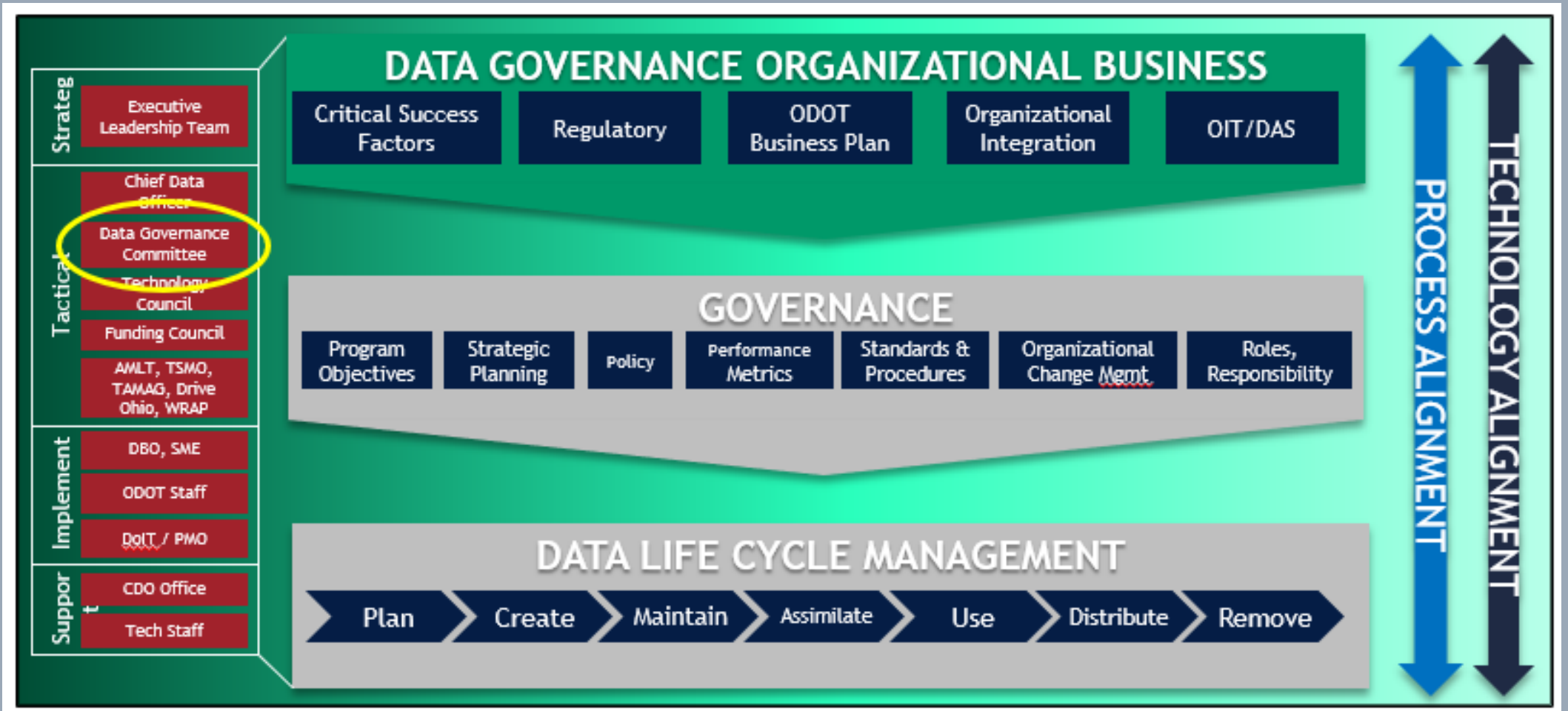
ODOT DEFINITION



DATA GOVERNANCE OFFICE

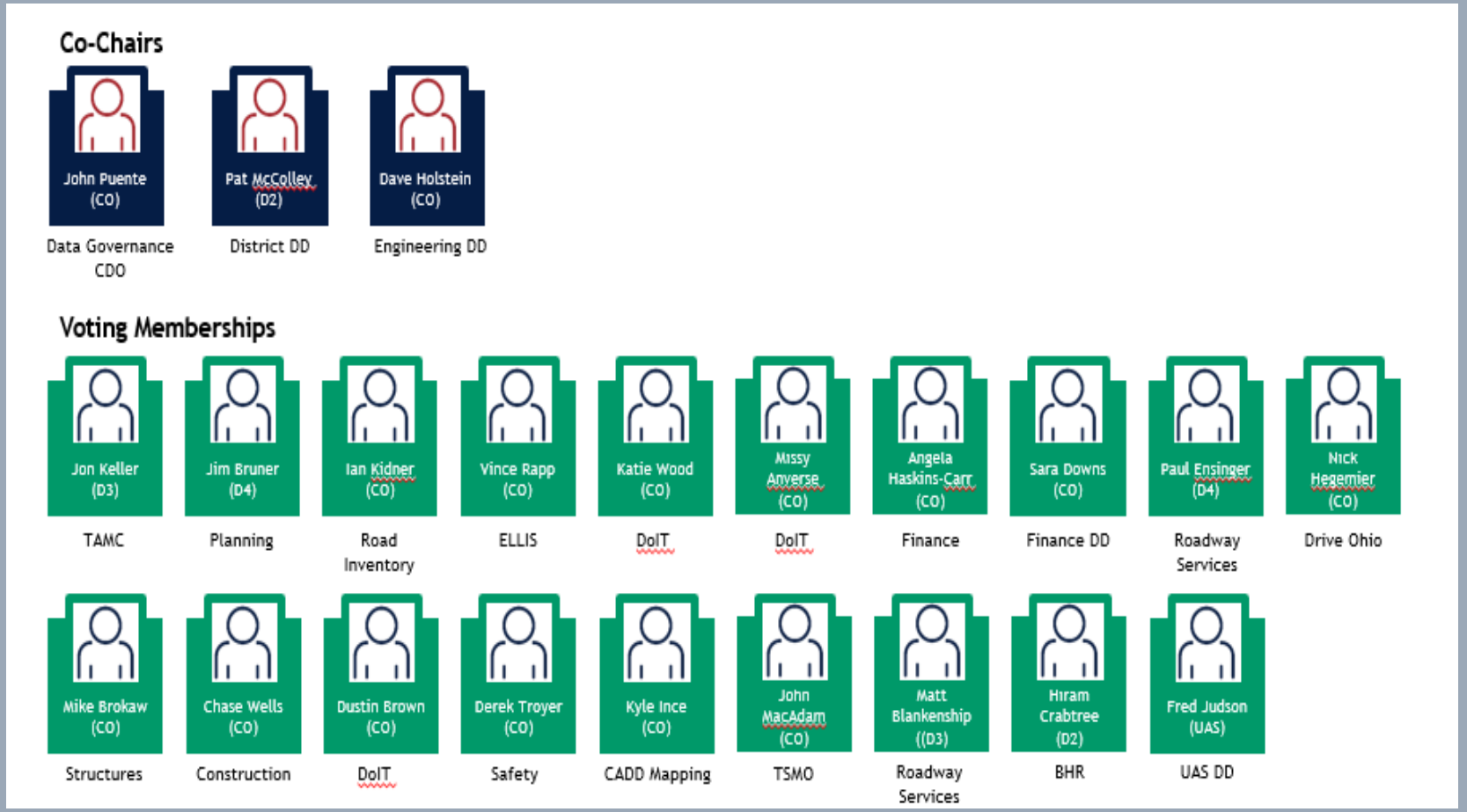


DATA GOVERNANCE MODEL



DATA GOVERNANCE FRAMEWORK

- **Co-Chairs**
- **Voting Membership**
- **Non-voting sub-committees (SME)**
- **All Disciplines of Data Represented**



DATA GOVERNANCE COMMITTEE

- **TAM Audit Group Standard Attributes**
- **Organizational Standards**
- **Critical Data Elements**

STANDARD ATTRIBUTES

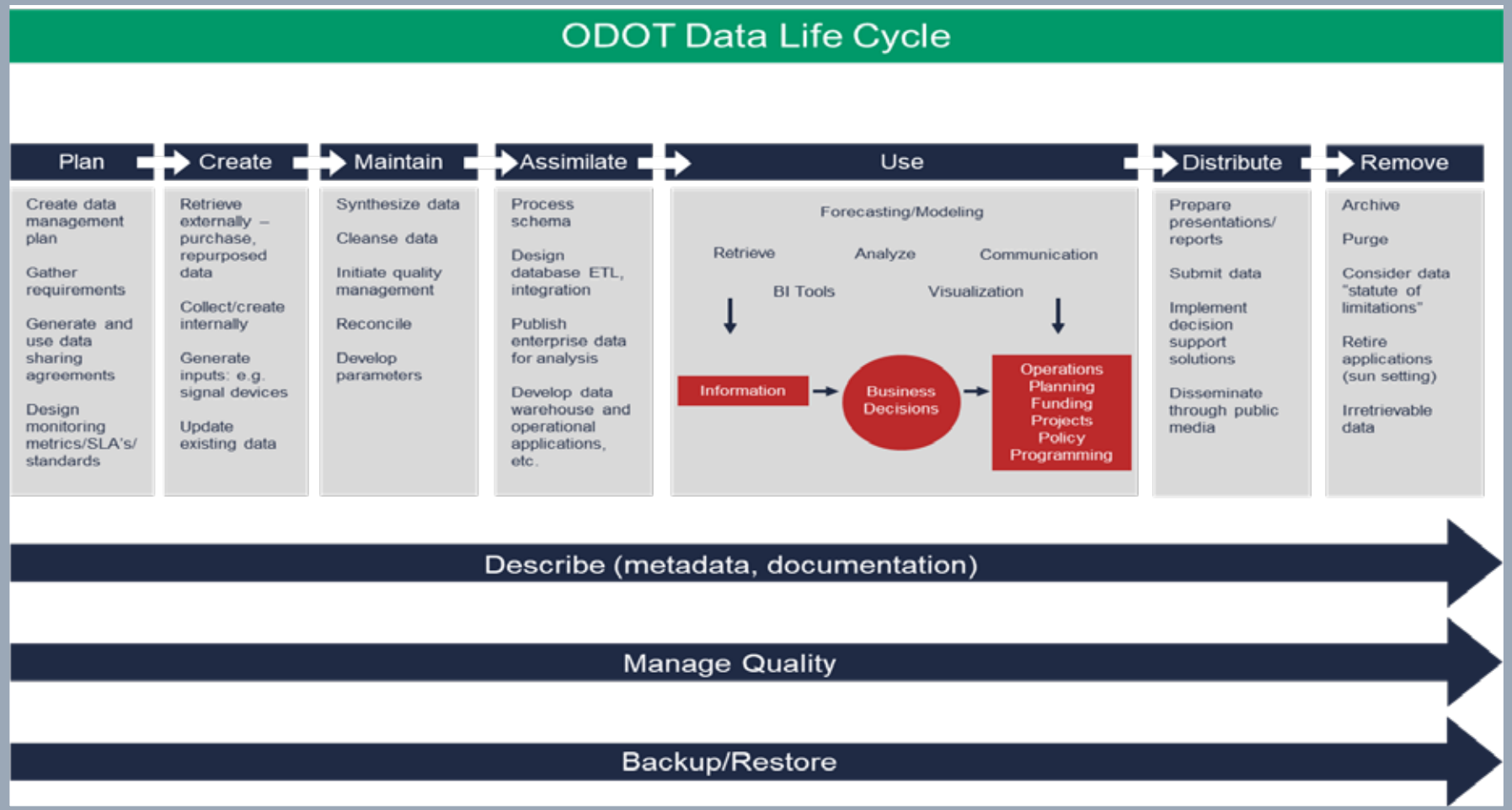
ODOT
Standard Attribute Requirements

Organizational LRS Standards

OBJECTID	System	*(System generated value in ESRI ArcSDE databases)*
NLF_ID	*Char (14)*	*(Network Linear Feature Identifier – Follow guidelines)*
ODOT_DISTRICT	*Char (2)*	*(District Number: 01, 02…leading zero)*
CRS	Char (14)	(County Route Section w/no leading zeros in route)
COUNTY	*Char (10)*	*(County Full Name)*
COUNTY_CD	*Char (3)*	*(County three letter Code)*
ROUTE_TYPE	Char (2)	(Formally Route Designation: US, IR, SR)
ROUTE_NBR	Char (5)	(Route ID; 5 characters to account for local systems)
ROUTE_SUFFIX	Char (1)	(For routes such as 309D or 115A)
CTL_BEGIN_NBR	Number (7.3)	(County Begin Point – Both point and linear)
CTL_END_NBR	Number (7.3)	(County End point - linear)
STL_BEGIN_NBR	Number (7.3)	(State Begin Point – Both point and linear)
STL_END_NBR	Number (7.3)	(State End Point - Linear)
LATITUDE_DD_BEGIN	Decimal Degrees (6 positions) (8, 6)	
LONGITUDE_DD BEGIN	Decimal Degrees (6 positions) (8, 6)	
LATITUDE_DD_END	Decimal Degrees (6 positions) (8, 6)	
LONGITUDE_DD END	Decimal Degrees (6 positions) (8, 6)	
PERP_YEAR	Number (4,0)	(Year of published LRS = CY year - 1)

Functional Standards

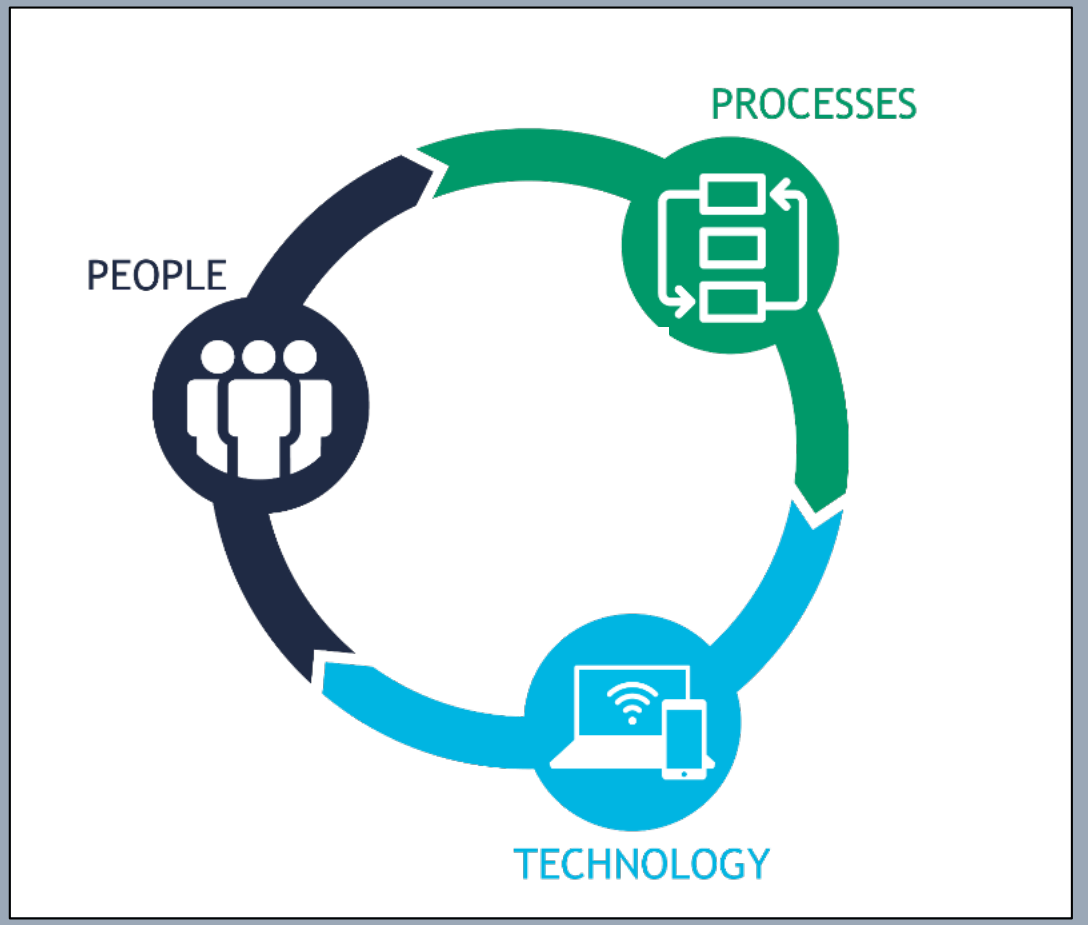
QC_COMPLETE	Char (1)	(QC Complete Y/N. Default Value 'N')
STATUS	Char (1)	(**P**roposed, **R**etired, **C**ancelled, **I**nactive or **A**ctive)
INSTALLATION_DATE	Date	(Date the asset was installed/constructed)
PROJECTION	WGS84 Mercator Auxiliary Sphere (m)	(Required for mapping, not an attribute in DB)
PID_NBR	Int (10,0)	(Capital Projects Unique Project Identifier)
AWARD_DATE	Date	(ELLIS date assigned for project award to contractor)
ASSET_OWNER	Char(1)	(Entity that owns the asset)
MAINTAIN_RESPONIBLE	Char(1)	(Entity that has Maintenance Responsibility on asset)
MUNI_FIPS_CODE	Vchar (75)	(Municipality Federal Information Processing Code)
TWP_FIPS_CODE	Vchar (75)	(Township Federal Information Processing Code)
MAINTAIN_REQUIRED	Char (1)	(Y/N, Default Value 'N')
MAINTAIN_COMPLETE	Char (1)	(Y/N, Default Value 'Null')
LET_PLANS_URL	Vchar (150)	(URL to PID Project Construction Plan Set)
INTERSECTION_ID	TBD	(To be used with any asset in an intersection)
LEG_ID	TBD	(Identifies intersection leg the asset is associated with)
INTERCHANGE_ID	TBD	(To be used with any asset related to an interchange)



DATA LIFECYCLE STAGES

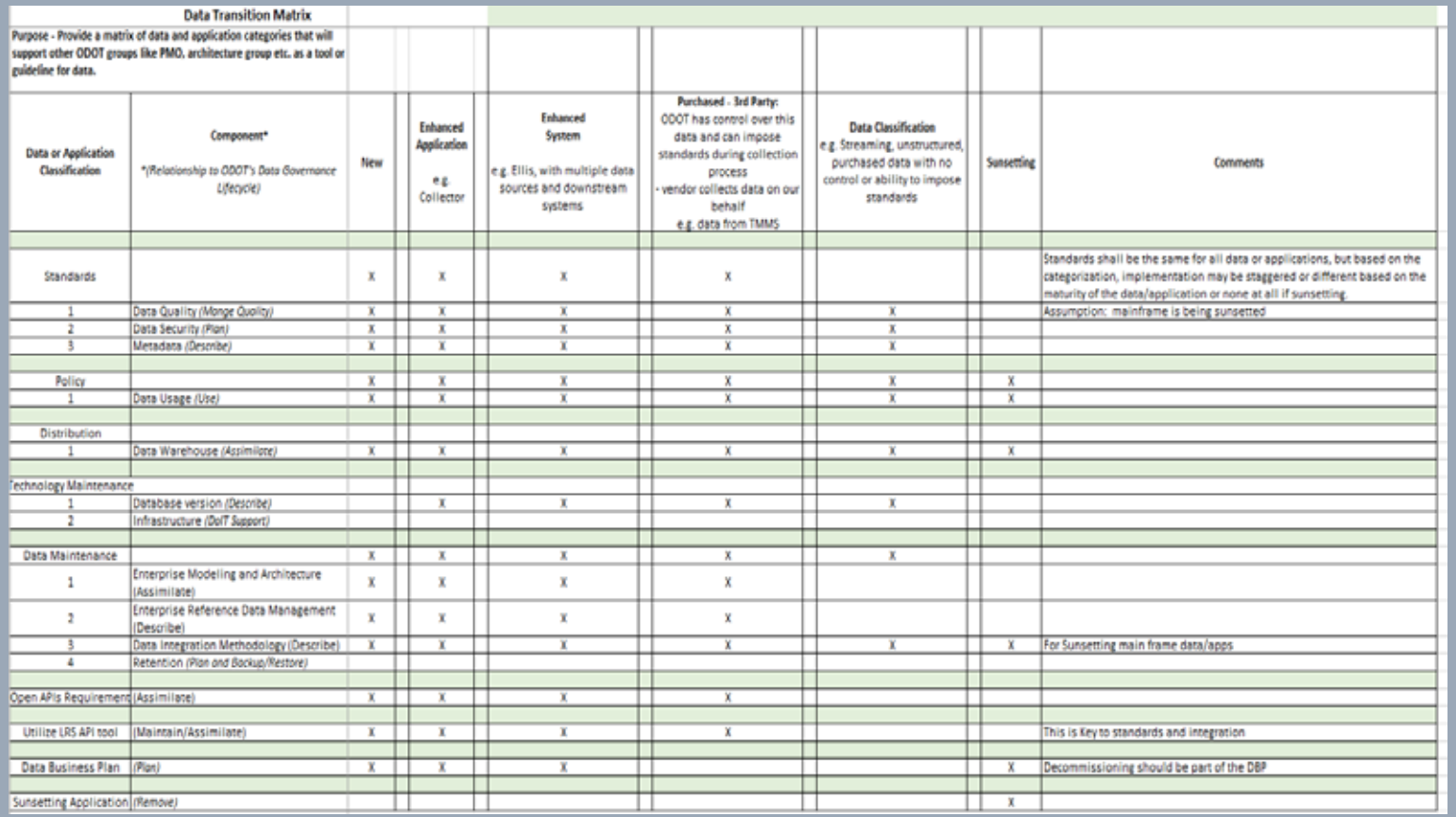
HOW DOES DATA GOVERNANCE FIT

- **Who will do it**
- **What will they do**
- **How will they get it done**



TOOLS FOR SUCCESS - TRIAD

- **Roles**
- **Responsibilities**
- **Follows Data Lifecycle**



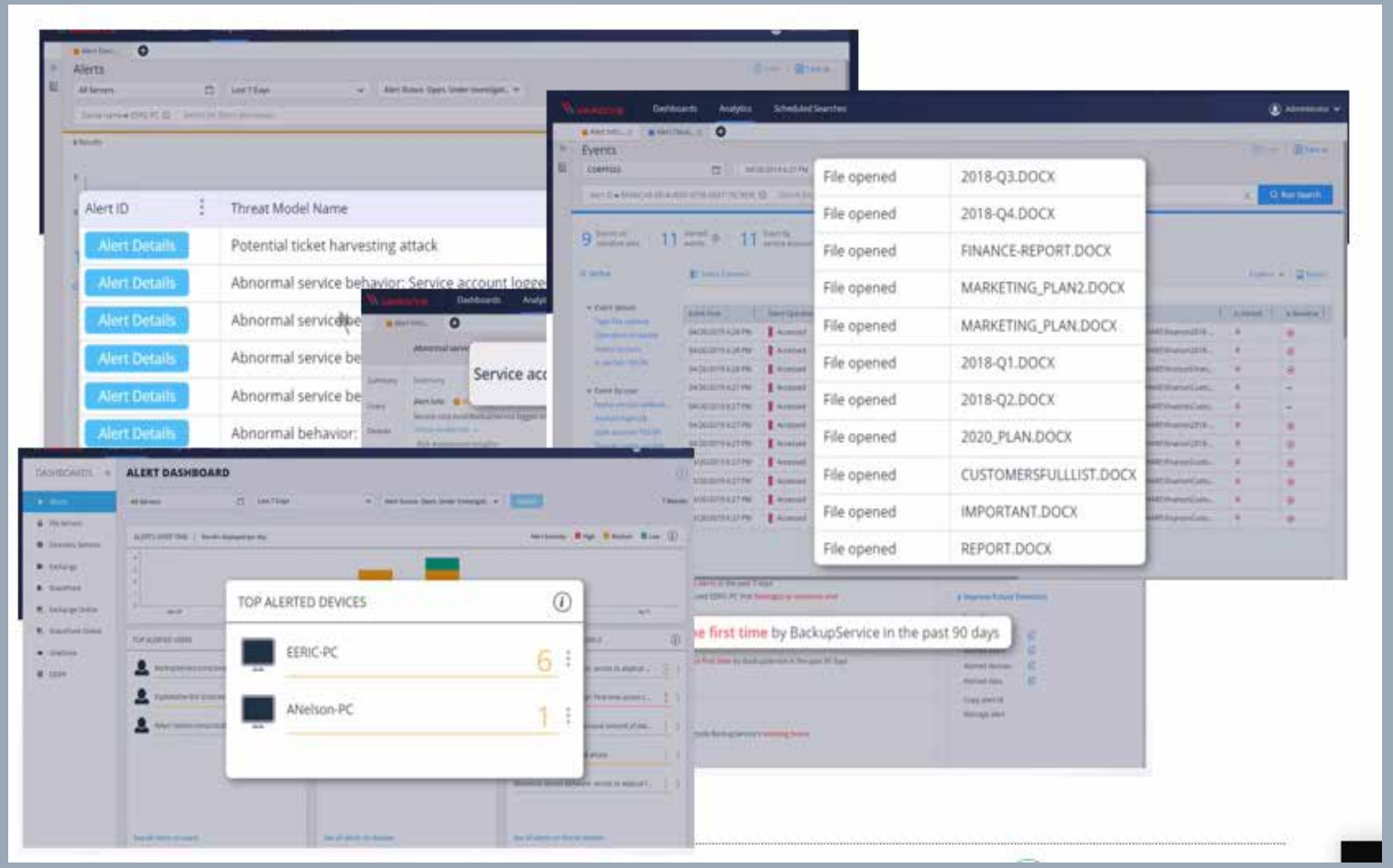
Data Transition Matrix

Purpose - Provide a matrix of data and application categories that will support other ODOT groups like PMO, architecture group etc. as a tool or guideline for data.

Data or Application Classification	Component* *(Relationship to ODOT's Data Governance Lifecycle)*	New	Enhanced Application e.g. Collector	Enhanced System e.g. Ellis, with multiple data sources and downstream systems	Purchased - 3rd Party: ODOT has control over this data and can impose standards during collection process - vendor collects data on our behalf e.g. data from TMMS	Data Classification e.g. Streaming, unstructured, purchased data with no control or ability to impose standards	Sunsetting	Comments
Standards		X	X	X	X			Standards shall be the same for all data or applications, but based on the categorization, implementation may be staggered or different based on the maturity of the data/application or none at all if sunsetting.
1	Data Quality *(Monge Quality)*	X	X	X	X	X		Assumption: mainframe is being sunsetted
2	Data Security *(Plan)*	X	X	X	X	X		
3	Metadata *(Describe)*	X	X	X	X	X		
Policy		X	X	X	X	X	X	
1	Data Usage *(Use)*	X	X	X	X	X	X	
Distribution								
1	Data Warehouse *(Assimilate)*	X	X	X	X	X	X	
Technology Maintenance								
1	Database version *(Describe)*		X	X	X	X		
2	Infrastructure *(DoIT Support)*							
Data Maintenance		X	X	X	X	X		
1	Enterprise Modeling and Architecture (Assimilate)	X	X	X	X			
2	Enterprise Reference Data Management (Describe)	X	X	X	X			
3	Data Integration Methodology (Describe)	X	X	X	X	X	X	For Sunsetting main frame data/apps
4	Retention *(Plan and Backup/Restore)*							
Open APIs Requirement	(Assimilate)	X	X	X	X			
Utilize LRS API tool	(Maintain/Assimilate)	X	X	X	X			This is Key to standards and integration
Data Business Plan	(Plan)	X	X	X			X	Decommissioning should be part of the DBP
Sunsetting Application	(Remove)						X	

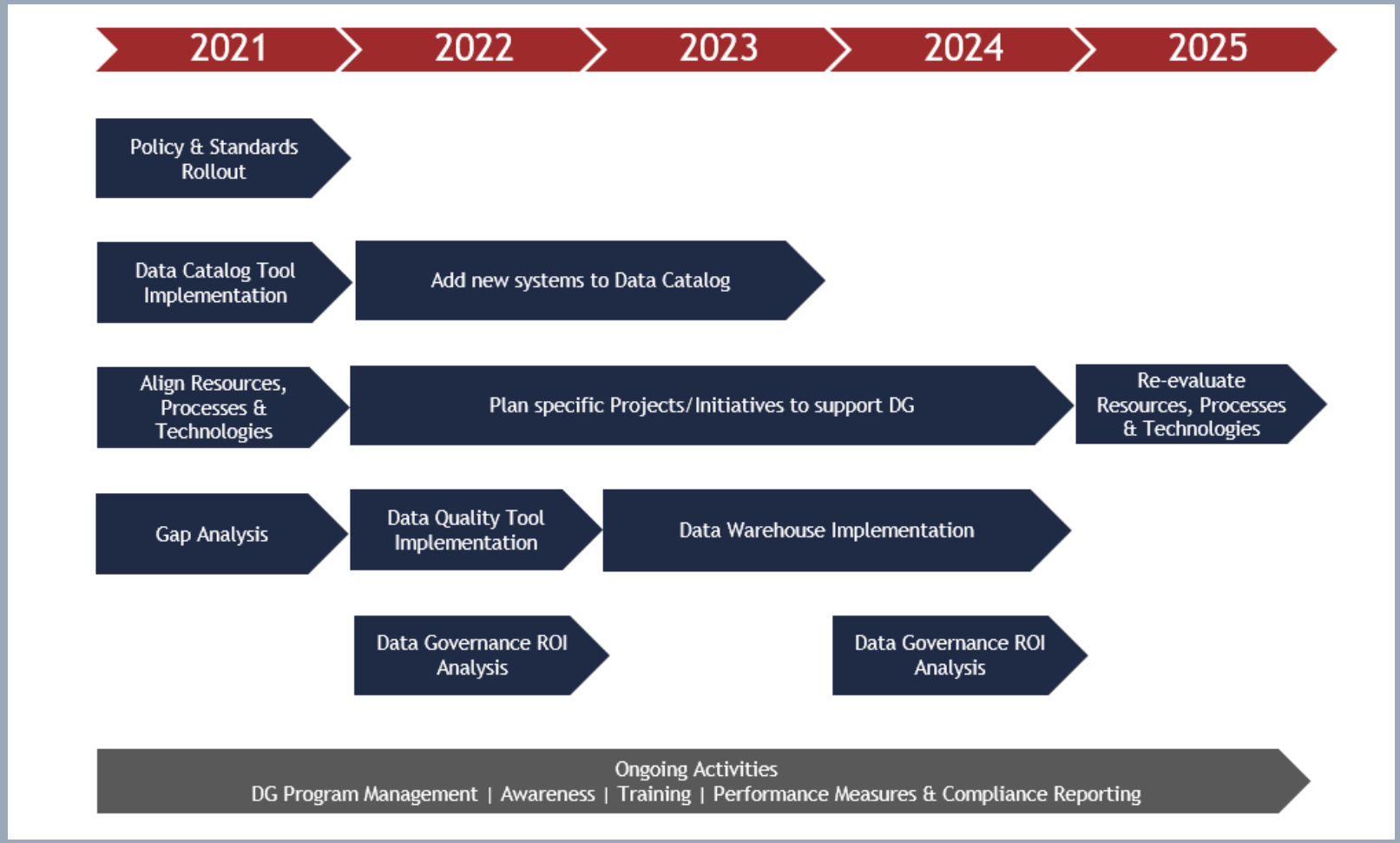
PEOPLE – DATA TRANSITION MATRIX

- **Personal Information**
- **Document Access**
- **Folder Monitoring**
- **Notification of Threats**
- **Who, When and How Long**



TECHNOLOGY - GOVERNANCE TOOLS

- **Data Standards**
- **Data Catalog**
- **Data Normalization Proof of Concept**



ROADMAP

- **Improved data quality and Integration**
- **Confidence in source data**
- **Data Ownership**
- **Data Protection and Security**
- **Regulatory compliance**

BENEFITS OF A GOOD PROGRAM

CONTACT INFORMATION

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Taking the Next Step for TAM with Data Governance

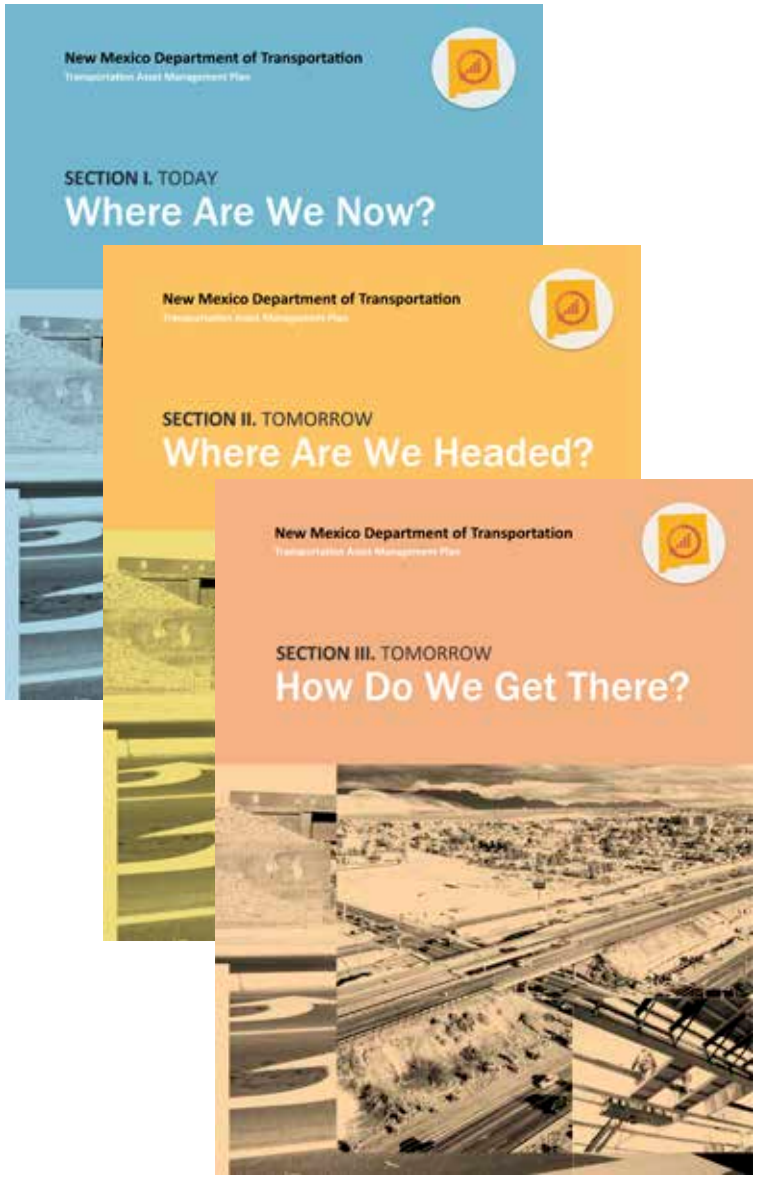
New Mexico Department of Transportation

Tammy Haas, NMDOT

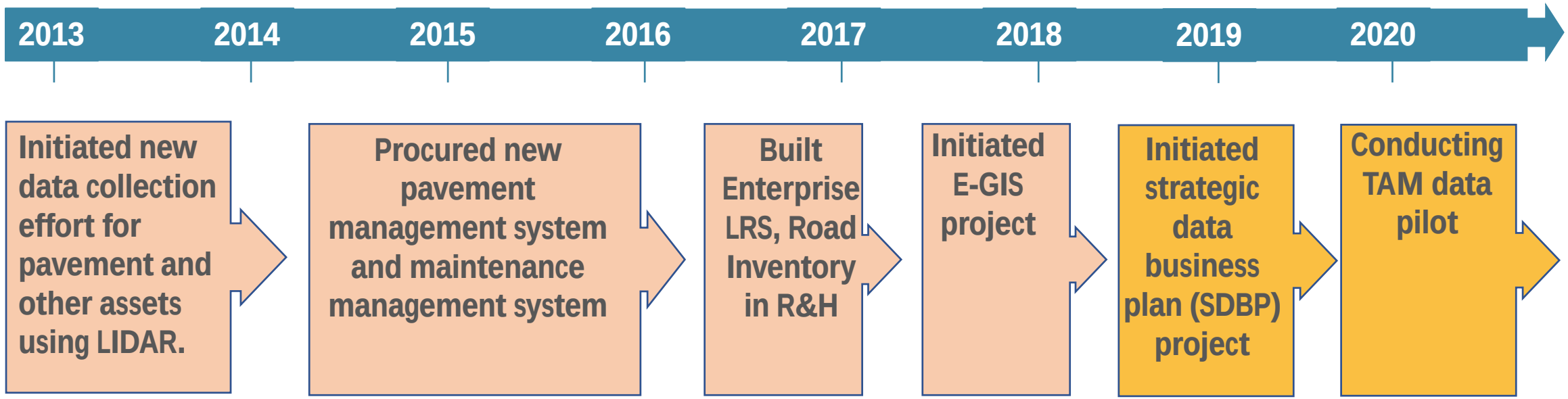
October 1, 2020

Introduction

1. NMDOT's TAM Journey
2. Strategic Data Business Plan (SDBP)
3. Data Governance at NMDOT
4. Exercising Data Governance for TAM: Pilot Project
5. Next Steps



NMDOT's TAM Journey



NMDOT's SDBP: Vision

NMDOT makes effective use of data to guide decisions, deliver better results, and provide transparency and accountability.

NMDOTs SDBP: Goals

- **Data Value.** Increase the value of data for decision making by improving data relevance, quality, usability, discoverability and accessibility.
- **Data Sharing.** Maximize sharing of existing data across agency business units by establishing single authoritative sources for data elements, building awareness of agency data resources, and encouraging data re-use.
- **Data Literacy.** Build agency staff awareness of practices for making effective use of data.
- **Data Efficiency.** Reduce duplication of effort by encouraging collaboration across business units on new data collection or acquisition efforts.
- **Data Consistency.** Increase data consistency and interoperability through standardizing data definitions and formats.
- **Data Protection.** Protect sensitive and confidential data from unauthorized access.

NMDOT's SDBP: Strategies

- **Put in place a consistent and sustainable approach to data improvement – involving people, process & technology**
  - Governance bodies and stewardship roles
  - Ongoing assessment and continuous improvement to data & systems
  - Processes for authoritative data designation, data quality & documentation
  - Communication and training to build data literacy

Data Governance at NMDOT: Scope

Roadway

- LRS
- Inventory

Assets

- Pavement & Bridge
- Inventory
- Condition/Performance

Projects

- Programming
- Design
- Construction

Maintenance

- Contracts & State Forces
- Work and Costs

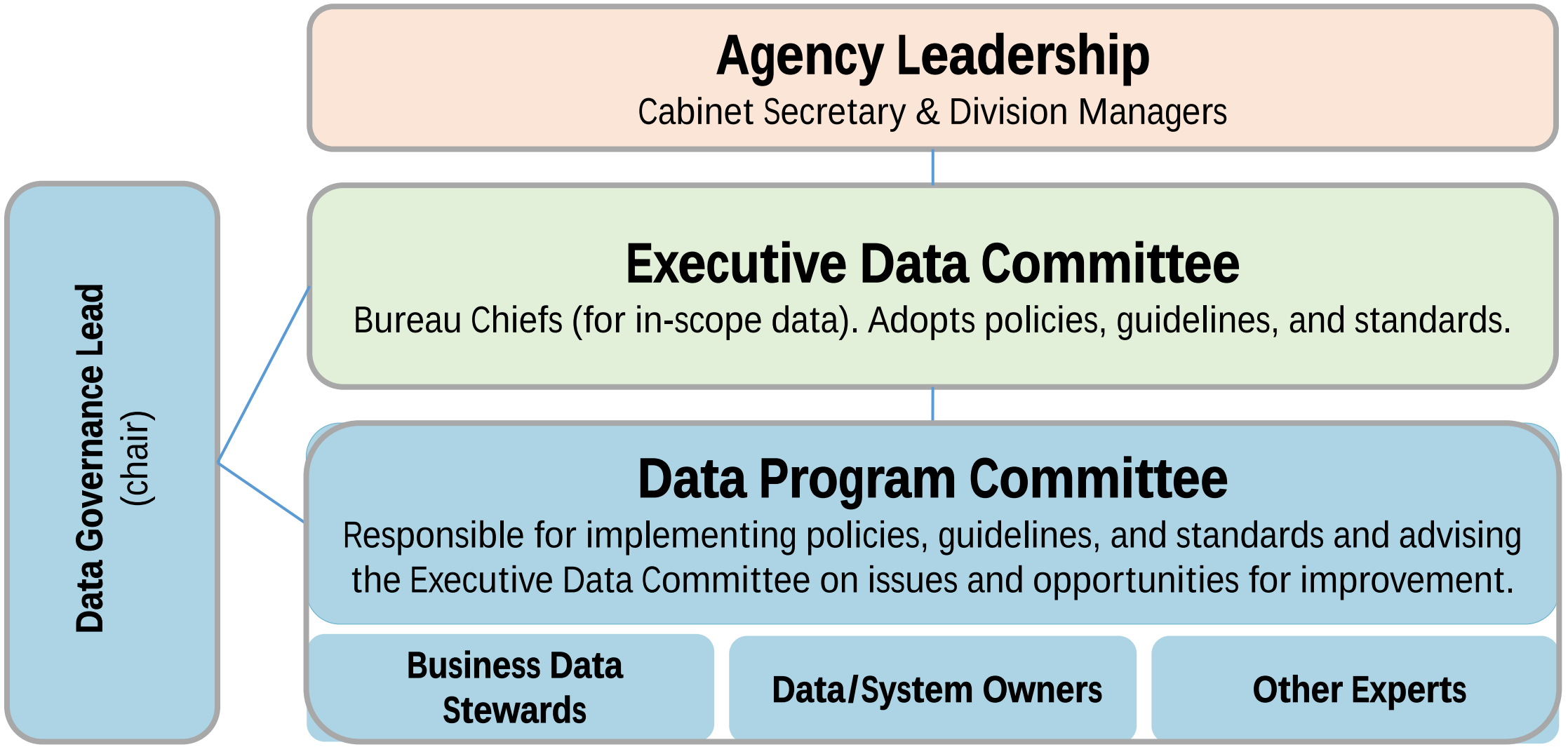
Travel

- Traffic
- Travel Time
- Transit/Rail

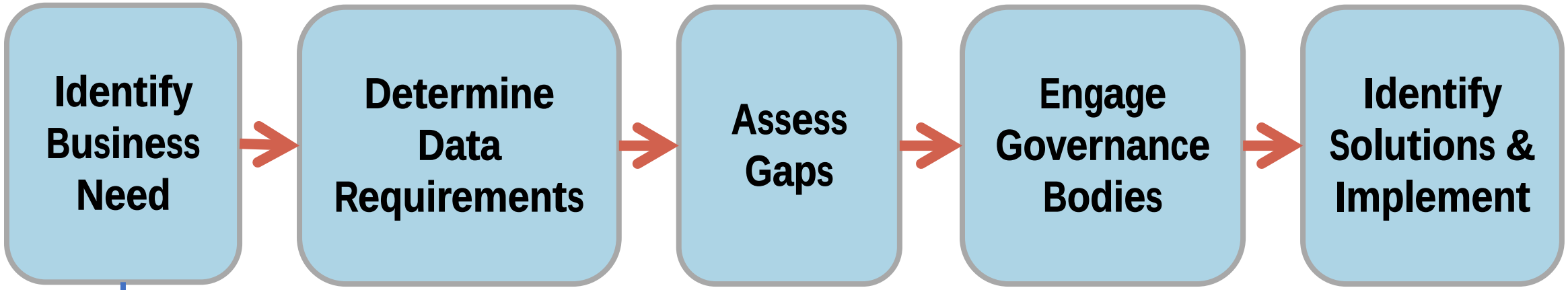
Safety

- Crashes & Fatalities
- Other

Data Governance Bodies & Roles

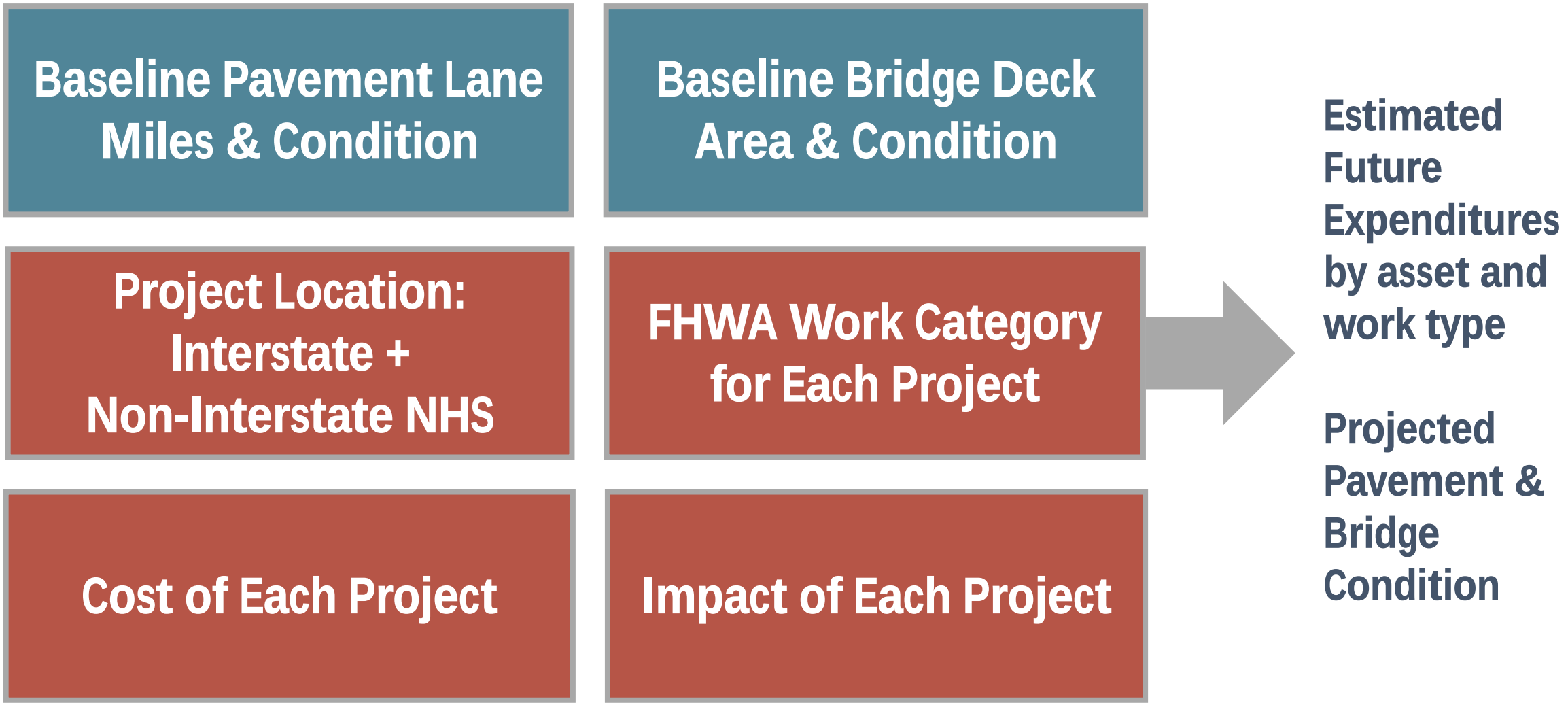


TAM Data Pilot

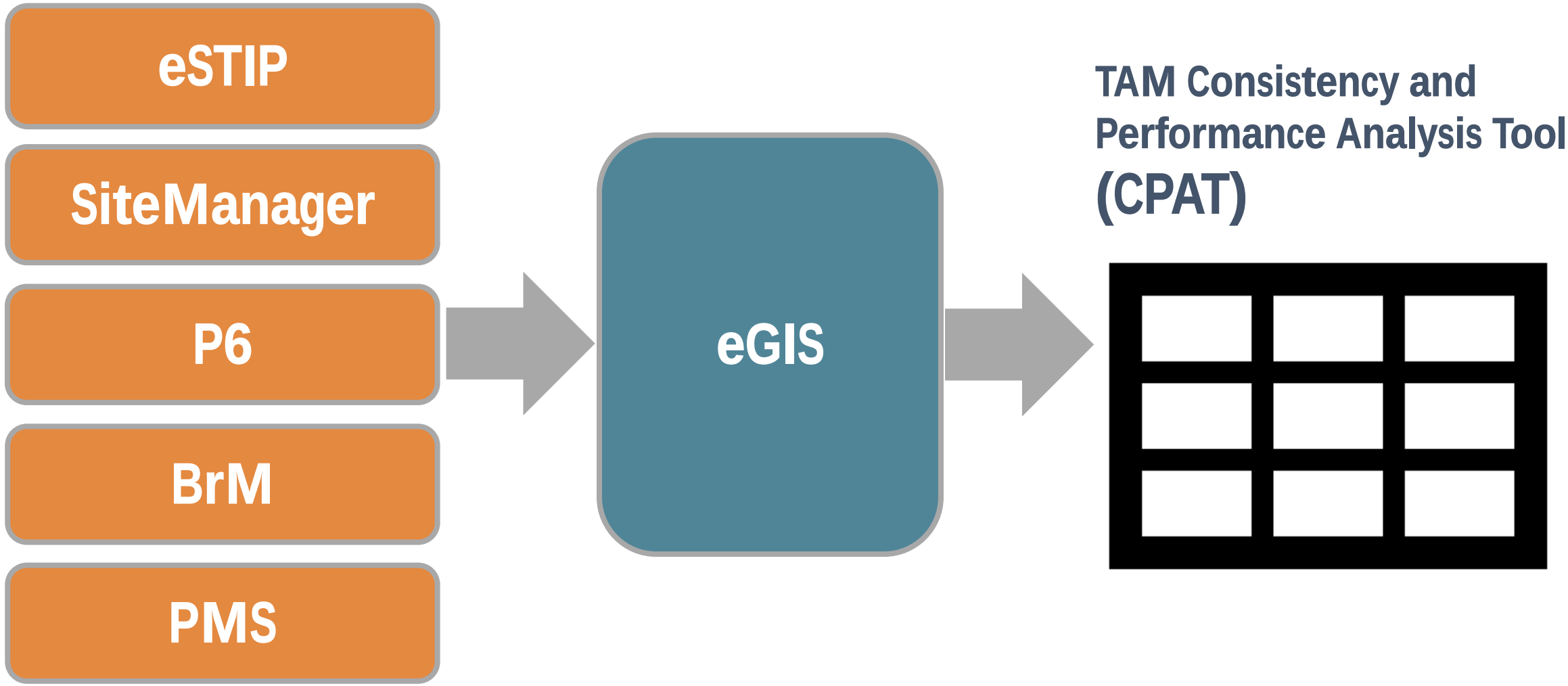


1. FHWA Consistency Review: Expenditures by Asset & Work Type
2. Target Check: Expected Pavement & Bridge performance based on the projects in the program

TAM Data Pilot: Data Requirements



TAM Data Pilot: Data Compilation & Review



CPAT - Financial Measures

Asset Classes

Systems

Work Types

Expenditures by Year

NMDOT Consistency and Performance Analysis Tool (CPAT)

Summary Results

Asset Class	System	Description	Value by Year 2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Financial Measures												
Pavement	Interstate	Maintenance	0	0	0	0	0	0	0	0	0	0
		Preservation	0	0	0	0	0	0	0	0	0	0
		Rehabil	0	4,631,343	38,782,271	25,150,929	12,491,086	23,962,930	55,450,000	4,000,000	0	0
		Reconst	0	4,091,618	21,319,634	27,789,996	13,863,866	0	3,000,000	0	0	0
		Total	*0*	*8,722,960*	*60,101,906*	*52,940,924*	*26,354,951*	*23,962,930*	*58,450,000*	*4,000,000*	*0*	*0*
	Non-Interstate NHS	Maintenance	0	0	0	0	0	0	0	0	0	0
		Preservation	0	0	0	0	0	0	0	0	0	0
		Rehabilitation	1,131,250	1,131,250	16,557,996	0	0	5,067,309	15,000,030	3,814,879	0	0
		Reconstruction	0	0	39,581,102	38,250,000	10,750,000	5,500,000	3,400,536	0	0	0
		Total	*1,131,250*	*1,131,250*	*56,139,097*	*38,250,000*	*10,750,000*	*10,567,309*	*18,400,566*	*3,814,879*	*0*	*0*
	NHS	Maintenance	0	0	0	0	0	0	0	0	0	0
		Preservation	0	0	0	0	0	0	0	0	0	0
		Rehabilitation	1,131,250	5,762,593	55,340,267	25,150,929	12,491,086	29,030,239	70,450,030	7,814,879	0	0
		Reconstruction	0	4,091,618	60,900,736	66,039,996	24,613,866	5,500,000	6,400,536	0	0	0
		Total	*1,131,250*	*9,854,210*	*116,241,003*	*91,190,924*	*37,104,951*	*34,530,239*	*76,850,566*	*7,814,879*	*0*	*0*
Bridge	NHS	Maintenance	0	0	0	0	0	0	0	0	0	0
		Preservation	0	0	0	0	0	0	0	0	0	0
		Rehabilitation	0	0	2,000,000	0	0	0	0	0	0	0
		Reconstruction	0	0	17,168,094	9,545,676	0	0	8,000,000	0	0	0
		Total	*0*	*0*	*19,168,094*	*9,545,676*	*0*	*0*	*8,000,000*	*0*	*0*	*0*
All	NHS	Maintenance	0	0	0	0	0	0	0	0	0	0
		Preservation	0	0	0	0	0	0	0	0	0	0
		Rehabilitation	1,131,250	5,762,593	57,340,267	25,150,929	12,491,086	29,030,239	70,450,030	7,814,879	0	0
		Reconstruction	0	4,091,618	78,068,829	75,585,671	24,613,866	5,500,000	14,400,536	0	0	0
		Total	*1,131,250*	*9,854,210*	*135,409,096*	*100,736,600*	*37,104,951*	*34,530,239*	*84,850,566*	*7,814,879*	*0*	*0*

CPAT - Performance Measures

NMDOT Consistency and Performance Analysis Tool (CPAT)

Summary Results

Asset Classes

Systems

Measures

Quantity Treated

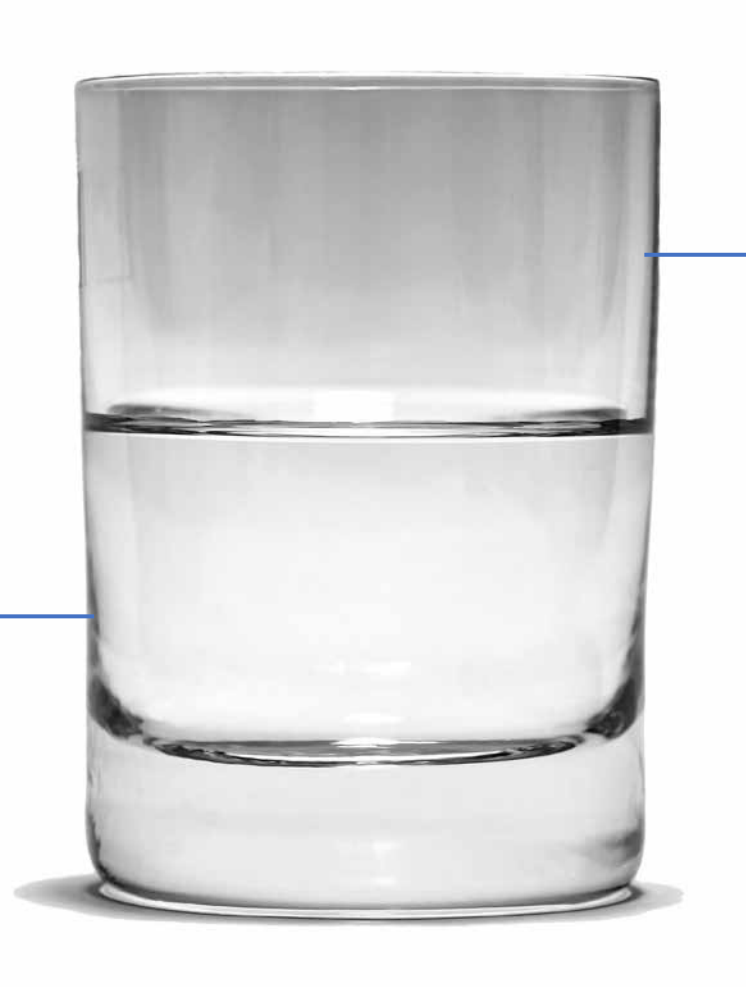
Cumulative Performance Change

Predicted Performance

Asset Class	System	Description	Value by Year 2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Performance Measures by Year												
Pavement	Interstate	Poor Treated (lane miles)	0.0	0.0	43.5	45.3	10.9	28.2	73.0	11.7	0.0	0.0
		Fair Treated (lane miles)	0.0	0.0	12.6	6.9	0.4	1.3	4.2	0.8	0.0	0.0
		Poor/	0.0	0.0	56.1	52.3	11.3	29.5	77.2	12.5	0.0	0.0
	Non-Interstate NHS	Poor	0.0	0.0	9.5	2.7			42.5	4.5	0.0	0.0
		Fair T	0.0	0.0	0.5	0.0			4.6	1.2	0.0	0.0
		Poor/Fair Treated (lane miles)	0.0	0.0	10.1	2.7			47.1	5.6	0.0	0.0
	NHS	Poor Treated (lane miles)	0.0	0.0	53.0	48.0			115.5	16.2	0.0	0.0
		Fair Treated (lane miles)	0.0	0.0	13.2	7.0			8.8	2.0	0.0	0.0
		Poor/Fair Treated (lane miles)	0.0	0.0	66.1	55.0			124.3	18.2	0.0	0.0
Bridge	NHS	Poor Treated (square feet)	0	19,373	0	0	13,545	13,545	0	0	0	0
		Fair Treated (square feet)	0	121,942	68,559	7,976	71,879	186,777	11,959	0	0	0
		Poor/Fair Treated (square feet)	0	141,315	68,559	7,976	85,424	200,322	11,959	0	0	0
Cumulative Performance Changes												
Pavement	Interstate	Reduction in % Poor	0.00%	0.00%	1.06%	2.16%	2.43%	3.11%	4.89%	5.18%	5.18%	5.18%
		Increase in % Good	0.00%	0.00%	1.37%	2.64%			5.51%	5.82%	5.82%	5.82%
	Non-Interstate NHS	Reduction in % Poor	0.00%	0.00%	0.14%	0.18%			0.95%	1.02%	1.02%	1.02%
		Increase in % Good	0.00%	0.00%	0.15%	0.19%			1.06%	1.14%	1.14%	1.14%
	NHS	Reduction in % Poor	0.00%	0.00%	0.48%	0.92%			2.43%	2.58%	2.58%	2.58%
		Increase in % Good	0.00%	0.00%	0.60%	1.11%			2.73%	2.90%	2.90%	2.90%
Bridge	NHS	Reduction in % Poor	0.00%	0.00%	0.14%	0.14%			0.33%	0.33%	0.33%	0.33%
		Increase in % Good	0.00%	0.00%	1.01%	1.50%	1.56%	2.17%	3.61%	3.69%	3.69%	3.69%
Predicted Performance												
Pavement	Interstate	% Poor	8.00%	8.00%	6.94%	5.84%	5.57%	4.89%	3.11%	2.82%	2.82%	2.82%
		% Good	70.00%	70.00%	71.37%	72.64%			75.51%	75.82%	75.82%	75.82%
	Non-Interstate NHS	% Poor	10.00%	10.00%	9.86%	9.82%			9.05%	8.98%	8.98%	8.98%
		% Good	65.00%	65.00%	65.15%	65.19%			66.06%	66.14%	66.14%	66.14%
	NHS	% Poor	7.50%	7.50%	7.02%	6.58%			5.07%	4.92%	4.92%	4.92%
		% Good	68.00%	68.00%	68.60%	69.11%			70.73%	70.90%	70.90%	70.90%
Bridge	NHS	% Poor	12.00%	12.00%	11.86%	11.86%			11.67%	11.67%	11.67%	11.67%
		% Good	50.00%	50.00%	51.01%	51.50%	51.56%	52.17%	53.61%	53.69%	53.69%	53.69%

TAM Data Pilot: Good News/Bad News

There's hope! eGIS provides a platform for pulling authoritative data for analysis



Results were partial and tentative due to data issues – need to add data to eGIS and improve data quality

TAM Data Pilot: Data Challenges

Work Types

- Data only available for rehab and reconst projects
- Data sources for preservation & maintenance are less complete

Work Locations

- Inconsistent location fields across systems
- Manual effort required to map to NMDOT's common LRS.

Work Costs

- No breakdown of costs for projects involving multiple assets – need to estimate using bid tabs.
- Obligation amounts not available in eGIS

General Data Issues

Lack of single authoritative source for project data – need to combine fields from different systems

Missing project and asset data

Uneven data validation

Uneven documentation

Next Steps: Implement Improvements

Exercise the recommended Governance Structure & Roles:

- **Engage the Data Program Committee**
  - Get consensus on immediate and longer-term improvements
  - Designate authoritative sources for project attributes
- **Engage the Executive Data Committee**
  - Sponsor and support the data improvement effort
  - Facilitate resourcing of needed database changes
- **Engage data owners and stewards**
  - Data validation and cleansing – with emphasis on location, cost, and work type
  - Data quality management plans to address systemic issues
  - Improved data documentation

Contact

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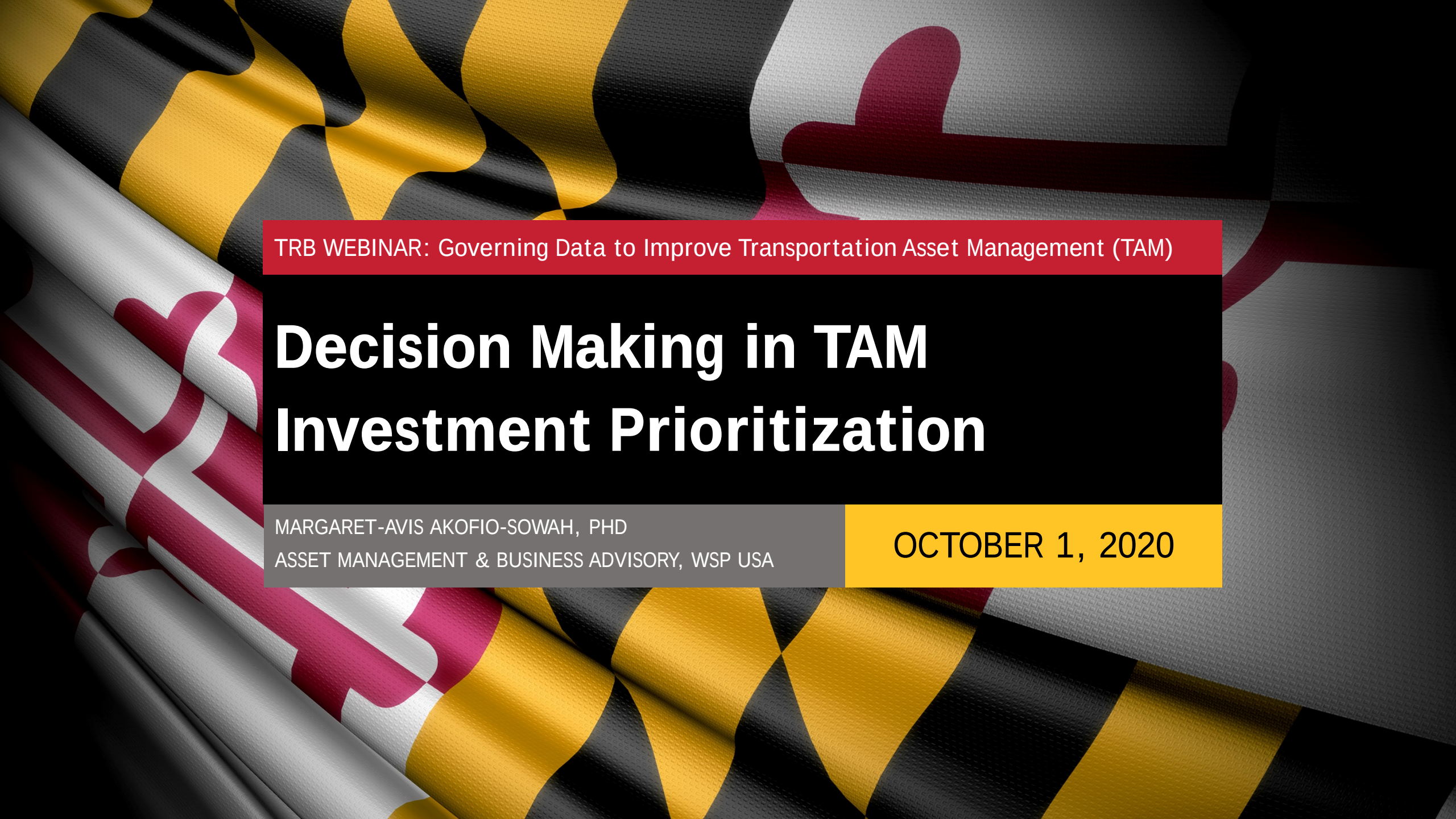


TRB WEBINAR: Governing Data to Improve Transportation Asset Management (TAM)

Decision Making in TAM Investment Prioritization

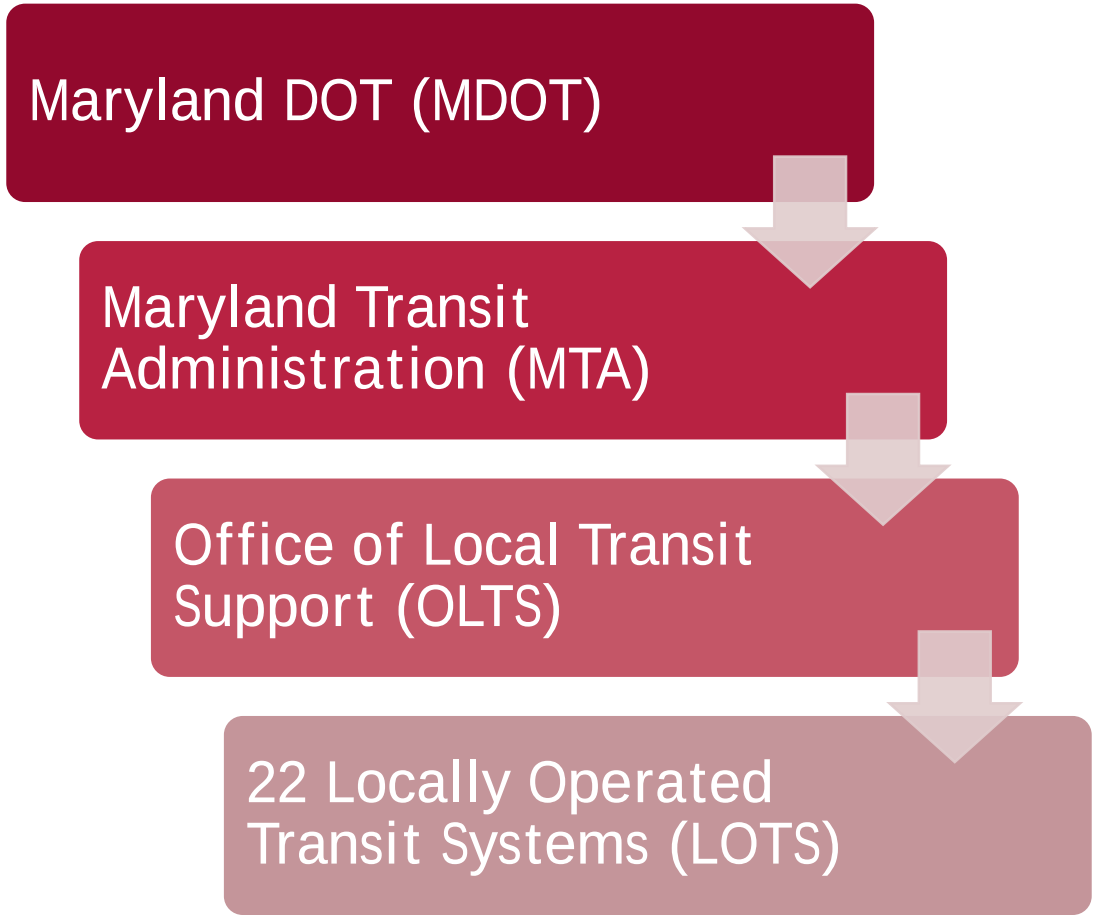
MARGARET-AVIS AKOFIO-SOWAH, PHD
ASSET MANAGEMENT & BUSINESS ADVISORY, WSP USA

OCTOBER 1, 2020

Overview

1. Background & Context
2. Structure of the Prioritization Framework
3. Data Governance Considerations
4. Looking Forward

Maryland Local Transit Context



- MDOT MTA OLTS oversees asset management for the 22 subrecipient agencies (LOTS)
- Group Transit Asset Management Plan (TAMP) sponsorship for 20 Tier II LOTS
- Technical support for 2 Tier I LOTS

**FTA defines Tier I and Tier II providers based on revenue vehicle fleet size*

Asset Management & Annual Transportation Plan (ATP)

- ATP is the annual grant award process facilitated by OLTS to administer Federal & State funding

- Asset management decision making is integrated into the ATP process

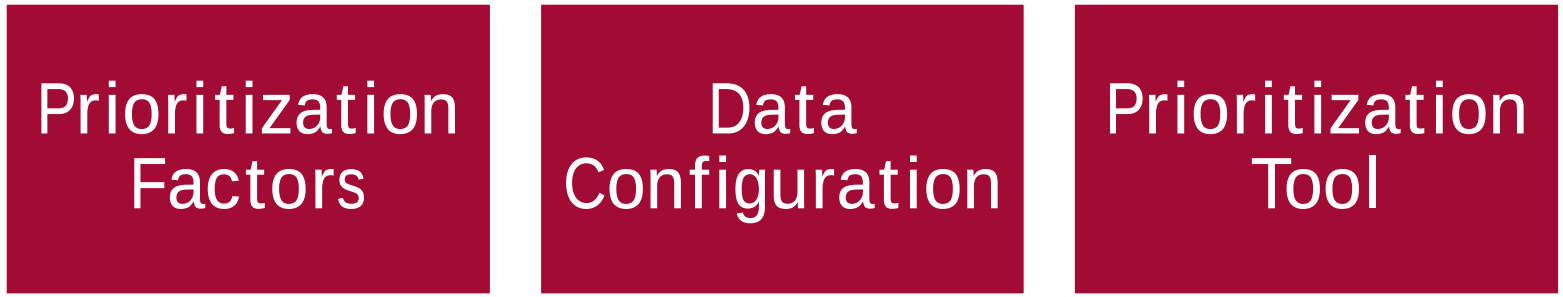
Motivation for a Prioritization Framework

- FTA Asset Management regulations (49 CFR 625.33)
  - TAM plan must include an investment prioritization that identifies a provider's programs and projects
  - Provider must rank projects in order of priority and anticipated project year
  - Project rankings must be consistent with TAM policy and strategies
  - Investment prioritization must consider projects to improve an identified unacceptable safety risk

- For the OLTS ATP process
  - A structured approach can eliminate bias for a more objective process
  - Documented rational for grant award decisions
  - More informed decisions

What is the Prioritization Framework?

- Uses a multi-criteria decision analysis methodology
- Intended to inform and support facilitation of grant award discussions
- Three major parts



How does the tool work?

- **Multi-criteria decision analysis**: structuring and solving a problem involving multiple criteria

- Weighted sum model analysis process:
  - Identify prioritization criteria/factors
  - Assign scoring definition and factor weighting
  - Compute prioritization score

Score = (Factor 1 x Weight 1) + (Factor 2 x Weight 2) + (Factor 3 x Weight 3) + ...

Prioritization Factors

Factor	Definition
Ability to Spend Allocation	Proportion of capital allocation (total grant) left by year
Ability to Spend Preventive Maintenance	Proportion of PM allocation left by year
Asset Condition	Condition of the asset(s) that a project applies to as indicated on the inventory forms submitted by each agency For PM: Percent of revenue fleet assets that are at or past ULB (i.e. in backlog)
Operating/Service Performance	Measurement of standard operating performance measures
Project Justification	Justification provided by LOTS in Capital Project Requests
Risk Management	Risk index for each project as determined by the LOTS
Spare Ratio (vehicles only)	Proportion of vehicles in a LOTS inventory that are spares
Safety	Was the asset being replaced involved in a safety event? Does the project address a safety concern?
LOTS Priority	The priority that the LOTS assign to the project

Asset Inventory & Condition Data

Data governance considerations:

- Roles & responsibilities
- Data definitions
- Data standards
- Data quality reviews

Data Governance Roles

Oversight Committee (OLTS Leadership)

- Establishing policies, approving processes, standards, and guidelines

Data Stewards (OLTS/Consultant Team)

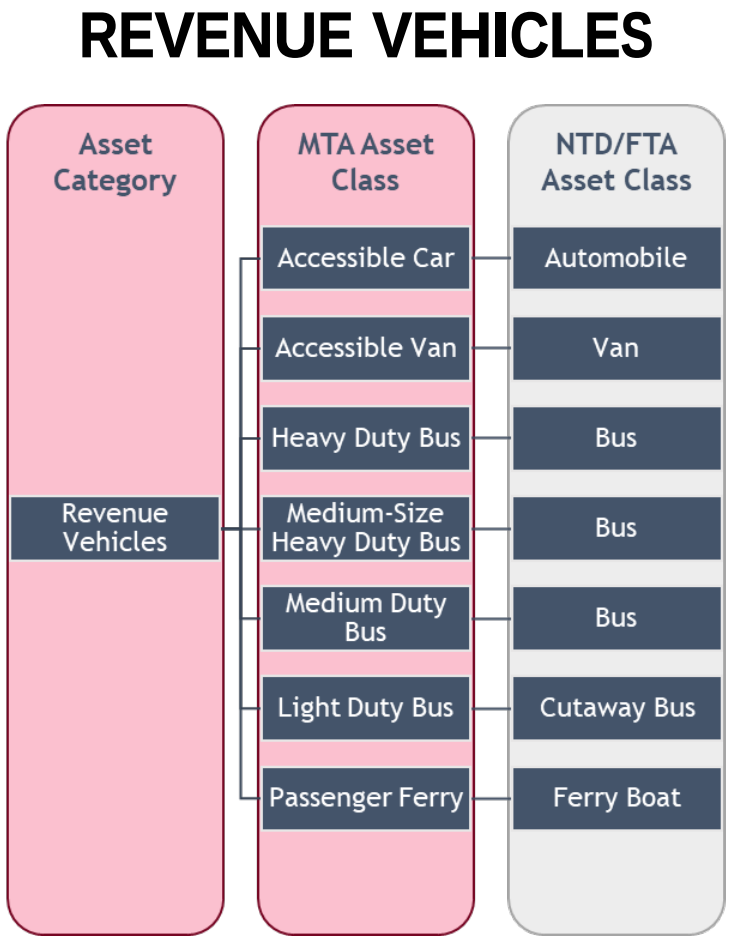
- Centralized data analysis; ensuring policies are adhered to

Data Owners (LOTS)

- Accountable for their agency's data

Data Definitions – Asset Hierarchy

- Defines relationships between assets and systems or components
- Supports consistent aggregation of asset information
- Standardizes terminology between LOTS, OLTS, and FTA



Data Dictionary – Asset Inventory User Guide

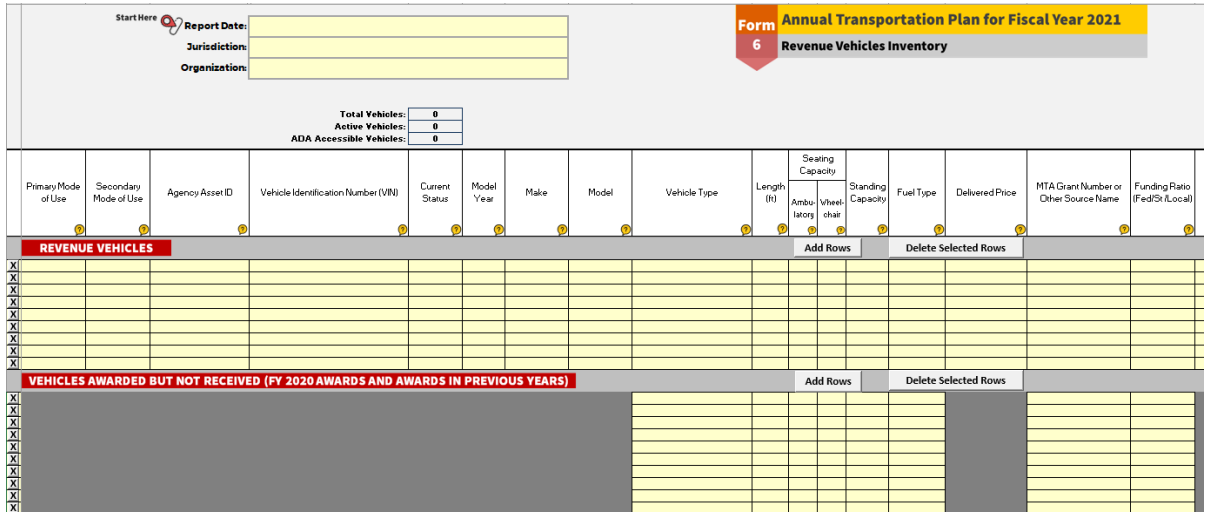
- Provides specifications and requirements for asset information
- Defines commonly confused terms (e.g. vehicle status: active, spare, inactive, disposed)

Column	Heading	Data Format	Description
C	Primary Mode of Use	Text (Drop-down Menu)	The type of transit service provided by vehicle. *(For value options, please see the Appendix.)*
D	Secondary Mode of Use	Text (Drop-down Menu)	Indicates if the asset supports another mode. (e.g., cutaway bus is occasionally used for both **fixed route** and **demand response**). *(For value options, please see the Appendix.)*
E	Agency Asset ID	Alphanumeric	The unique identifier assigned to the vehicle asset by the LOTS provider. **Helpful Tip:** *It is good practice to have a unique identifier for all your assets. If you don't currently have Agency Asset IDs, you should create them for all your assets.*
G	Vehicle Identification Number (VIN)	Alphanumeric	The identification number assigned to the vehicle by the vehicle's manufacturer.
H	Current Status	Text (Drop-down Menu)	The vehicle's availability for revenue service. *(For value options, please see the Appendix.)*

Establishing Data Standards

Processes and procedures for managing data

- What data to include (e.g. capital responsibility)
- When to add or remove assets from the dataset
- Data process timing; performance baseline snapshots
- Assigning unique asset identifiers
  - Agency Asset ID (Local)
  - MTA Asset ID (State)
  - NTD RVI ID (Federal)



Data Quality Reviews

LOTS submit inventory

↓ ★

Individual datasets aggregated to database

↓ ★

Data analysis and forecasting

↓ ★

Performance dashboard update & FY baseline

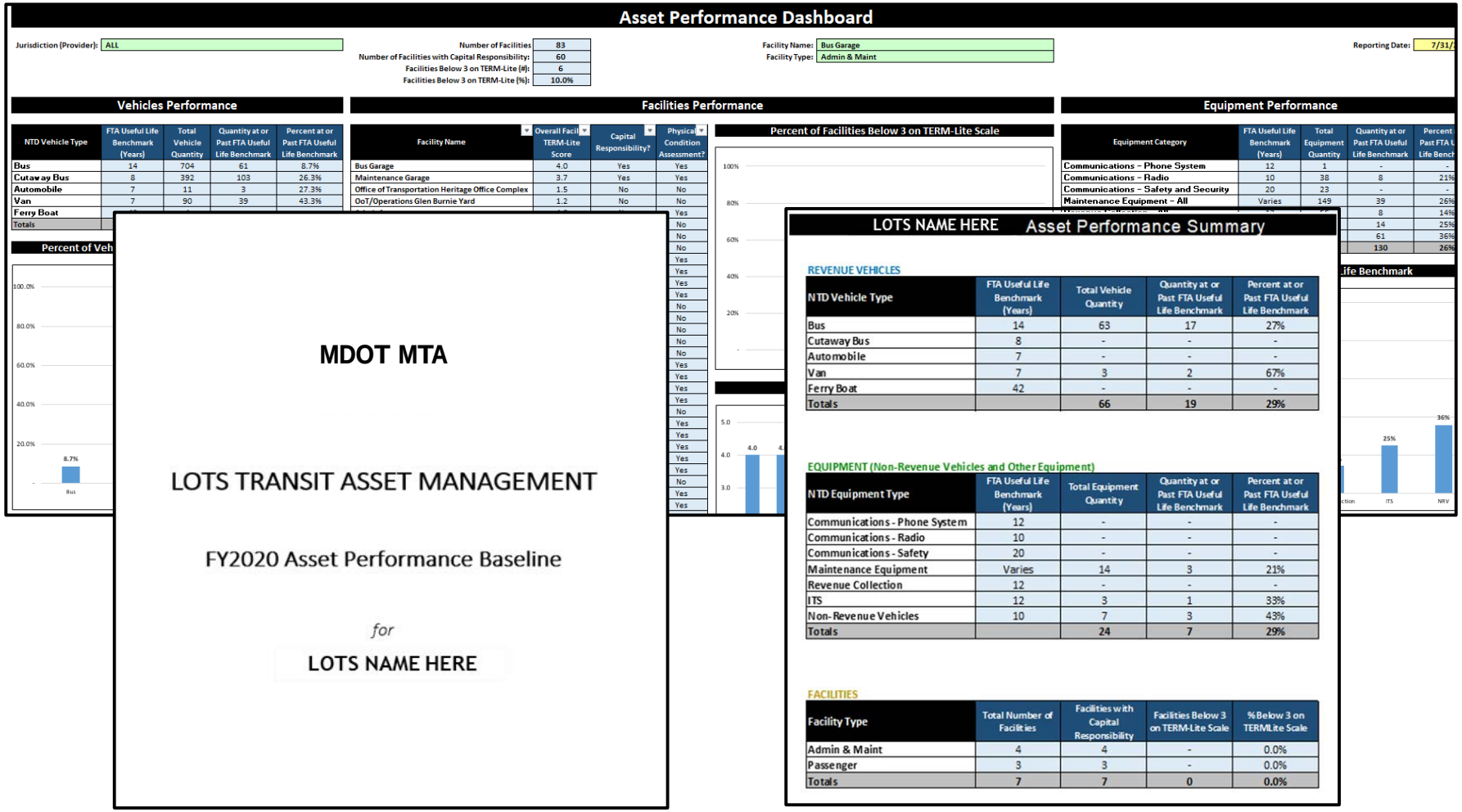
↓ ★

NTD Reporting

↓

Investment Prioritization

★ *Data quality checks*



Common Data Challenges

Informing local-level data governance and management practices

Local-State-Federal data terminology crosswalk

Manual process and timing challenges

LOTS resourcing

Looking Forward – Future Considerations

- Measuring data quality and confidence
- Formal data governance and management
- Semi-automated processes from inventory through investment prioritization

Thank You

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NJDOT

Maritime Asset Management System (MAMS)

Yun Bai, Center for Advanced Infrastructure and Transportation (CAIT), Rutgers University

TRB Webinar: Governing Data to Improve Transportation Asset Management

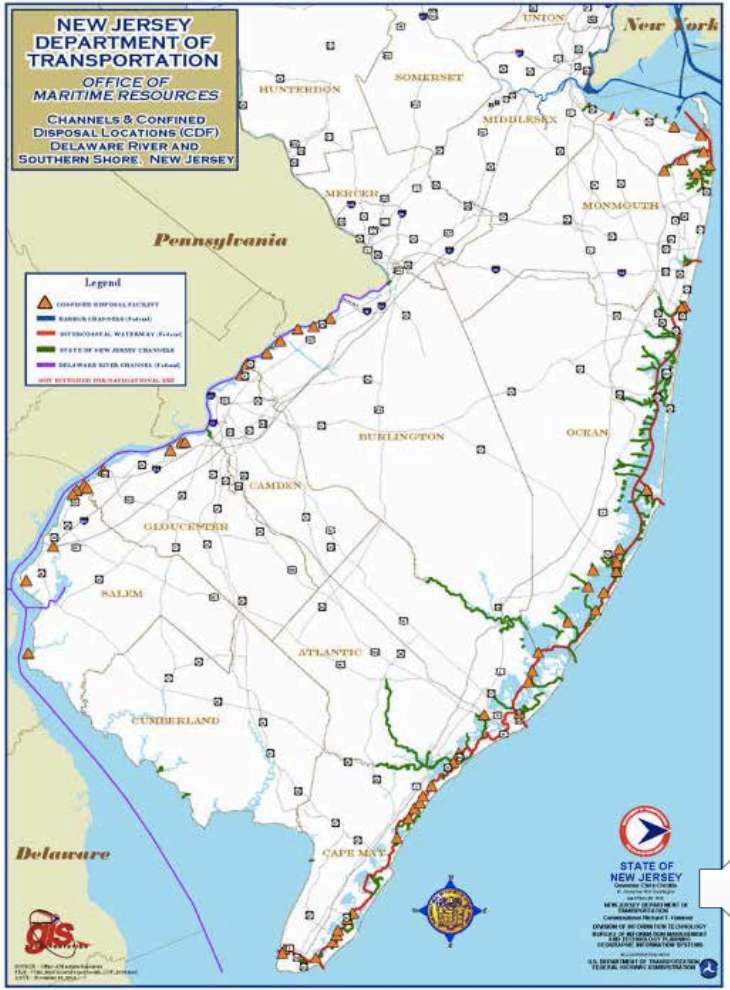
October 2020

Outline

1. New Jersey Maritime Transportation System Background and Data Management
2. Maritime Asset Management System (MAMS) Overview

New Jersey Maritime Transportation System

- Federal Channels in NY/NJ Harbor, Delaware River, and NJ Intracoastal Waterway; over 465 nm (860 km) of engineered waterways
- State Channel Network - 215 Marked and Identified Channels; over 200 nm (370 km) of engineered waterways
- Two International Ports (PONYNJ and South Jersey Port Corporation)
- Internationally recognized tourism destination
- World Class Fishery (most lucrative shellfishery in the U.S.)
- Worth over $50 billion annually to the New Jersey economy



State Channel Dredging Program

Dredging

Dredged Material Management

Navigation Dredging in New Jersey

Large mechanical equipment for deep draft navigation

Large hoppers and cutterhead dredges for Sand and Delaware River

Dredged Material Management

Confined Disposal Facility (CDF)

- open earthen berm settling ponds designed to hold slurry from dredging for at least 24 hours
- requires ample inexpensive open space

Beneficial Use (beach replenishment, habitat creation and restoration, landfill cover, and land site remediation, etc.)

Data Management

New Jersey Maritime Asset Management

Data Collection & Management

Channels – WLS

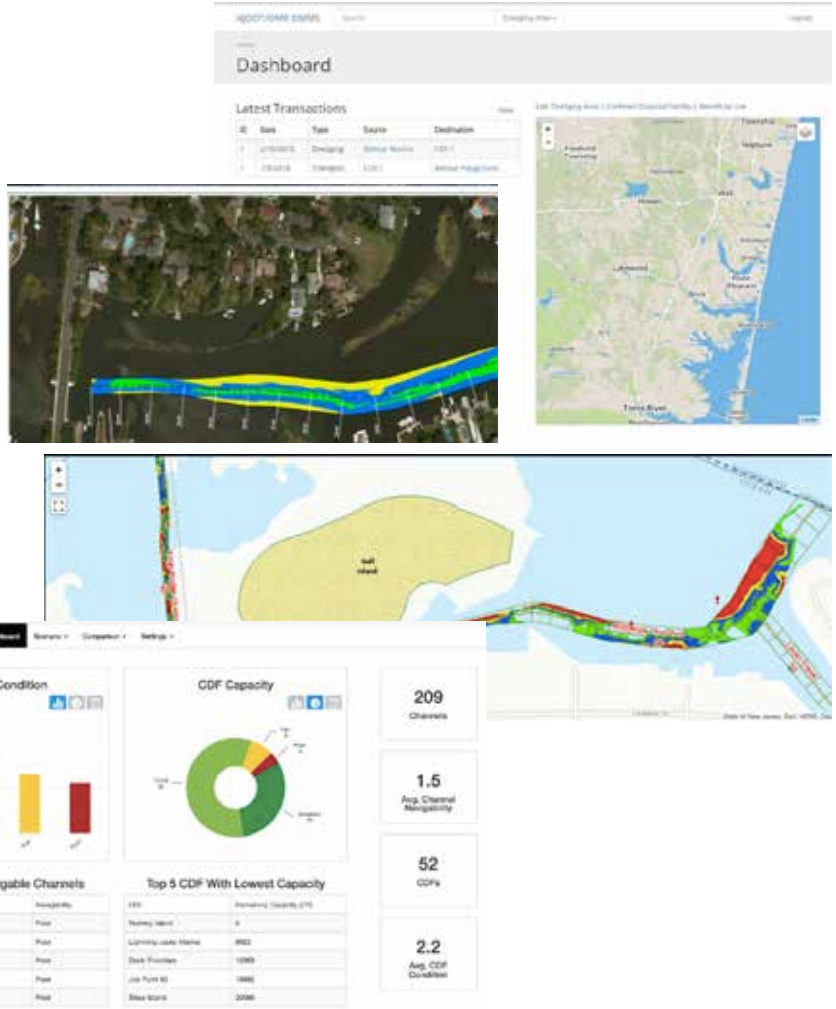
- Waterway reference model
- Navigation channel limits
- Bathymetric survey data

CDF – DMMS

- CDF map/survey
- Dredged material sampling analysis
- Permit data
- CDF capacity,
- Placement options/beneficial use

Strategic Planning – MAMS

- WLS and DMMS data
- Navigability & Shoaling model
- Cost data



Outline

1. New Jersey Maritime Transportation System Background and Data Management
2. Maritime Asset Management System (MAMS) Overview

MAMS Overview

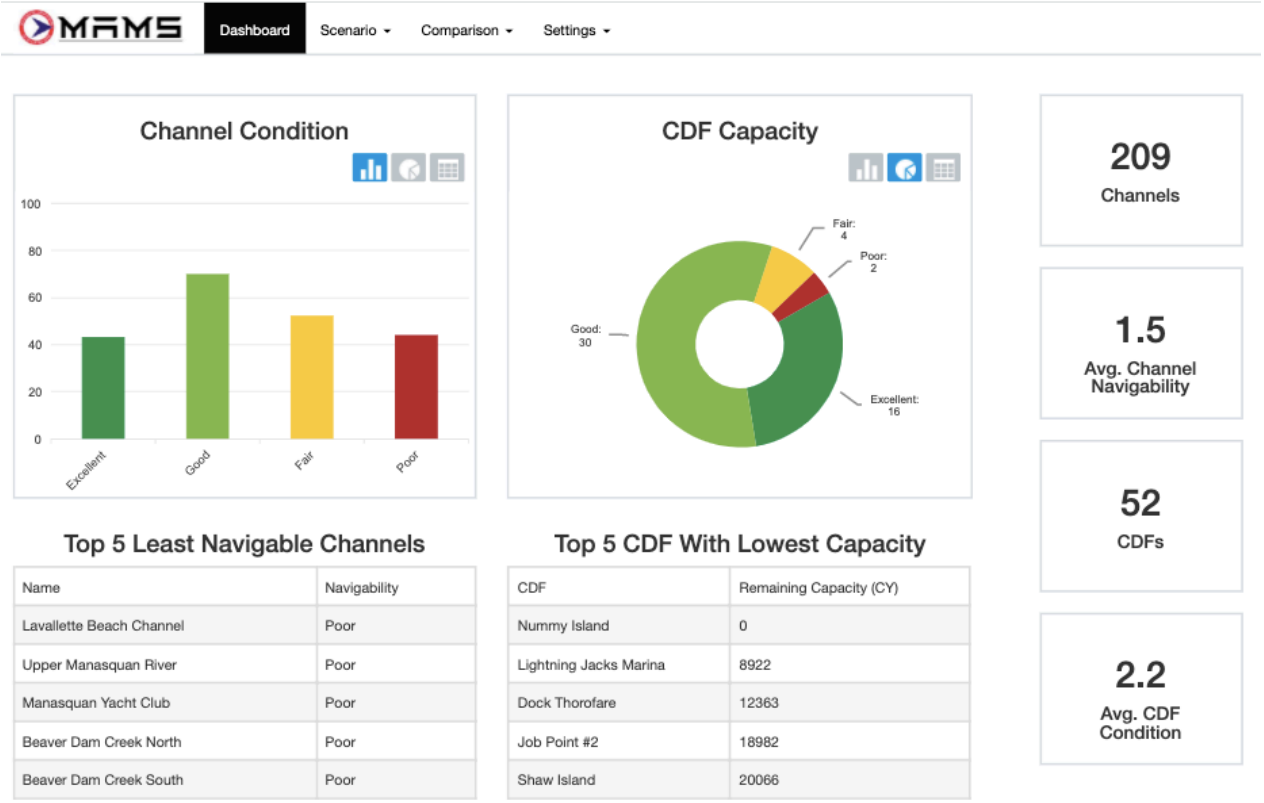
MAMS: maritime asset management decision support tool

1) Prioritization of assets/projects
2) Capital planning

Key Upper Management Questions that MAMS can help answer

1. How much budget is needed in order to keep pace with sedimentation and maintain state of good repair? **(budget planning, LCCA)**
2. How much budget is needed to get rid of Sandy backlog? What are the priorities? **(budget planning & allocation)**
3. Given a budget, what performance outcome can I get? How to maximize the benefit? **(performance analysis)**
4. What happens if we get this much extra money? What if I allocate different budget in different years **(scenario analysis)**
5. In 5, 10, or 15 years what is needed to get to an improved state of good repair? E.g., 80% channels in SGR by year 5 **(long term capital planning)**

Dashboard


MAMS
Dashboard
Scenario
Comparison
Settings
Channel Condition
100
80
60
40
20
0
Excellent
Good
Fair
Poor
CDF Capacity
Fair: 4
Poor: 2
Good: 30
Excellent: 16
209
Channels
1.5
Avg. Channel Navigability
52
CDFs
2.2
Avg. CDF Condition
Top 5 Least Navigable Channels
Name | Navigability
Lavallette Beach Channel | Poor
Upper Manasquan River | Poor
Manasquan Yacht Club | Poor
Beaver Dam Creek North | Poor
Beaver Dam Creek South | Poor
Top 5 CDF With Lowest Capacity
CDF | Remaining Capacity (CY)
Nummy Island | 0
Lightning Jacks Marina | 8922
Dock Thorofare | 12363
Job Point #2 | 18982
Shaw Island | 20066

Modeling

Single year Prioritization: Dredging Prioritization Model (DPM)

- Ranks dredging channels/projects for the next planning year (or period)
- Tiered ranking criteria
- Considers user constraints, channel bundling and dependence (for linked channels)

Multi-year Capital Planning: (LCCA based) Dredging Optimization Model (DOM)

- Dredging and dredged material management optimization in a multi-year planning horizon
- Incorporates shoaling model (deterioration model) for predicting future conditions
- Optimizes disposal of dredged materials to spatially distributed CDFs
- Enables life cycle cost analysis - evaluate how the system evolves over time under long-term budgeting and performance goal scenarios

Modeling

Two Problem Scenario Types (Input)

1. **Fixed Budget: Given a budget,**

Single year DPM: the algorithm ranks all channels based on the user specified tiered ranking criteria, and sorts channels in priority order until the budget runs out.
Multi-year DOM: the model maximizes one performance objective with the fixed budget

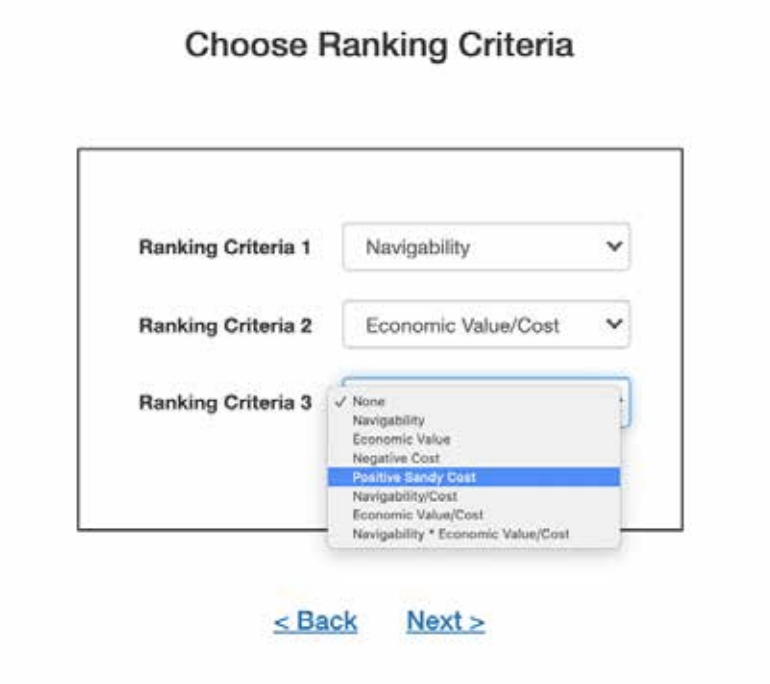
2. **Fixed Performance: Given a performance target,**

Single year DPM: the algorithm ranks all channels based on the tiered ranking criteria, and sorts channels in priority order until the objective is achieved.
Multi-year DOM: the model minimizes the budget needed to meet the performance requirement

Single Year Dredging Prioritization Model (DPM)

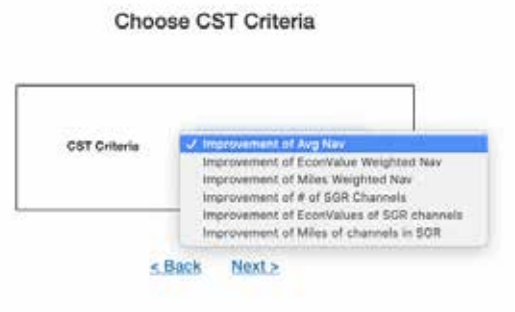
Input ranking criteria up to 3 tiers

1. Navigability
2. Economic value
3. Total cost
4. Reimbursable Sandy cost
5. Navigability/total cost
6. Economic value/total cost
7. Navigability*economic value/total cost



Multi-Year Dredging Optimization Model (DOM)

1. Fixed budget scenario, maximize one of the following objectives
    a. average navigability of all channels
    b. average econ value weighted navigability of all channels
    c. average miles weighted navigability of all channels
    d. number of SGR channels
    e. total econ value of all channels in SGR
    f. total miles in SGR
    g. Maximize total Sandy cost reimbursement
2. Fixed performance scenario, minimize the budget needed to satisfy one or multiple performance requirements
    a. Constraint 1: average navigability index or % improvement must be satisfied
    b. Constraint 2: econ value weighted average navigability index or % improvement must be satisfied
    c. Constraint 3: mile weighted average navigability index or % improvement must be satisfied
    d. Constraint 4: # of SGR channels or % improvement must be satisfied
    e. Constraint 5: total econ value of the SGR channels or % improvement must be satisfied
    f. Constraint 6: miles of channels in SGR or % improvement must be satisfied



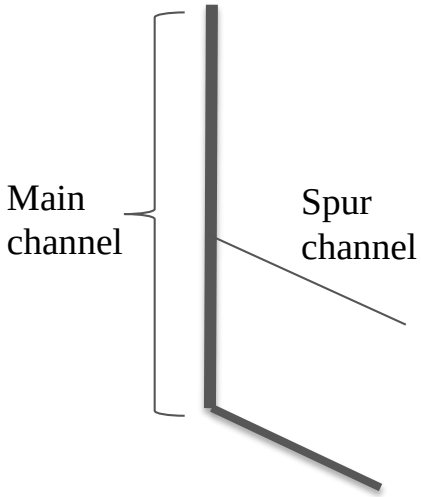
Modeling

Channel Bundling

- Predefine channel groups: dredging the channels in the same group together saves cost
- Modeled by fixed cost per group and variable costs per channel

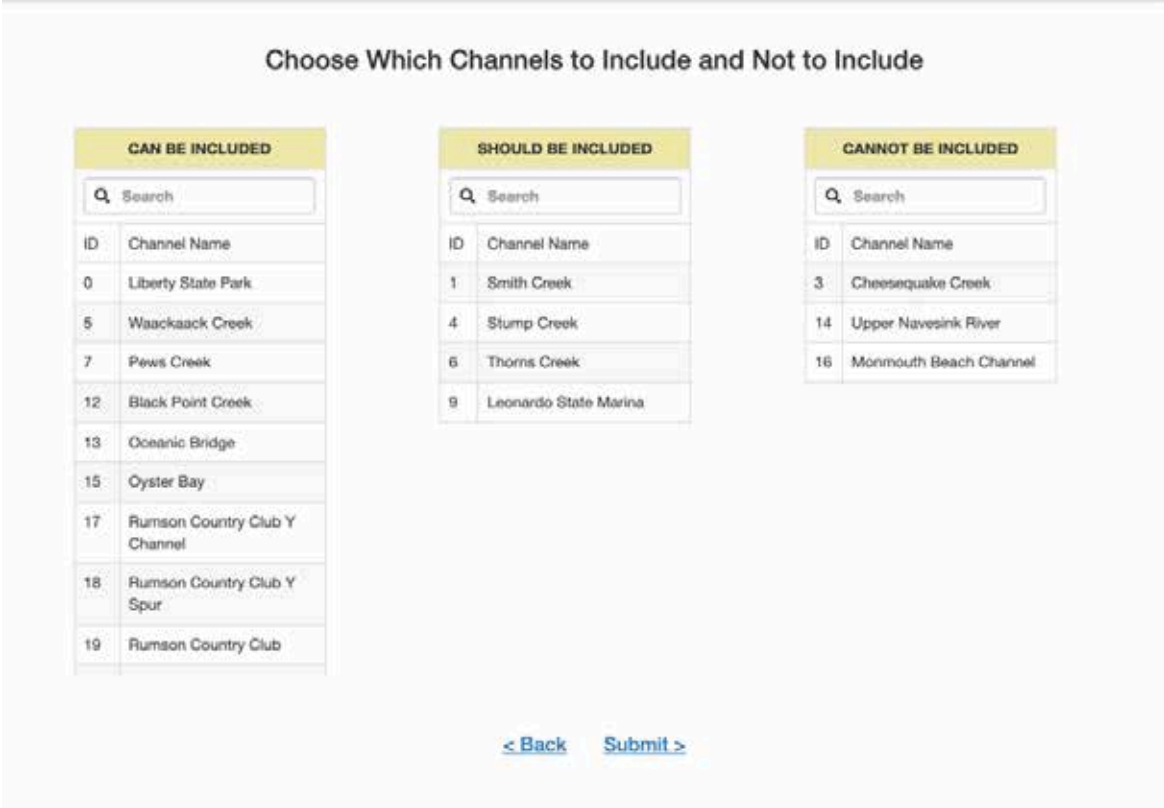
Channel Dependency

- For single year prioritization (DPM), if a spur channel is selected in the dredging priority list and its main channel which is also in critical condition but has not been selected yet, then the main channel will be added in the priority list right before the spur channel
- For multi-year optimization (DOM), the one-way dependency relationship is modeled as a conditional constraint



Modeling

User specification

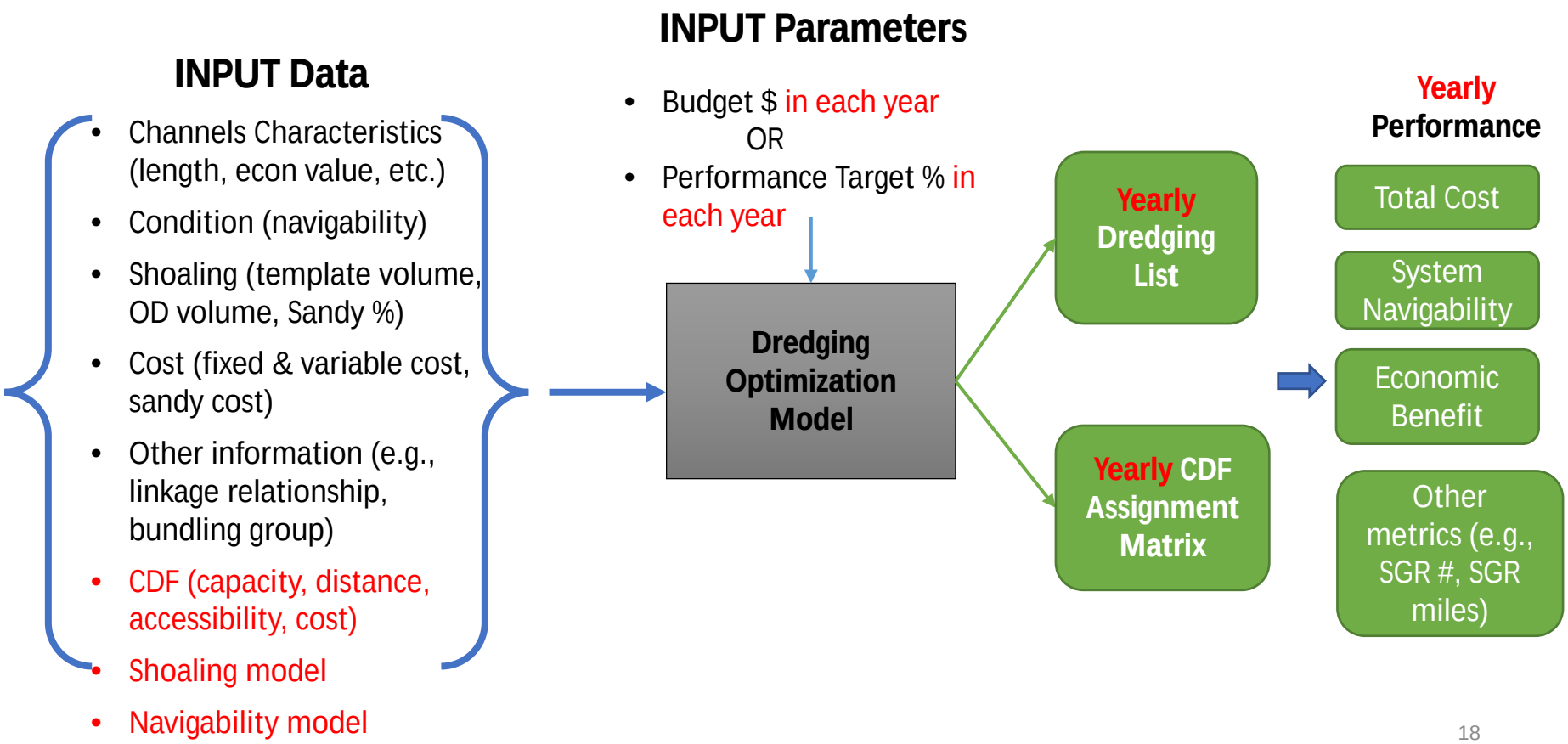


(LCCA based) Multi-year DOM

Incorporated factors and engineering constraints

- Deterioration - navigability degrading (if do nothing)
- Shoaling - dredging volume accumulation
- Budget or performance objective
- Dredging eligibility, e.g., exclusion of SGR and low shoaling channels
- User specified list
- Economy of scale – channel bundling with a fixed group cost
- Channel dependence – linked channel relationship
- CDF capacity
- Sandy cost reimbursement

Multi-year DOM: Input-Output Overview



Input Example 1 – Single Year Fixed Budget

LCCA | **Scenario** | Comparison | Channels

A | **Scenario** | Comparison | Channels

oard | LCCA | **Scenario** | Comparison | Channels

Choose The Scenario Type

- (●) 1 - Fixed Budget
- ( ) 2 - Navigability Improvement Percentage
- ( ) 3 - % Increase of Channels in SGR

Next >

Enter Budget Information

Budget $ 20,000,000

< Back Next >

Enter Ranking Criteria

1st Tier Rank Navigability/Cost

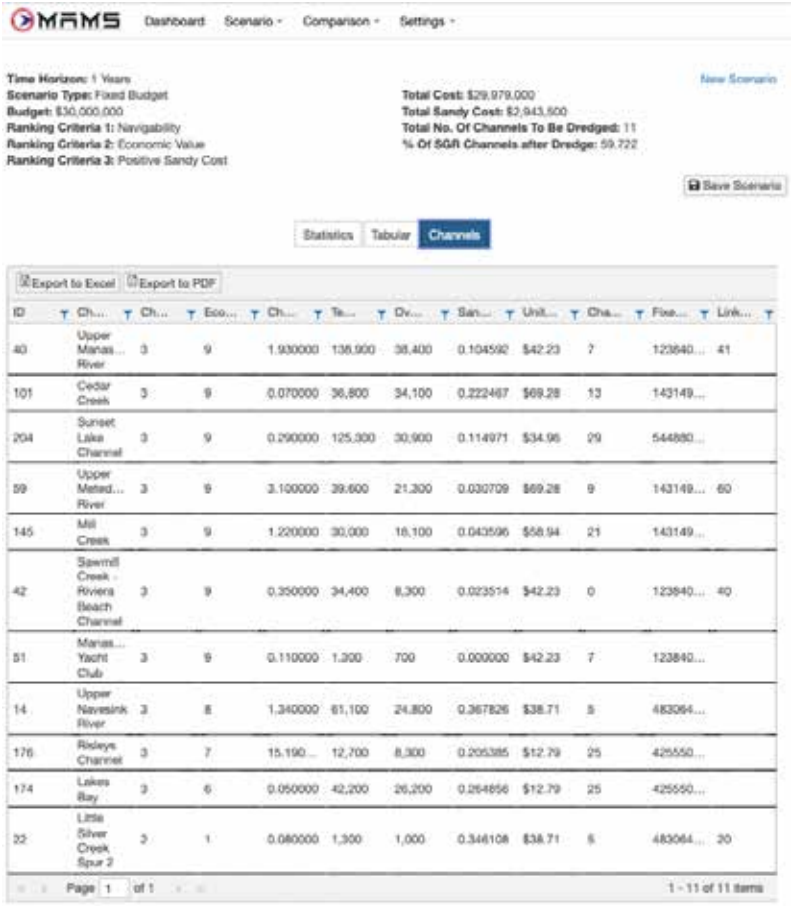
2nd Tier Rank Economic Value

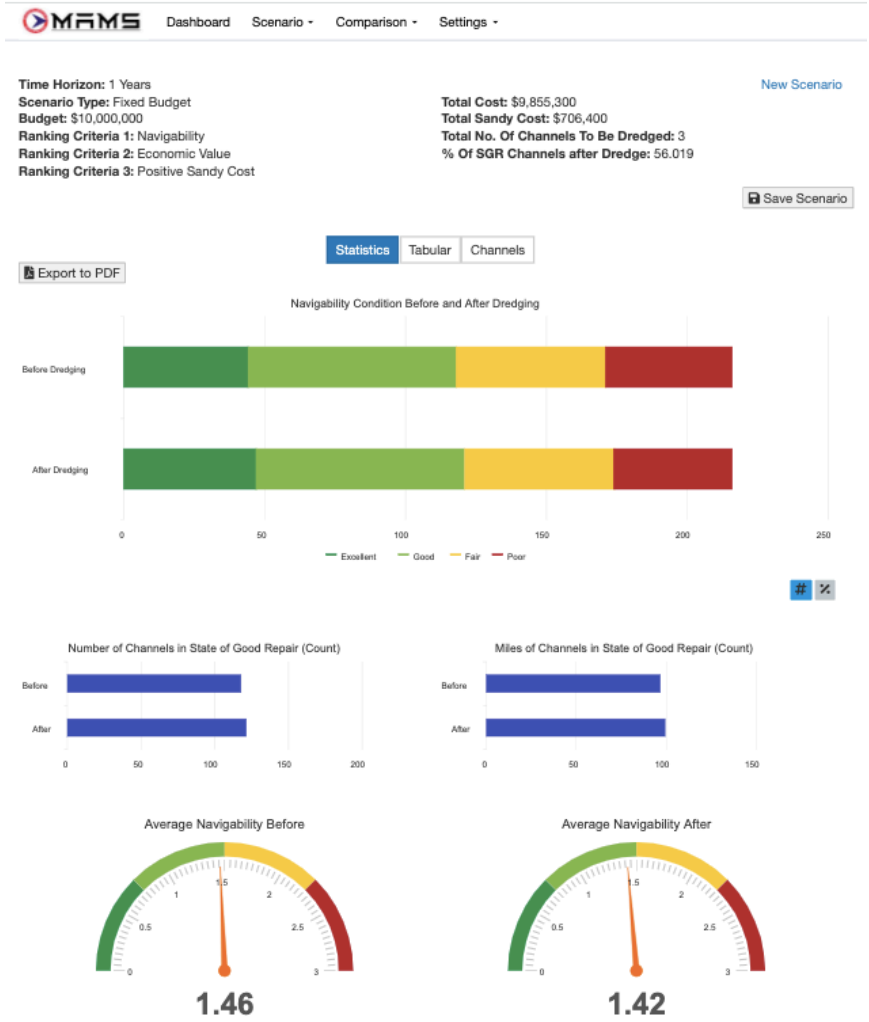
3rd Tier Rank None

< Back Next >

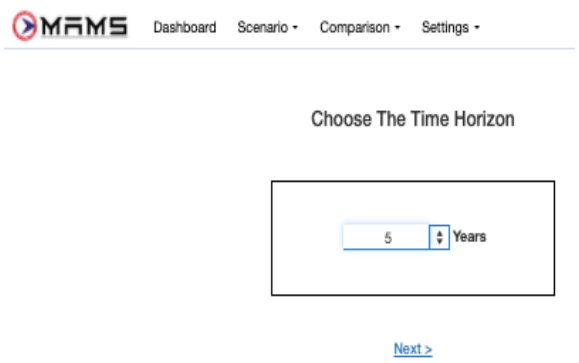
submit

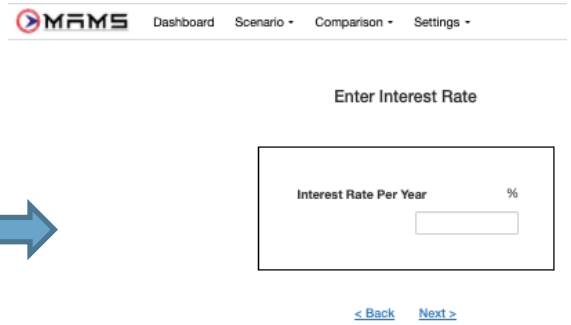
Output pages

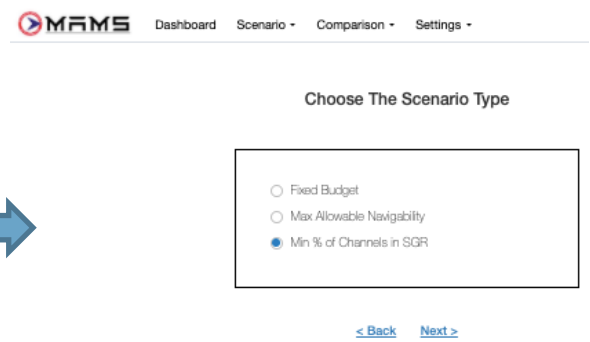


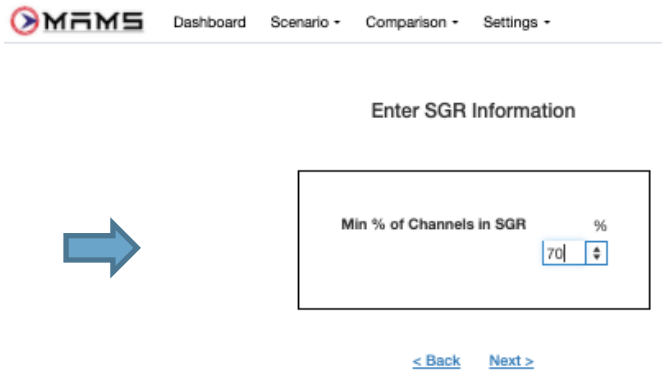


Input Example 2 – Multi-year Fixed Performance









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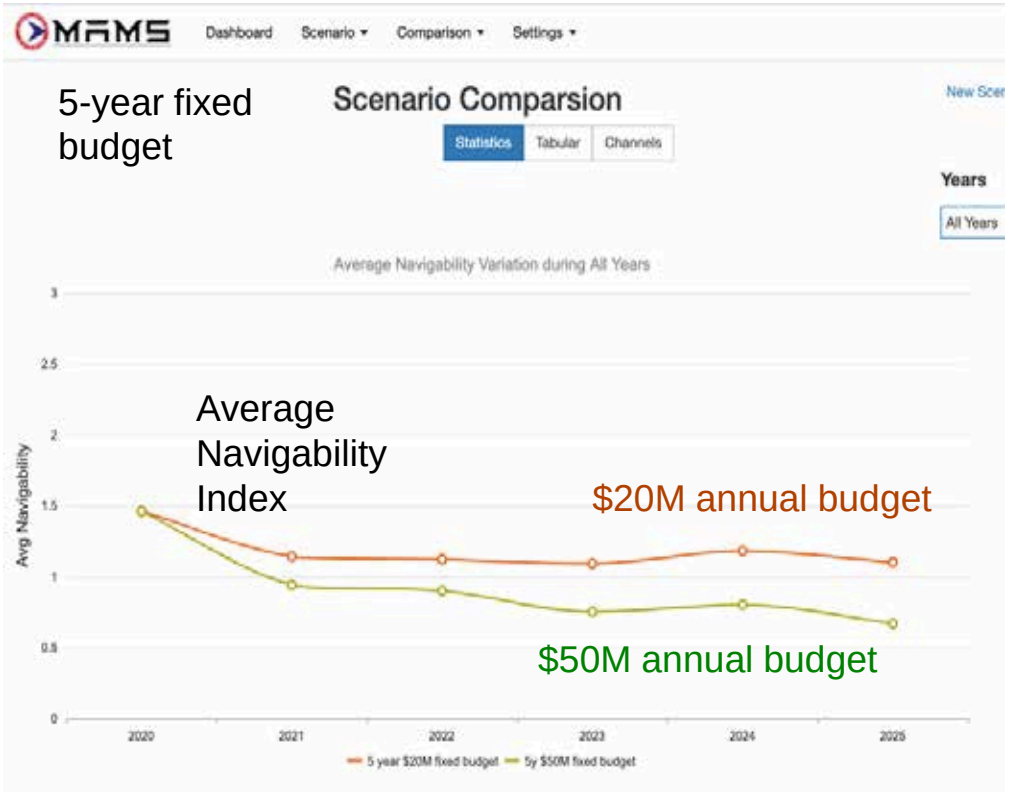
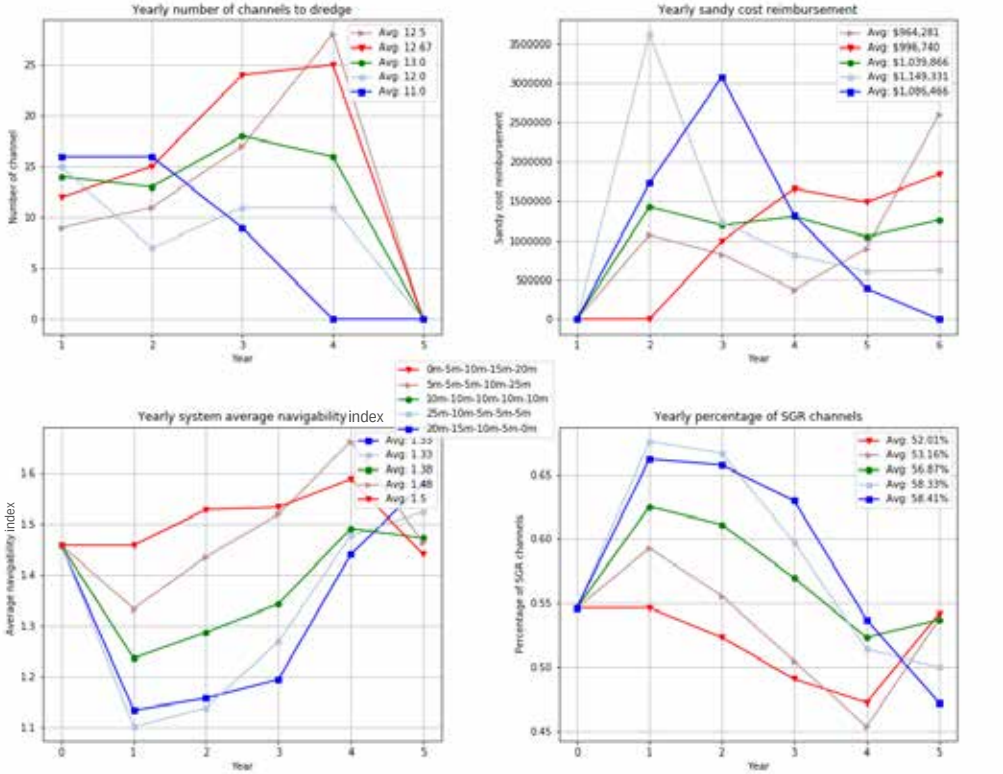
Output Pages – Scenario Comparison



Case study

5 year planning horizon, fixed budget ($50M in 5 year), maximize avg navigability



Thank you!

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Today's Panelists

#TRBWebinar

Moderator:
Jack Stickel,
Tempestas Enterprises

John Puente,
Ohio DOT

Tamara Hass,
New Mexico DOT

Margaret-Avis Akofio-Sowah, *WSP*

Yun Bai, *Rutgers*

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