NATIONAL ACADEMIES Sciences Engineering Medicine

TRB TRANSPORTATION RESEARCH BOARD

TRB Webinar: Preparing and Conducting Traffic Management System Assessments

July 15, 2024

2:00 – 3:30 PM

PDH Certification Information

1.5 Professional Development Hours (PDH) – see follow-up email

You must attend the entire webinar.

Questions? Contact Andie Pitchford at TRBwebinar@nas.edu

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

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Purpose Statement

This webinar will identify opportunities for TMSs to meet agency objectives, performance expectations, desired functions, services, and capabilities. Presenters will share information to prepare for and conduct a full TMS assessment and integrating TMS planning into agency institutional processes.

Learning Objectives

At the end of this webinar, you will be able to:

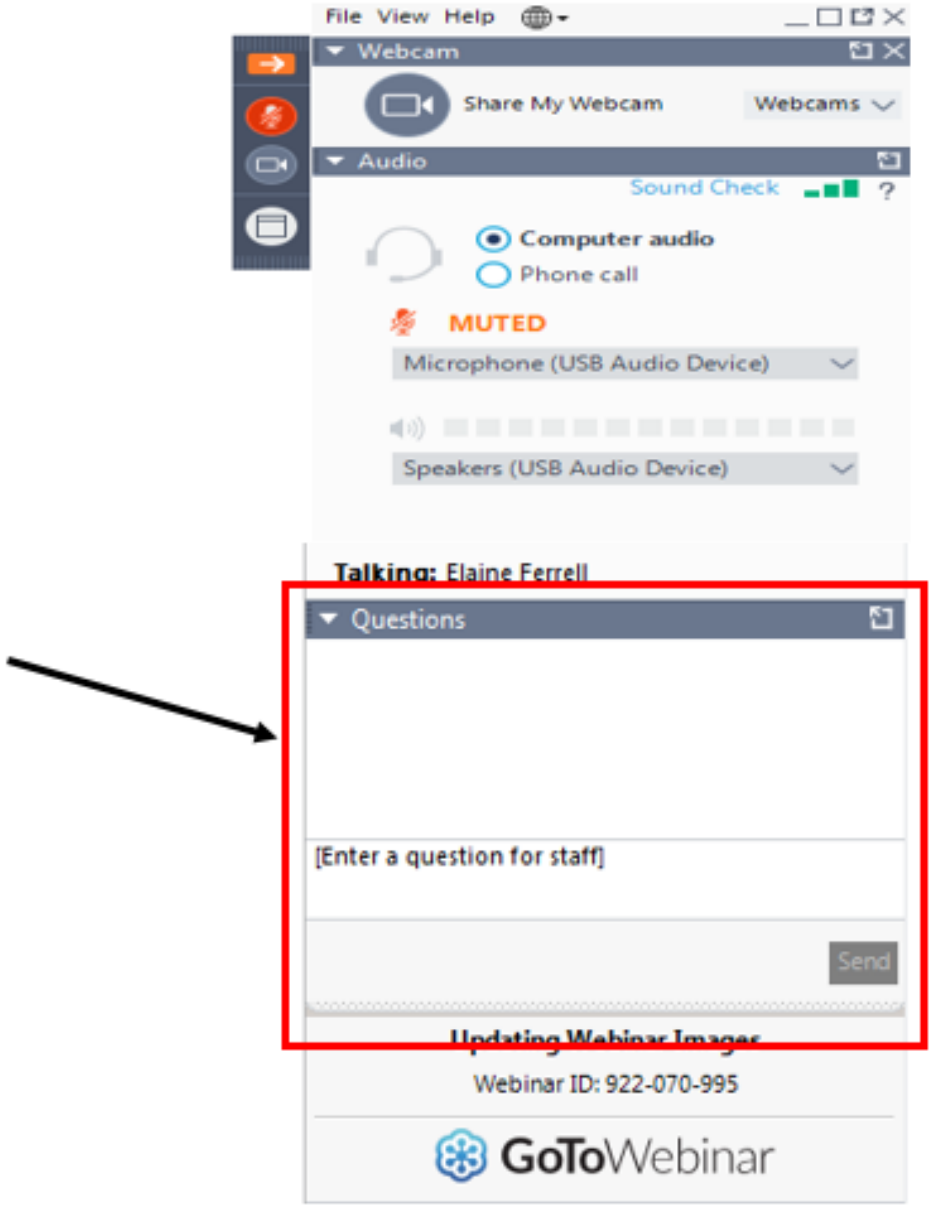
(1) Conduct on-going assessments of their TMS

(2) Apply the AASHTO-FHWA Capability Maturity Model framework to TMS assessments

(3) Integrate TMS planning into agency institutional processes

Questions and Answers

- Please type your questions into your webinar control panel
- We will read your questions out loud, and answer as many as time allows



Today's presenters

Pete Marshall
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HNTB

John MacAdam
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MacAdam CONSULTING

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PARSONS

NATIONAL ACADEMIES *Sciences Engineering Medicine*

Overview – Preparing, Conducting, and Summarizing the Results - Assessing Traffic Management Systems (TMSs)

Moderator: Pete Marshall (D2 Traffic Technologies)

Presenters:

- Matt Junek, *HNTB*
- Dan Lukasik, *Parsons*
- John MacAdam, *MacAdam Consulting*
- Matt Junak, *HNTB*

Framing the Discussion: Preparing, Conducting, and Summarizing the Results - Assessing TMSs

Pete Marshall, P.E., PTOE (moderator)
D2 Traffic Technologies

Topics:

1 | Overview (Pete)

2 | Assessing TMSs (Matt)

3 | Preparing for and Conducting a TMS Assessment (Dan)

4 | Assessing TMSs Capabilities and Performance (John)

5 | Identifying Opportunities and Approaches for Improving TMSs (Matt)

6 | Summary of Industry Input and Comments (Pete)

7 | Q/A, Discussion (put your questions or comments in the chat) (Pete to moderate

Overview

Preparing for and Assessing the Capabilities and Performance of Agency's TMSs

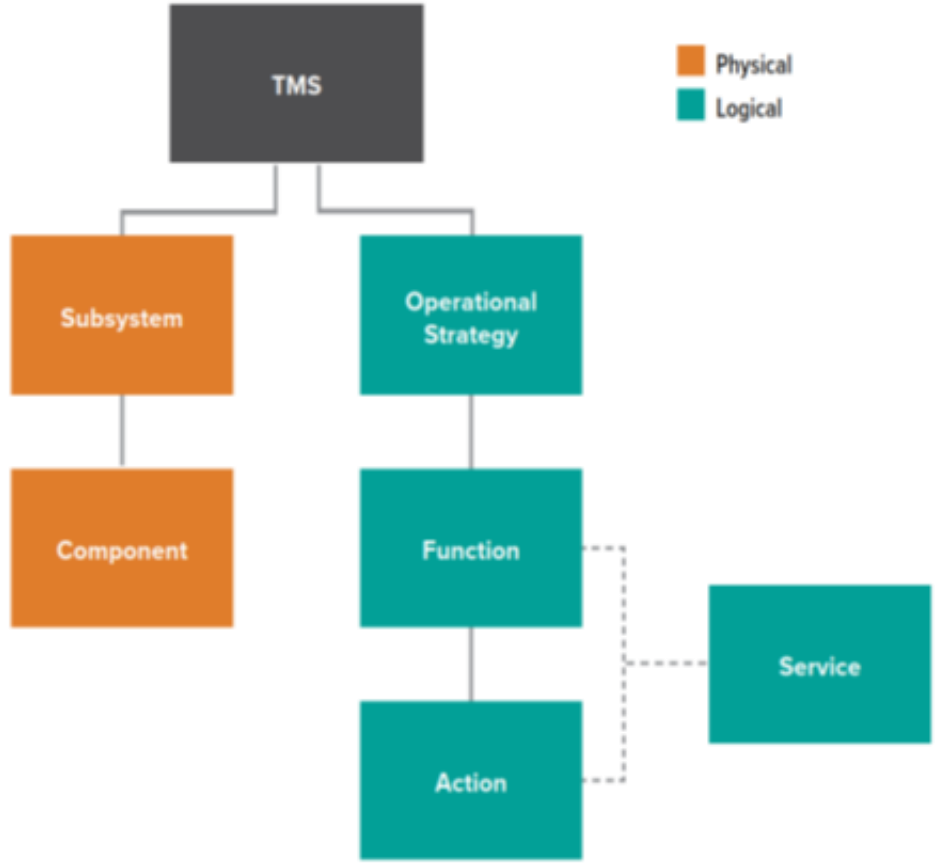
- **Frame** the value proposition
- **Identify** potential issues, methods, and information to consider
- **Introduce** *information* to provide a basis for agencies planning assessments

GOALS:

- ***Clear understanding*** of the meaning and intent of each of the three framing topics:
  1) preparing for and conducting a TMS assessment
  2) assessing TMS capabilities and performance
  3) identifying opportunities and approaches for improving TMSs
- ***Awareness of issues*** to consider with preparing for, conducting, and assessing the capabilities and performance of an agencies TMS
- ***Present Resources*** for Further Information

What is This Important?

- Resources typically do not exist to support reporting, assessing, and benchmarking performance
- Initiatives need to facilitate assessing the:
  - Day-to-day management and operation, maintenance, repair, and management of all assets and resources
  - Staff, policies, procedures, support resources, and operational issues
  - TMS planning, design, implementation, and system life-cycle:
    - TMS capabilities
    - TMS performance
    - TMS capacity
    - TMS geographical scope and reach
  - TMS sharing and using data with external sources and stakeholders



Source: FHWA

Framing the Discussion

Should agencies consider conducting an assessments of their TMSs in addition to other TSMO assessments agencies are conducting?

Existing Dimensions or Process Improvement Areas	
Dimensions or Process Areas	*What is it? What does it do?*
1. Business Process	Plans, Programs, Budget
2. Systems & Tech	Approach to Building Systems
3. Performance Measurement	Use of Performance Measures
4. Workforce	Improving Capability of Workforce
5. Culture	Changing Culture and Building Champions
6. Collaboration	Improving Working Relationships

Examples of CMM assessments agencies are conducting:

- Active Management Cycle
- Traffic Management
- Active Demand Management
- Traffic Incident Management
- Planned Special Events
- Traffic Signal Management
- Work Zone Traffic Management
- Road Weather Management

Source: FHWA

Framing the Discussion

What might be agency motivations for assessing TMSs?

- Provides a means for assessing:
  - System effectiveness and reliability
  - How a TMS is being managed and operated
  - Implications of operational decision making
  - Condition of TMS assets
- Provides basis for:
  - Improving how TMSs are being managed and operated
  - Identifying opportunities to improve TMS capabilities and performance
  - Exploring implications of changing the way a TMS is managed and operated
  - Creating baseline to compare future capabilities and performance
  - Engaging key stakeholders to build/maintain support for improvements or allocation of resources
  - Enhancing how assets are being managed (e.g., operations, maintenance, repair, replacement)
  - Identifying and prioritizing needed improvements

Framing the Discussion: Assessing TMSs

Matt Junak
HNTB

Session 1 Presentations:

1 | Assessing TMSs

2 | Preparing for and Conducting a TMS Assessment

3 | Assessing TMSs Capabilities and Performance

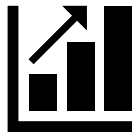
4 | Identifying Opportunities and Approaches for Improving TMSs

Framing the Discussion

An ***Assessment*** is a formal, structured process for identifying current levels of capabilities and performance.

Use an established process or framework for conducting assessments

Involve key stakeholders in process

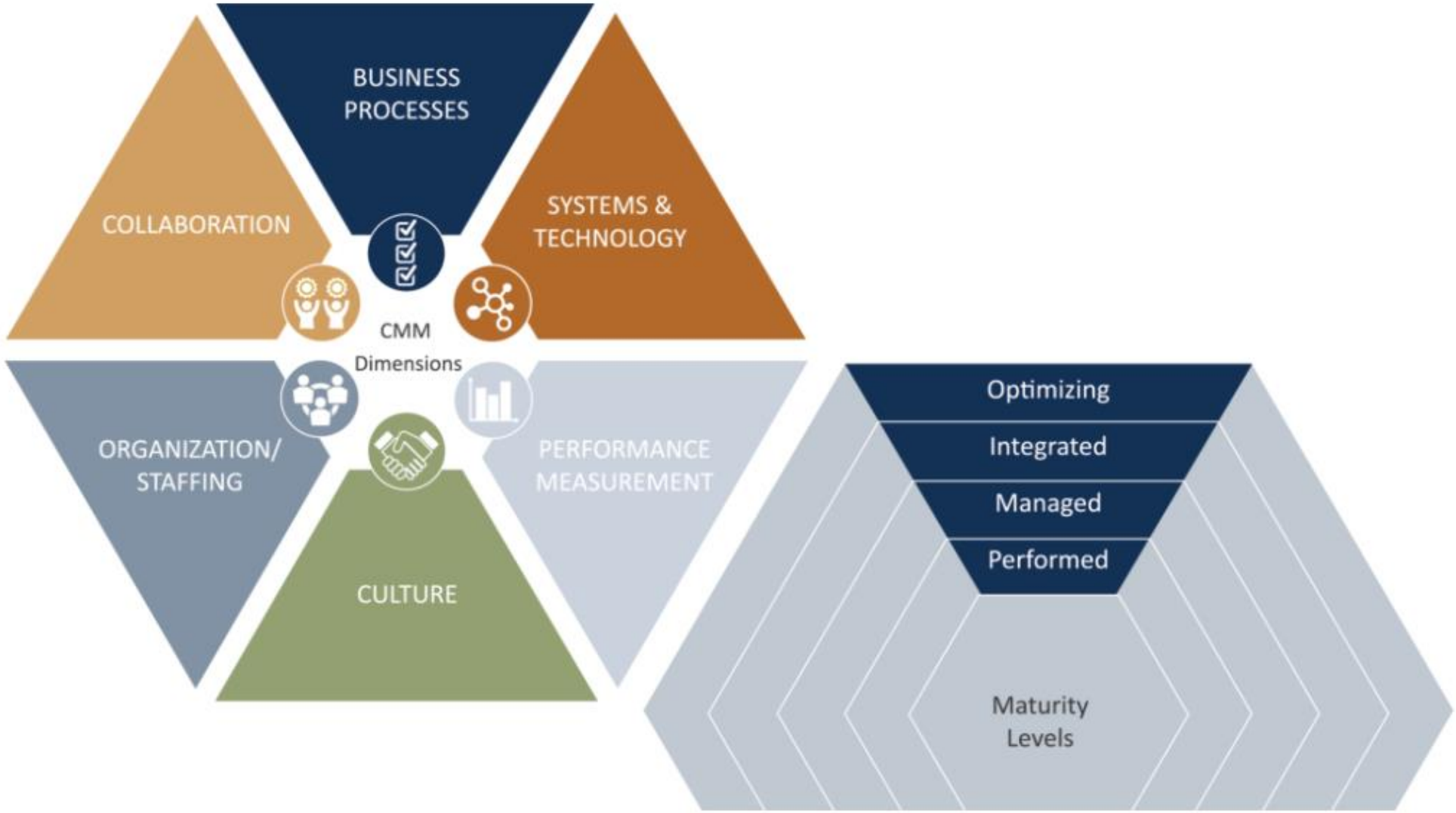


Outputs of assessments can be used to:

- **Identify enhancements to improve performance**
- **Develop consensus around needed improvements**
- **Identify immediate priorities for action or changes**
- **Identify opportunities for future improvements**

Framing the Discussion

AASHTO-FHWA Capability Maturity Model (CMM) framework:



Source: FHWA

Framing the Discussion

What other dimensions might agencies consider when assessing TMSs?

Existing Dimensions or Process Improvement Areas	
Dimensions or Process Areas	*What is it? What does it do?*
Business Process	Plans, Programs, Budget
Systems & Technologies	Approach to Building Systems
Performance Measurement	Use of Performance Measures
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Missing Process Improvement Areas	
Dimensions or Process Areas	*What is it? What does it do?*
Management & Operation	Managing and Operating Daily
Maintenance & Repair	Conducting Daily Maintenance and Repairs
Sharing and Using Data	Policies, procedures, agreements, and activities to enable the sharing and use of data with sources external to TMS

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Possible Process Improvement Areas to Assess TMSs	
Dimensions or Process Areas	*What is it? What does it do?*
1. Business Process	Plans, Programs, Budget
2. Systems & Technologies	Approach to Building Systems
3. Performance Measurement	Use of Performance Measures
4. Workforce	Improving Capability of Workforce
5. Culture	Changing Culture and Building Champions
6. Collaboration	Improving Working Relationships
7. Management & Operation	**Managing and Operating Daily**
8. Maintenance & Repair	**Conducting Daily Maintenance and Repairs**
9. Sharing and Using Data	**Activities to enable sharing and use of data with sources external to TMS**

Source: FHWA

Framing the Discussion

What dimensions and subdimensions to consider when assessing TMSs?

Level 4. Optimizing
Level 3. Integrated
Level 2. Managed
Level 1. Performed

Planning and Operational Focused Dimensions

Business Processes	*Culture*	*Collaboration*	*Workforce*	*Systems and Technology*
•TMS Program and Plan •TMS & Plan Integrated into Agency Plans & Programs •Programming & Budget •Operating Policies & Procedures	•Visibility TMS Program w/in Agency Strategic Plans •TMS Program Integrated into TSMO & Agency Program Plans & Funding	•Agency Collaboration •Third party relationships	•Organizational structure & governance •Staff Development •Staff recruitment •Staff development & retention plans	•Subsystem, components, and devices •System mutli-year plan •System design •Inventory assets & resources

Technical Focused Dimensions

Sharing and Using Data	*Performance*	*Management and Operations*	*Maintenance & Repairs*
•Data Sharing •Data Exchange Procedures, Agreements, APIs, & Data Formats •Using Data From Other Sources •Interoperability	•Data collection •Performance Measures •TMS Monitoring •TMS Asset Monitoring	•Service Level & Resiliency •TMS Oper. Capabilities •TMS Asset Impact •High avail. / remote ops	•Asset Documentation •Configuration Management •Maintenance request management •TMS feature roadmap

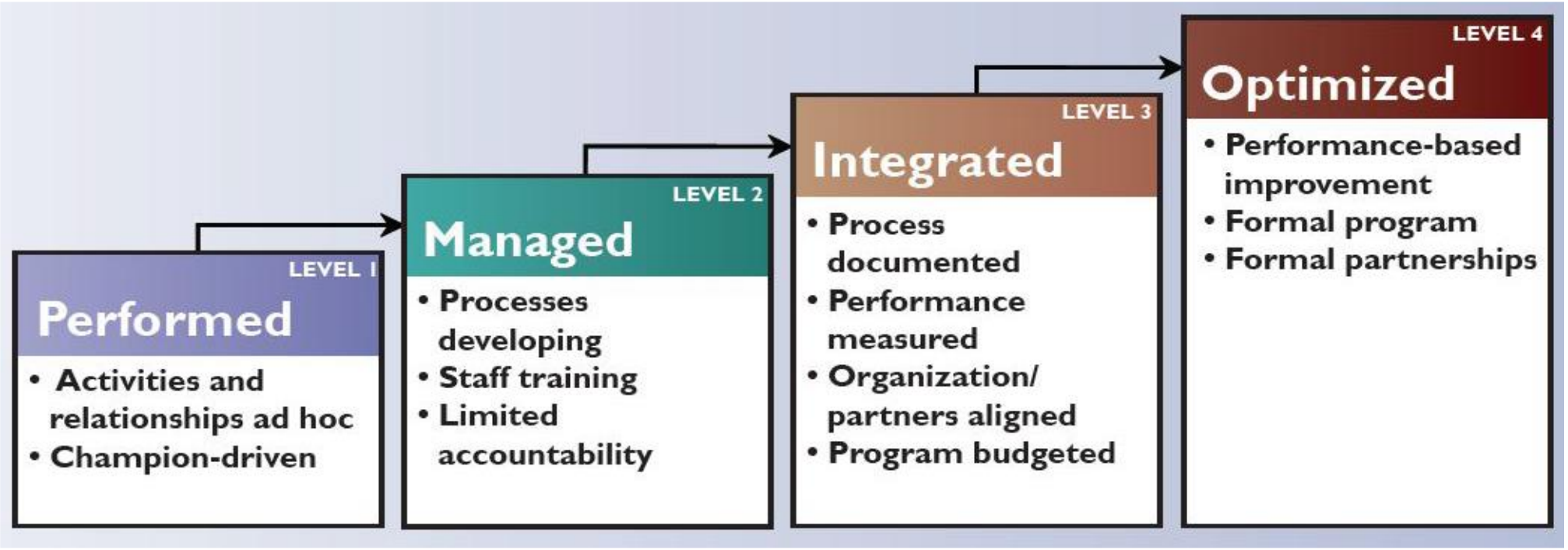
Source: FHWA

Framing the Discussion

What issues to consider in support of assessing the capabilities of dimensions?

Once you know your Capability Maturity Levels, consider:

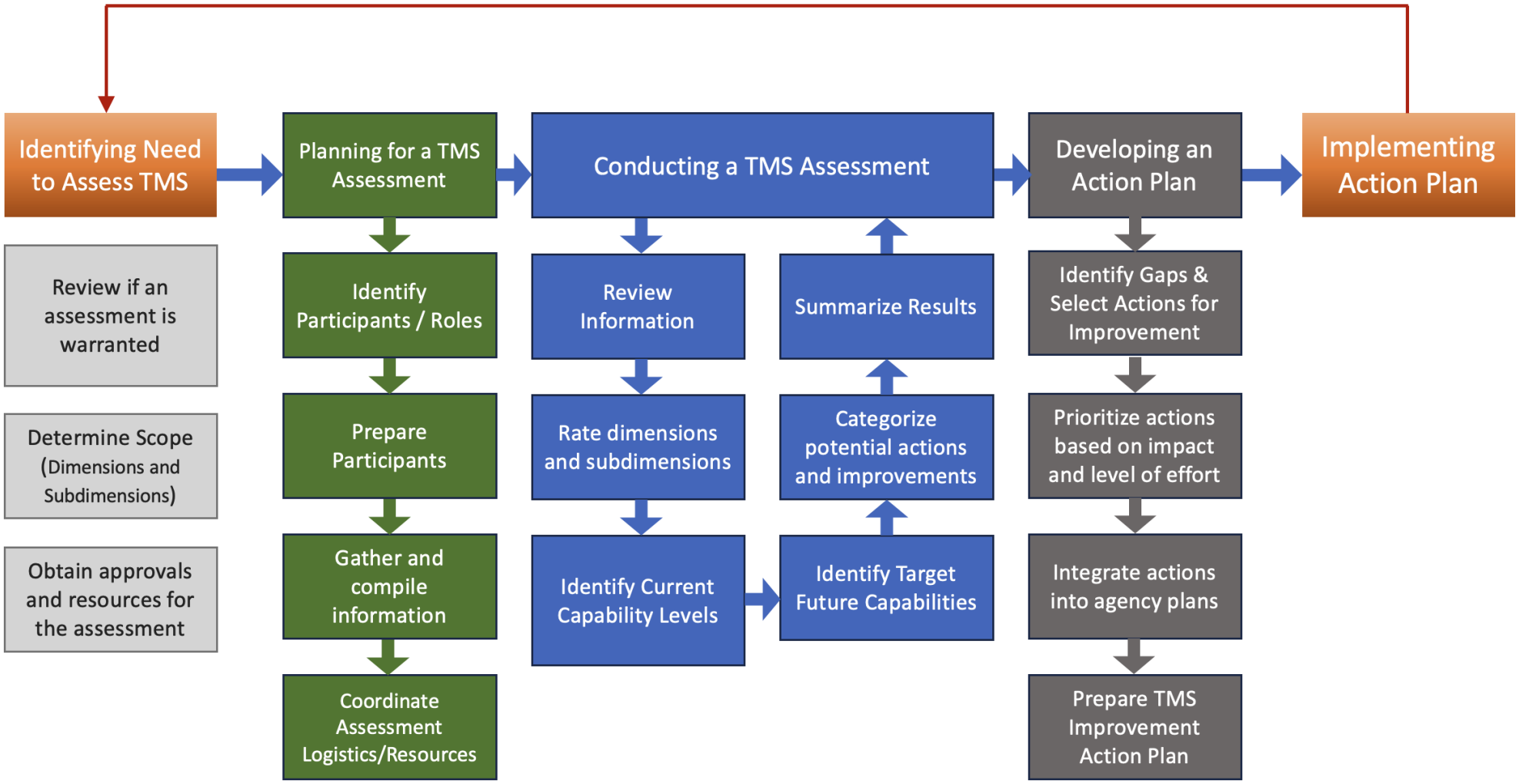
- *Where are the highest priorities for improvement?*
- *Are there areas for early action ("low-hanging fruit")?*
- *What projects are important but may take more time and resources?*



Source: FHWA

Framing the Discussion

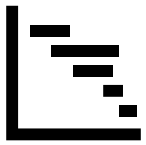
What process might agencies follow when preparing for or assessing TMSs?



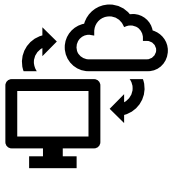
Framing the Discussion

What to consider when identifying opportunities for TMS improvements?

Assessing TMSs provides information to support efforts to identify the needs of the next generation agency TMS system



Planning and plans identifying strategic directions and future capabilities

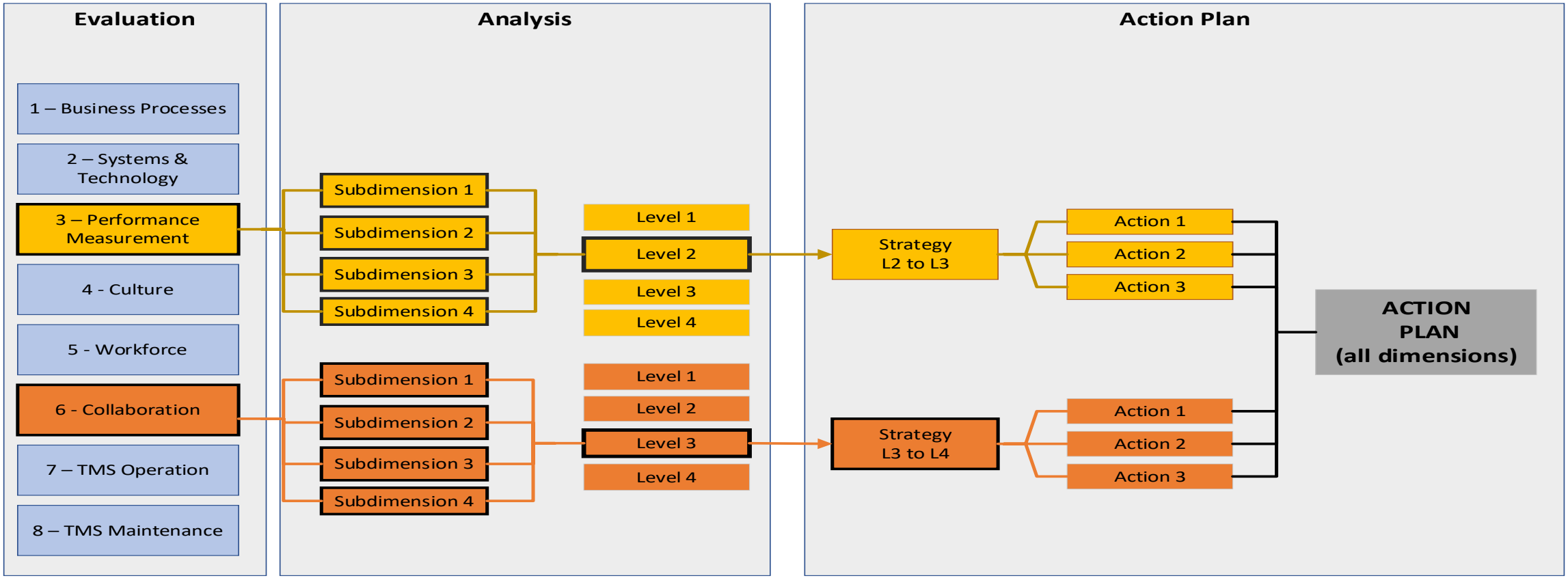


Modular and expandable subsystems (e.g., software, data) to adjust to or meet evolving future

Resources to support TMS (e.g., plan, design, manage, operate, maintain, repair)

Framing the Discussion

EXAMPLE: identifying, evaluating, and prioritizing possible TMS improvements



Source: FHWA

Framing the Discussion

Examples of resources to support conducting TMS assessments:

1. FHWA's capability maturity framework (CMF) https://ops.fhwa.dot.gov/tsmoframeworktool/index.htm
2. FHWA self-assessment resources for specific TSMO Program Areas or strategies
3. **FHWA developing new resources for TMS assessments – finishing in 2024-2025**
4. Using Capability Maturity Frameworks for TSMO Program Advancement: Case Studies and Lessons Learned, FHWA. https://ops.fhwa.dot.gov/publications/fhwahop19011/index.htm
5. Traffic Management Capability Maturity Framework Tool, FHWA. https://ops.fhwa.dot.gov/tsmoframeworktool/tool/traffic_mgmt/index.htm
6. Resources to Support Traffic Management Capability Maturity Framework Users. https://ops.fhwa.dot.gov/tsmoframeworktool/available_frameworks/traffic.htm
7. Business Process Frameworks for Transportation Operations, FHWA. https://ops.fhwa.dot.gov/tsmoframeworktool/index.htm
8. Traffic Management Capability Maturity Framework – Fact Sheet, FHWA. https://ops.fhwa.dot.gov/publications/fhwahop16026/index.htm

Preparing for and Conducting a TMS Assessment

Dan Lukasik
Parsons

Session 1 Presentations:

1 | Assessing TMSs

2 | Preparing for and Conducting a TMS Assessment

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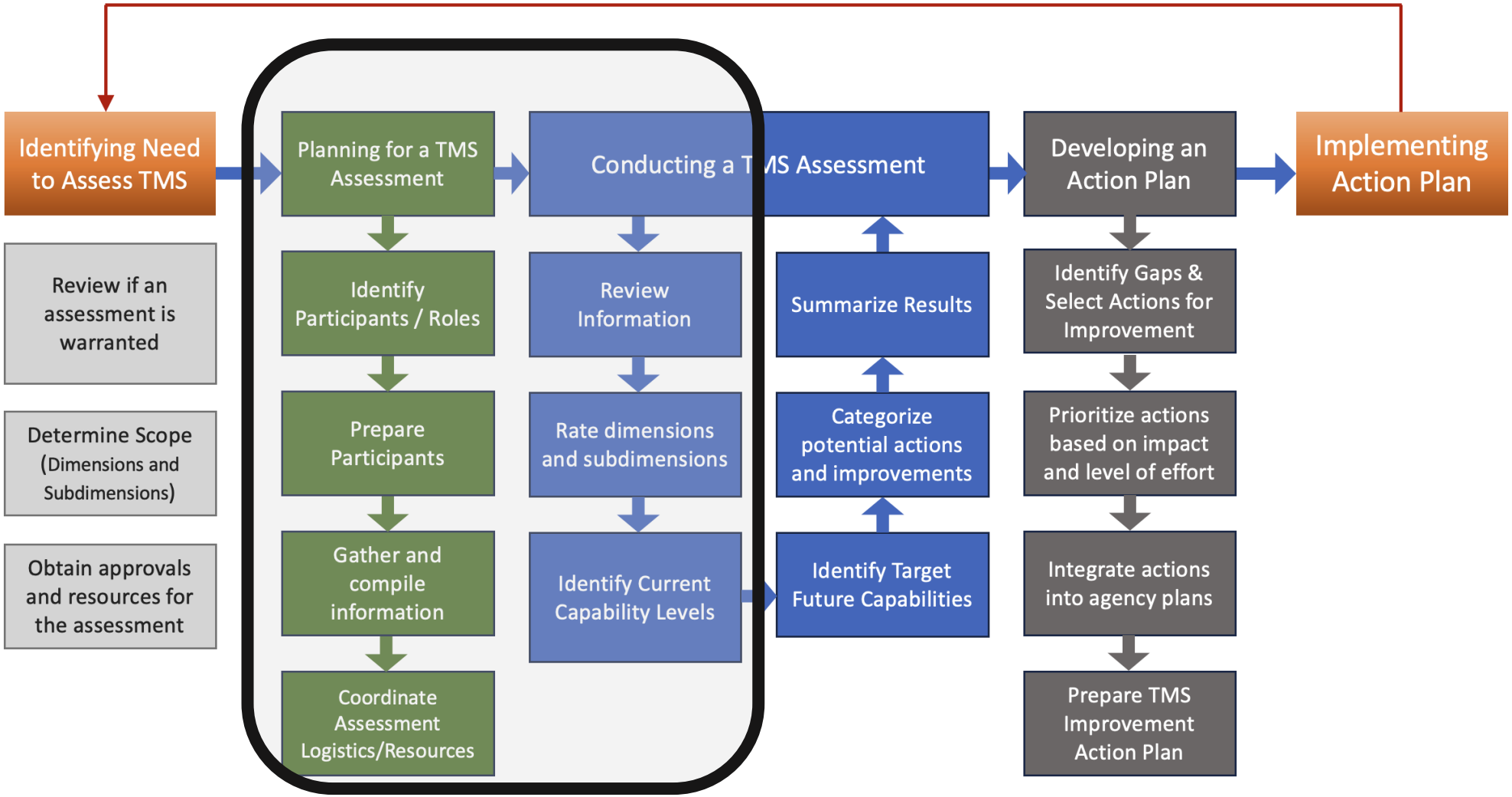
Preparing for and Conducting a TMS Assessment

Possible *assessment process and activities* to consider:



Source: FHWA

Preparing for and Conducting a TMS Assessment

Contemplating conducting an assessment – examples of issues to consider:

- Build agency support to conduct assessment
- Identify stakeholders to include in assessment process
- Determine timing
- Prepare for how to conduct the assessment
- Plan on how to use the assessment results
- Prepare stakeholders to participate in assessment
- Identify agency resources and information needed (e.g., goals, performance measures, links to agency strategic plans, condition of TMS assets, etc.)
- Obtain resources to conduct assessment

Preparing for and Conducting a TMS Assessment

Conducting an assessment— examples of issues to consider getting started:

- Identify information needed to conduct assessment
- Identify and incorporate key stakeholders
- Agree on process to follow with conducting the assessment
- Determine key issues and actions to be considered in the assessment
- Collect and compile information needed
  - Pull information from other relevant assessments (e.g., TSMO, traffic signal timing, active traffic management) and plans (e.g., Agency TSMO Plan, Regional Plans, TMS Plans)
  - Compile information needed to support the assessment
- Determine which analyses to conduct, and outputs to produce

Preparing for and Conducting a TMS Assessment

Examples of information to compile and analyze to support assessing each TMSs Dimension, Subdimension, or Capabilities:

- TMS day-to-day:
  - Maintenance, repairs, and asset management
  - Operation (e.g., center, performance, active management)
  - IT, security, emergencies, and support other systems (e.g., remote operations)
- Staffing TMSs (e.g., plans, policies, resources, scheduling, contractors)
- Policies, procedures, and tools to support managing and operating TMS
- Inclusion of TMS plans, requirements, and resources into agency or TSMO policies, programs, plans, initiatives, services, or efforts
- Planning, design, development, and implementation of TMS
- Planning and plans for an agency's next generation of TMS or improvements

Preparing for and Conducting a TMS Assessment

Examples of issues to consider when assessing performance of TMSs:

- What goals, objectives, or questions need to be addressed or answered?
- What measures are needed to support the assessment?
- Are these measures directly or indirectly produced by available data and/or information?
- What data does the TMS need to collect, use, or make available to support the desired assessment procedure in the future?
- Do you have the resources to collect, compile, and manage desired data and information?
- Are the TMS performance measures and supporting data elements integrated into TSMO planning, programs, and agency strategic plans?

Preparing for and Conducting a TMS Assessment

Subdimensions – *define, describe, and what to assess*?

- Identify and describe dimension (e.g., TMS lifecycle processes, TSMO program and plans, agency programs and plans)
- Identify and describe possible sub-dimensions
- Develop framework to assess tiers of capabilities to assess dimensions and subdimensions
- Measure and identify current capabilities or performance
- Identify possible or desired future capability levels

	Level 1	Level 2	Level 3	Level 4
Dimension				
SubDimension 1				
SubDimension 2				
SubDimension 3				

Source: FHWA

Dimensions or Process Areas	*What Is It?*
1. Business Process	*Plans, Programs, Budget*
2. Systems & Technologies	*Approach to Designing, Developing, and Implementing Systems*
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9. Sharing and Using Data	Activities to enable sharing and use of data with sources external to TMS

Source: FHWA

Preparing for and Conducting a TMS Assessment

Example: Systems & technology dimension - *where are we today?*

Today's TMSs

Focused on improving the safety, efficiency, and predictability of travel on the surface transportation system, using:

- Field devices
- ITS infrastructure
- Communications media
- Information technology
- Operations personnel
- Operational strategies and control plans
- Active management and control of traffic
- Operations centers

Technology Challenges Facing Today's TMSs

- Limited ability to share information internally within agency, with other systems or public
- Limited ability to capture or use data from emerging sources or 3rd parties
- Capabilities or resources lacking to automate system functions or use of operational strategies
- Operating environment, software, or components are difficult to modify, replace, or integrate new or emerging technologies or devices
- Adding functions, services or technologies may require replacing or upgrading system due to limitations with how system was designed

Source: FHWA

Preparing for and Conducting a TMS Assessment

Example: Systems & technology dimension - *where can we go tomorrow?*

Technology Advances

- Emerging sources of data
- Sharing and using data with travelers using mobile devices
- Innovative technologies and tools to analyze data
- Advanced computing capabilities
- Open source, agency-owned and off-the-shelf software
- Enhanced capabilities of ITS and traffic control devices
- Ability to share information with other systems and public
- Etc.

→

Next-Generation of an agencies TMS:

- Improvements to existing capabilities and entirely new functions or services
- Real-time decision-making, with highly automated operation, to proactively manage and control traffic
- Coordinating and sharing of information with other systems and service providers to improve safety and mobility
- Modular components and expandable platforms, will be easier for agencies to manage, operate, maintain, and modify to meet evolving future needs
- Etc.

→

Possible functions or services to consider for the next-generation of agencies TMS:

- Monitor, calculate, and predict
- Propose, select, and implement
- Automate management and operation
- Expand service area
- Enhance ability to share information with different systems, agencies, or service providers

Source: FHWA

Identifying Improvement Opportunities

EXAMPLE: Systems & technology dimension - *what are possible improvements?*

- Focus on approaches to planning, developing, or building TMS:
  - Ensure agency and stakeholder needs are addressed
  - Planning for and developing plans identifying, scoping, and estimating needs and costs for improvements
  - Follow systems engineering principles—to develop and trace requirements, establish a concept of operations, etc.
- Other issues to consider:
  - Technical feasibility
  - Operational feasibility
  - Condition of assets
  - Economic feasibility
  - Current and anticipated funding
  - Current and anticipated staff and contract support
  - Planning, plans, and planned improvement projects

Dimensions or Process Areas	*What Is It?*
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Source: FHWA

Preparing for and Conducting a TMS Assessment

Examples of TMS specific resources available to support conducting assessments:

1. Configuration Management for TMSs
2. TMC Information Technology Security
3. Recovery and Mitigation for TMCs
4. TMC Operator Requirements and Position Descriptions
5. Virtual TMC Development
6. Regional, Statewide, and Multi-State TMC Concept of Operations and Requirements
7. TMC Performance Dashboards
8. Performance Measure and Health Index of ITS Assets
9. Consideration of Current and Emerging TMC Data
10. Procuring, Managing, & Evaluating Performance of Contracted TMC Services
11. TMC Staffing and Scheduling for Day-to-Day Operations

* All of these resources are available via the TMC PFS website: https://tmcpfs.ops.fhwa.dot.gov/completedproj.htm

Assessing TMSs Capabilities and Performance

John MacAdam
MacAdam Consulting

Session 1 Presentations:

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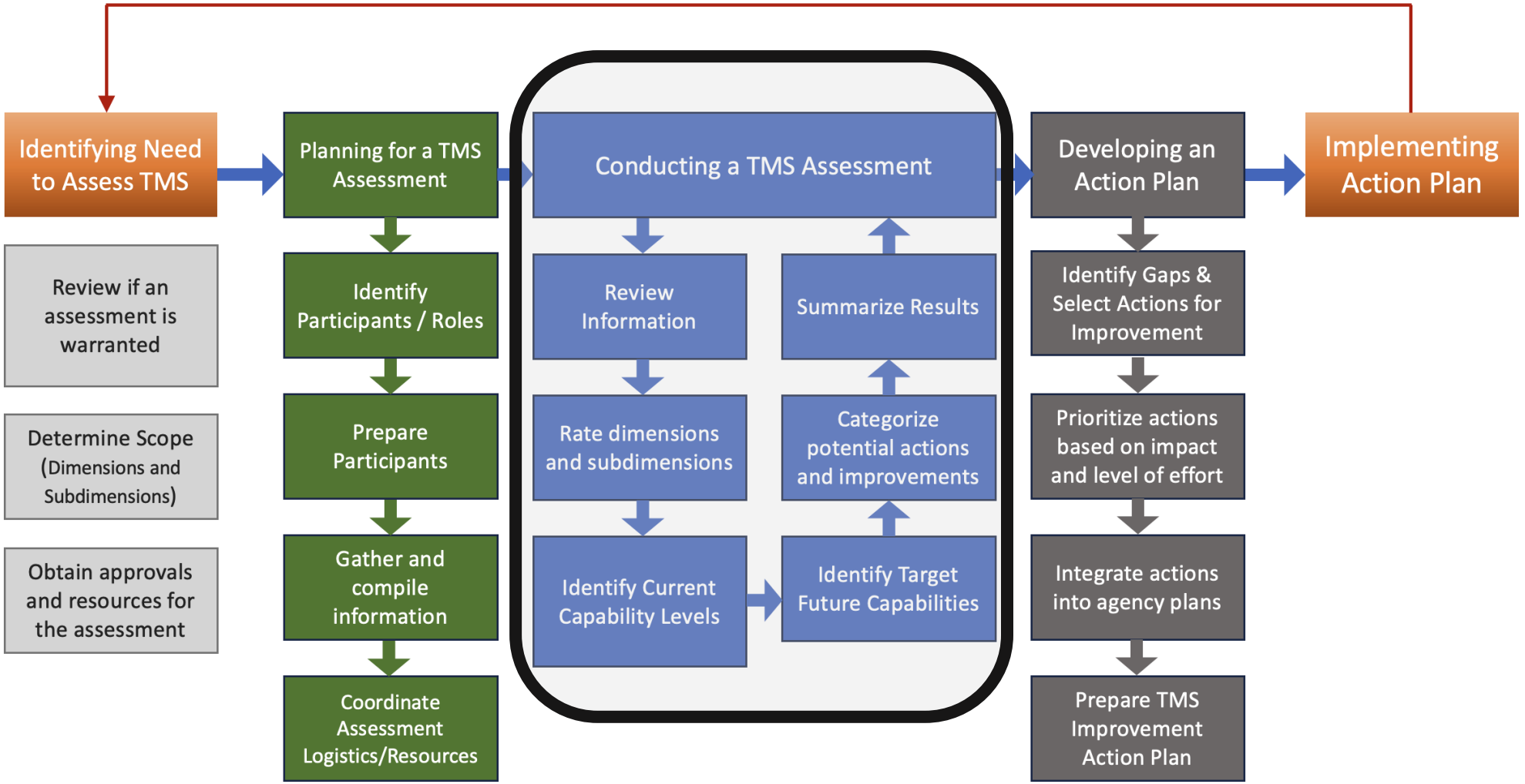
Assessing TMSs Capabilities and Performance

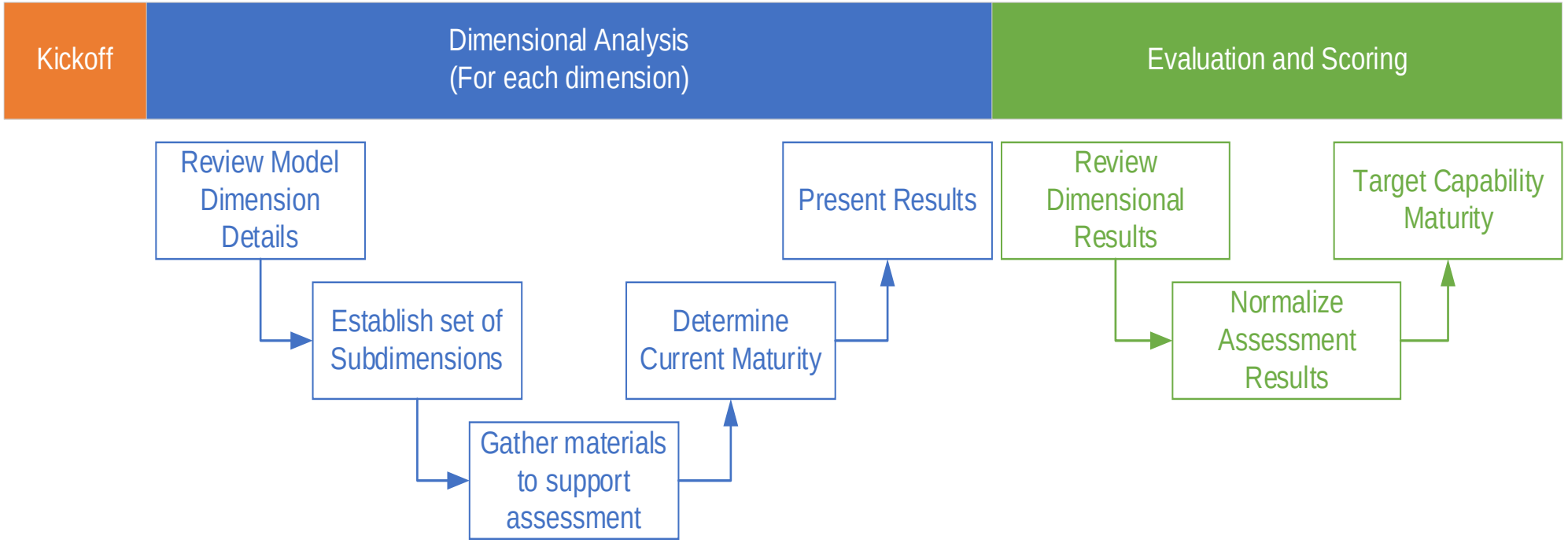
What might you consider with assessing TMS capabilities and performance?



Source: FHWA

Preparing for and Conducting a TMS Assessment

What issues to consider with assessing TMSs dimensions and sub-dimensions?



Source: FHWA

Assessing TMSs Capabilities and Performance

Dimension 1: *Business Process* – Possible TMS Sub-dimensions to consider

- TMS Program
- TMS Program Plan
- TMS proposed improvements incorporated into agency TSMO Program and Plan
- TMS resource needs incorporated into agency TSMO Program and agency process to prioritize and allocate resources
- Planning process established to identify needs and scope TMS improvements prior to obtaining approval for funding or procuring projects
- Policies governing the management and operation of TMS
- Procedures supporting the management and operation of TMS

Assessing TMSs Capabilities and Performance

EXAMPLE: Business Process improvements

Potential improvements could involve:

- Integrating TMS as a TSMO element in State/ Agency Long Range Plans and Regional Transportation Plans
- Establishing a multi-year TMS development plan
- Improving processes for identifying, budgeting, and programming funding
- Improving processes for planning and programming resources for TMS day-to-day operations, maintenance, and repairs
- Developing/improving an asset management process
- Improving clarity of organizational structure and administrative processes

Dimensions or Process Areas	*What Is It?*
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Source: FHWA

Assessing TMSs Capabilities and Performance

Dimension 2: *Systems and Technologies* – Possible TMS Sub-dimensions

- Software subsystem
- Data subsystem
- TMS design
- Managing TMS assets
- TMS inventory
- Data management plans, capabilities, resources, and activities
- Configuration management
- Transition plans and activities

Assessing TMSs Capabilities and Performance

EXAMPLE: Systems & Technology improvements

- Focus on approaches to planning and building systems
  - Ensure agency and stakeholder needs are addressed
  - Follow systems engineering principles—to develop and trace requirements, establish a concept of operations, etc.
- Other issues to consider:
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  - Operational feasibility
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  - Current and anticipated funding
  - Current and anticipated staff and contract support
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Sharing and Using Data	Activities to enable sharing and use of data with sources external to TMS

Source: FHWA

Analyzing the Results of a TMS Assessment

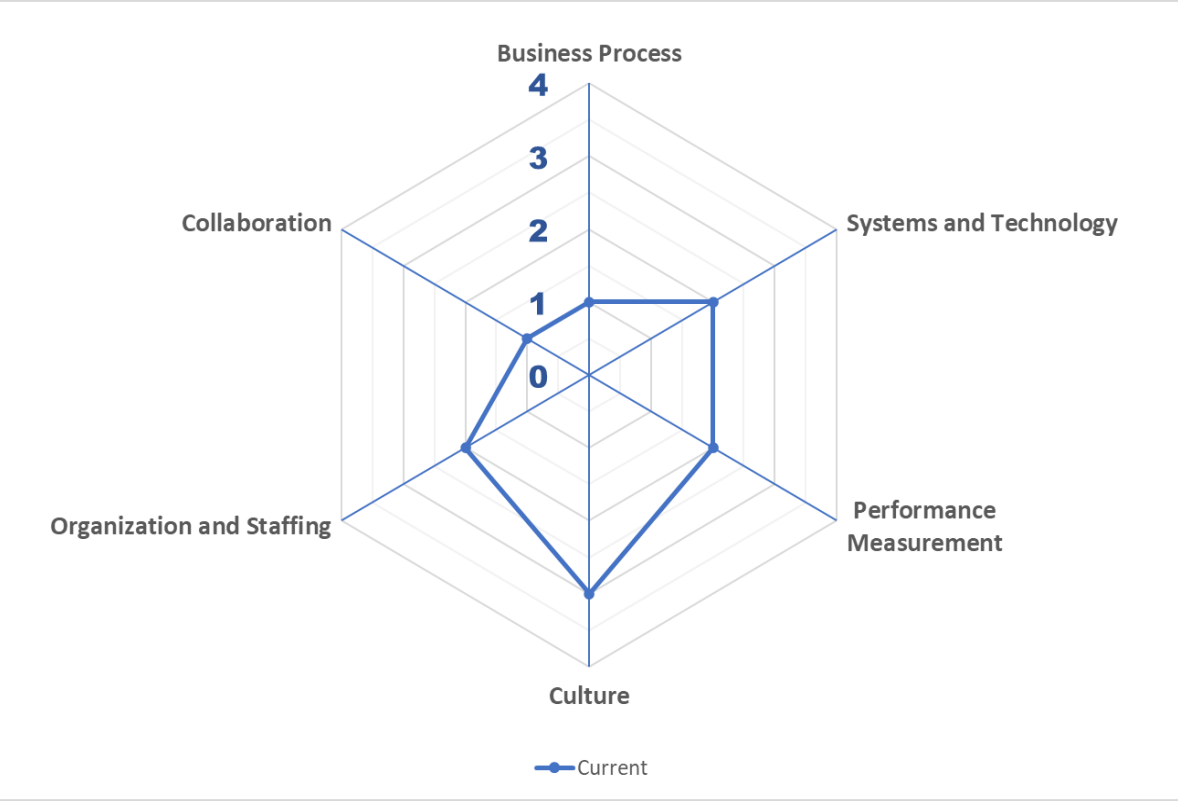
Systems & Technology Dimension – *what is current maturity level?*

Sub-Dimension	Level 1 Performed	Level 2 Managed	Level 3 Integrated	Level 4 Optimizing
Design, develop, and implement TMS improvements	Systems and technology approaches for TMS ConOps, Requirements, Structure, and Strategic Plan are ad-hoc and outside of systematic systems engineering.	System engineering is consistently employed for TMS ConOps, Requirements, Structure, and Strategic Plan, promoting the use of systems architecture standards and increasing interoperability. However, the level of documentation and training may still be limited	Systems and technology for TMS ConOps, Requirements, Structure, and Strategic Plan are standardized, documented, and interoperable. Staff is trained and educated on current and emerging technologies impacting TMS capabilities, ensuring a strong understanding of systems engineering principles and practices.	Systems and technology for TMS ConOps, Requirements, Structure, and Strategic Plan are continually upgraded and optimized to improve performance. The agency ensures that system engineering practices are adapted to support continuous improvement and maintain high levels of interoperability and standardization.
Software Subsystem	Minimal collaboration exists between TMS and IT groups. TMS may not be prioritized within IT operations	Some cooperation between IT group and TMS group. Some alignment on standards, practices, and system support.	TMS and IT technologies in alignment. Good collaboration for TMS-related tests, deployments, support, and enhancements.	Full cooperation and collaboration between TMS and IT groups. Each is involved in all major technology decisions for the TMS. TMS seen as a top priority system with IT resources supporting current and future enhancements.
Data Subsystem	TMS group uses proven technologies for the TMS. R&D is minimal. Any emerging technologies are usually met with skepticism.	TMS group acknowledge emerging technologies but adopts a "wait and see" attitude letting others deploy and approve	TMS group actively monitors emerging technologies and runs pilots to evaluate and test selected innovations	Proactive approach to R&D. The agency actively pursues advancements in technology and is an early adopter.

Source: FHWA

Analyzing the Results of a TMS Assessment

Summarizing existing capabilities of TMS dimension capabilities:



- Spider Diagram Format
- Visualize existing capability maturity across all dimensions

Source: FHWA

Analyzing the Results of a TMS Assessment

EXAMPLE: Systems & Technology Dimension improvements:

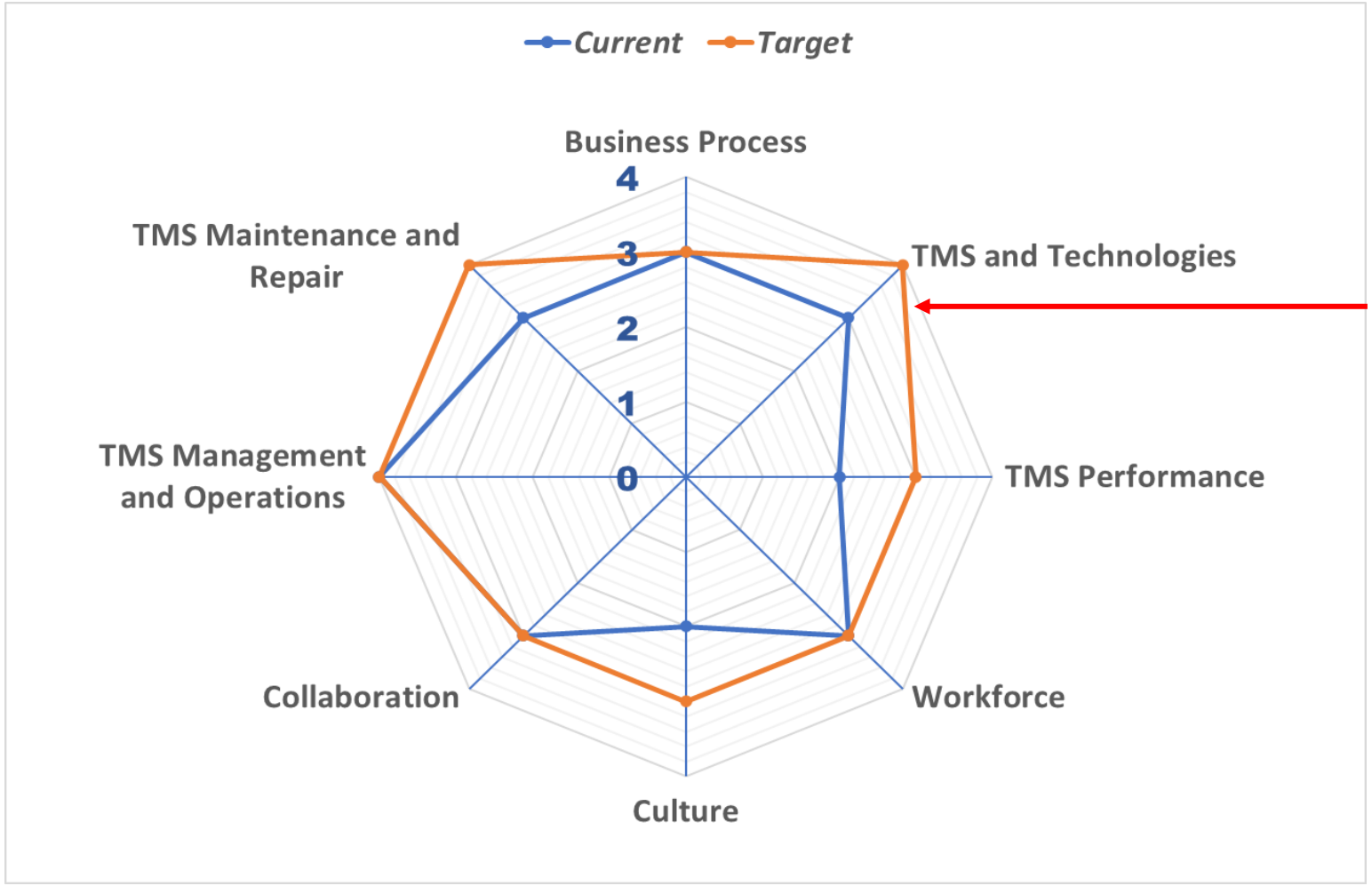
Identifying opportunities to advance capabilities for sub-dimensions and dimensions

Design, Develop, and Implement TMS Improvements			
Achieving Level 1	Achieving Level 2	Achieving Level 3	Achieving Level 4
Actions to Get to the Next Level			
	Introduce systems engineering into TMS program planning	Develop tools to support adoption of standard system engineering process	Constantly review and refine processes
	Introduce systems engineering into TMS development projects	Develop procedures to support adoption of standard system engineering process	Maintain adaptability and responsiveness to technology changes or advancements
		Develop training to support adoption of standard system engineering process	
Key Stakeholders			
	TMS champions	IT Staff Policy staff Systems integrators	IT Staff Policy staff Systems integrators

Source: FHWA

Analyzing the Results of a TMS Assessment

How do we translate assessment results into action planning?



Identifying existing and desired future capability levels across these dimensions provide the basis to identify and prioritize opportunities for improvements

Source: FHWA

Assessing TMSs Capabilities and Performance

Thank you!

Identifying Opportunities and Approaches for Improving TMSs

Matt Junak
HNTB

Session 1 Presentations:

1 | Assessing TMSs

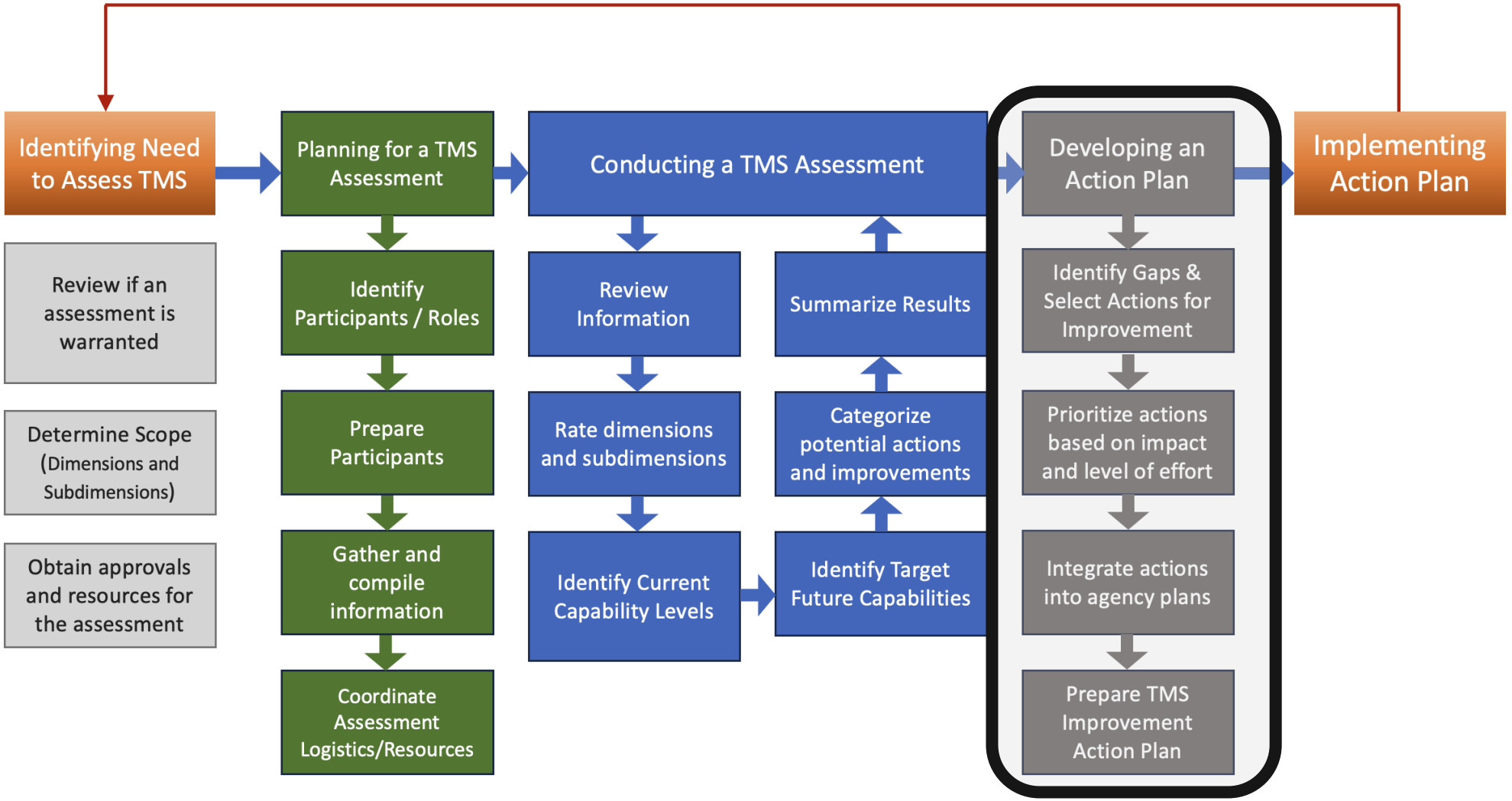
2 | Preparing for and Conducting a TMS Assessment

3 | Assessing TMSs Capabilities and Performance

4 | Identifying Opportunities and Approaches for Improving TMSs

Identifying Improvement Opportunities

TMS Assessments - Action Planning and Plans:



Identifying Improvement Opportunities

Action Planning and Plans:

- What are the outcomes you are trying to influence?

- What are the key aspects of the improvement process?
  - Get stakeholder buy-in
  - Establish awareness of current capabilities
  - Identify opportunities for improvement
  - Develop a sound basis to prioritize resources and actions
  - Identify projects to pursue for improvements

Time-based Categories:

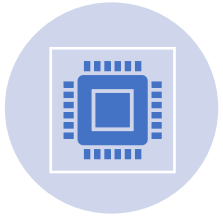
Immediate changes could include: control plans used for different events, plans to add or improve the use of operational strategies and control plans, or change operational practices.

Near-term changes could include: changes in operations, changes in policies and procedures, or adjusting allocation of resources and practices for maintenance or repair of assets

Long-term changes could include: build long-term agency support for TMS; grow funding; develop multi-year plan for next-gen TMS; obtain resources to improve the capabilities and performance of TMS; and integrate TMS plans and needs into other agency plans and planning processes

Identifying Improvement Opportunities

Identifying, prioritizing and selecting improvements - issues to consider:



Identify purpose, needs, gaps, and scope of proposed projects

Consider prioritizing both present and future needs

Compare TMS goals and performance measures to outcomes of proposed improvements

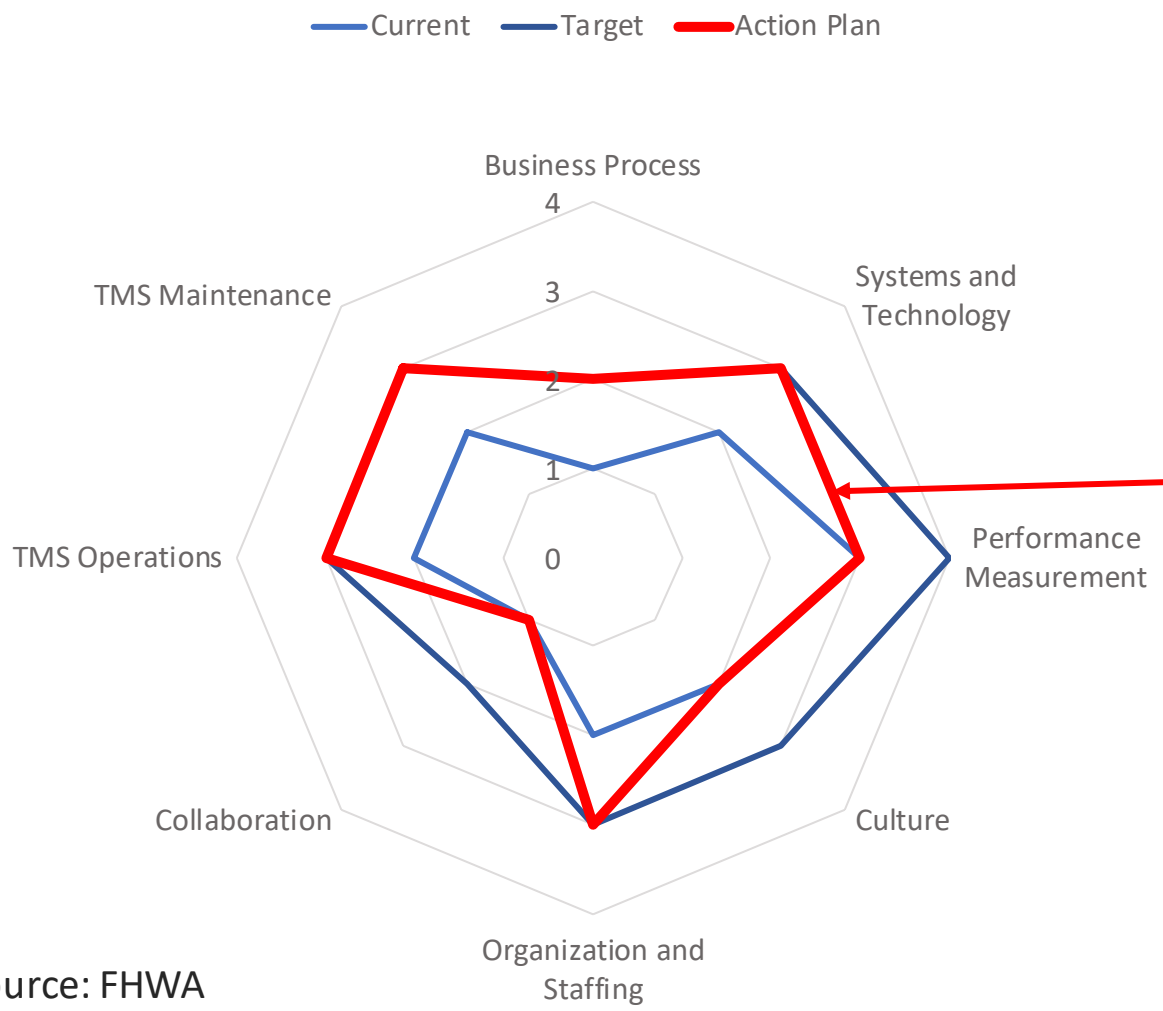
Connect project outcomes to vision, goals, and long-range plans

Match proposed TMS funding needs to eligible funding sources

Identify resources needed to support managing, developing, implementing, testing, accepting, and initiating

Identifying Improvement Opportunities

Prioritizing improvement opportunities in TMS action plans:

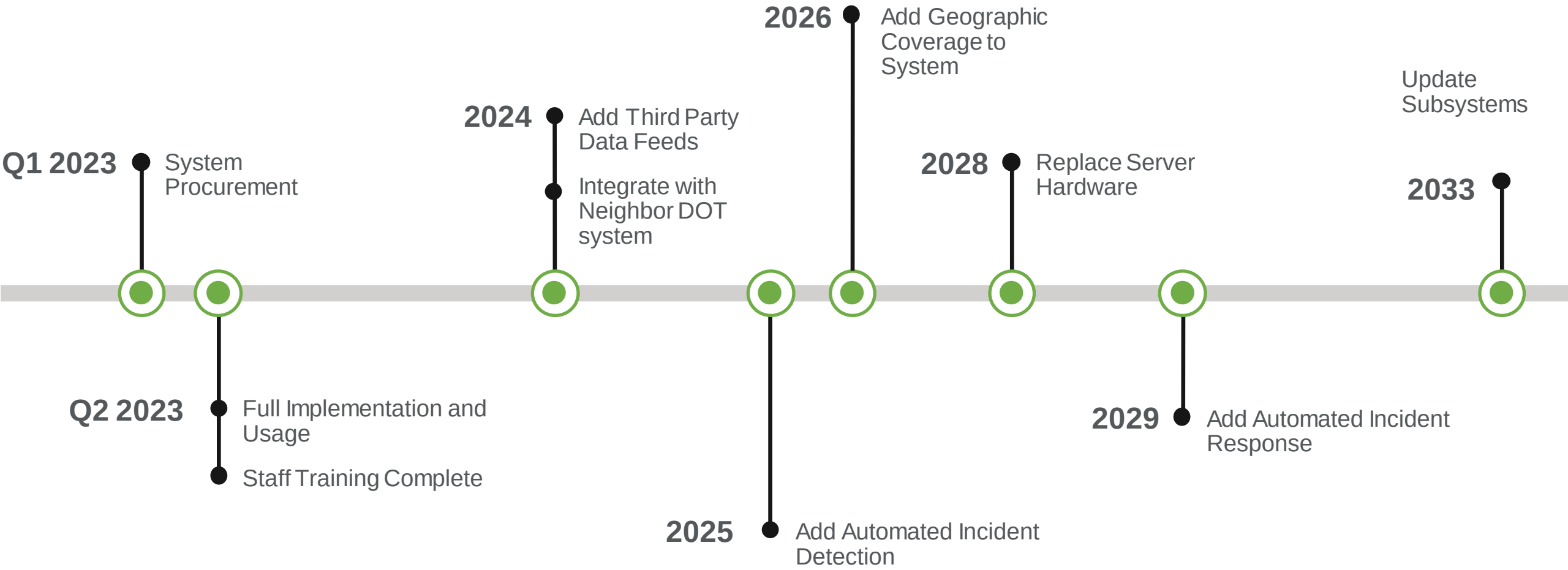


Identifying existing and desired future capability levels across these dimensions provide the basis to identify and prioritize opportunities for improvements

Source: FHWA

Identifying Improvement Opportunities

Prioritizing improvement opportunities in TMS action plans:



Source: FHWA

Identifying Improvement Opportunities

Improvement opportunities identified in TMS assessments:

- Prepare procedures, control plans, and actions for specific events or scenarios
- Identify and obtain staff or contract support with the knowledge, ability and support resources to support TMSs
- Plan and obtain resources needed for improvements
- Plan and develop plans for the next generation of the agency's TMS
- Develop staffing plan and obtain resources to improve scheduling of staff and support resources to meet the TMS's operational needs

Identifying Improvement Opportunities

Scoping proposed improvement projects:

- Identify physical changes needed
- Decide other enhancements to support proposed changes
- Consider what items to include
- Plan for needed funding:
  - Capital expenditures for improvement projects
  - Operating expenditures and resources to support improvement project and operation of TMS

Identifying Improvement Opportunities

Adjustments to agency or TMS operating policies and procedures

Changes to TMS operations procedures, operator tasks, or support services

Updates to TMS inventory, documentation, and information to include in configuration management process

Changes to asset management, maintenance, or repair actions

Implementation coordination, resources, and support

Framing the Discussion

Examples of Opportunities to Integrate TMS Assessment Results into Agency Processes and Plans:

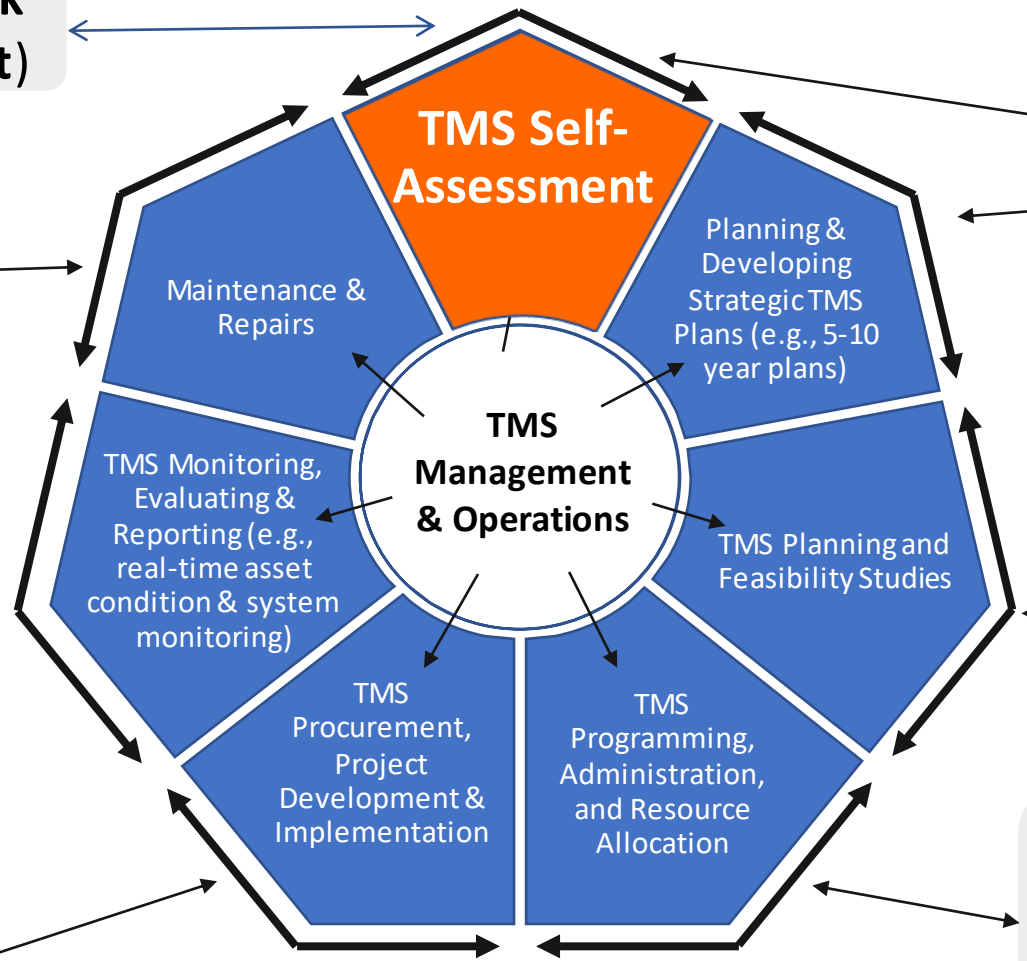
Agency Processes & Plans:

Capability Maturity Framework for TSMO (Traffic Management)

Conducting Daily Maintenance and Repairs

Facilities Performance Monitoring and Reporting, TMS Asset Monitoring and Reporting, TMS Asset Performance Evaluation, TMS Program and Plan

Design, Development and Procurement of Projects (e.g., systems engineering), TMS Program and Plan, Agency or Regional ITS Architecture



Agency Processes & Plans:

Agency Strategic Plan, TSMO Program and Plan, TMS Program and Plan, MPO TSMO or ITS Plan, Agency or Regional ITS Architecture

Planning & Design of TSMO Initiatives, Operational Strategies, or ITS Projects (feasibility study, planning study), Agency or Regional ITS Architecture

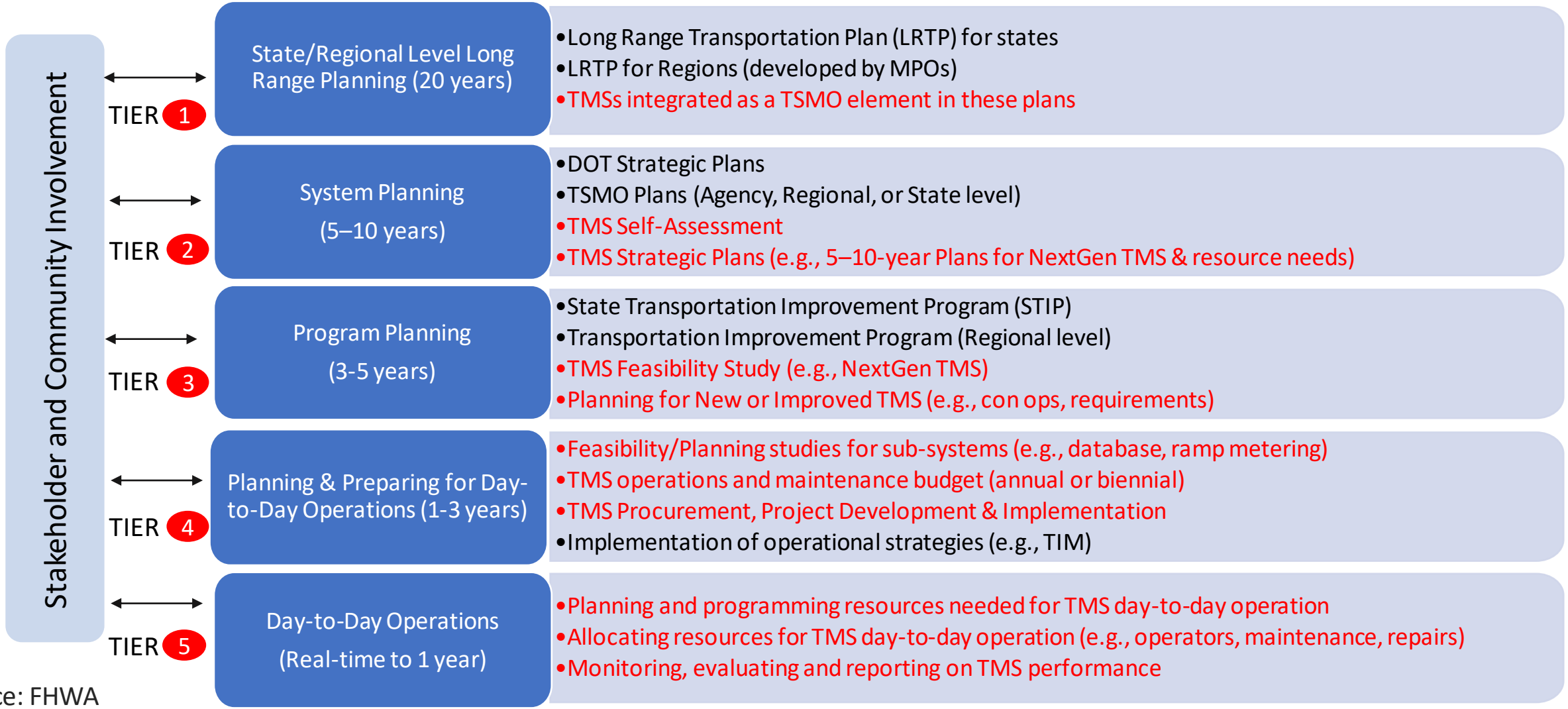
TSMO Project Selection & Prioritization, TMS Improvement Projects, Allocating Resources for Maintenance and Operations, TMS Program and Plan, Agency or Regional ITS Architecture

Source: FHWA

Identifying Improvement Opportunities

EXAMPLE: Incorporate needed TMS improvements into agency processes and plans

Red text = opportunities to incorporate TMSs into agency planning processes and plans



Source: FHWA

Results From Breakout Sessions

Topic 1: Preparing for and Conducting a TMS Assessment

Topic 2: Opportunities for Improvements: TMS Assessment Action Plans

Topic 3: TMS CMF Dimension 1: Business Process

Topic 4: TMS CMF Dimensions 3 & 4: Performance Measurement + Workforce

Topic 5: TMS CMF Dimensions 5 & 6: Culture + Collaboration

Topic 6: TMS CMF Dimensions 7, 8, 9: Mgmt. & Operations + Maintenance & Repair + Sharing/Using Data

Topic 1: Preparing for and Conducting a TMS Assessment

Possible changes needed to the assessment process or steps:	Information needed:	Issues to consider:	Resources or support may be needed:	Examples of successful practices right now:
Performance of the existing systems Are capabilities fully utilized?	Identify needs of both internal vs external	IT policy? Law enforcement Data governance & privacy (cyber security)	Institutionalize Executive leadership Policy-maker	Assess systems - CMM framework (With workforce development issues; Actionable items come from)
What are purposes of participating and training? Where we live today?		Maturity of the TSMO? Aware of it? Interpretation of it? TSMO driven effort? What does it mean? Identify the needs	Planning agency ITS architecture	Depending on what system you use: Transit operators Emergency operators End users - Daily commuters
Some of the order is different for different agencies. Define subdimensions	More elements on how rather than why?	Why should we need to do this (TMS), majority is few people(2-3) is handling the TMS.	Commitment to action	New York – ITS strategies
	•Feedback from who use the system daily (e.g., system engineers) •Internal operational partner	Work force development (transit)		FDOT – Active lane management
	Identify who is going to the assessment, who will lead the assessment	Skills, capabilities Timeline (reevaluate)		

Topic 2: Opportunities for Improvements: TMS Assessment Action Plans

Possible steps to include in a TMS action plan:	Best practices for developing a TMS action plan:	Other topics to consider for a TMS action plan:
•Example it ATMS deployment in NJDOT •Knowledge Transfer is important •Immediate – short – long term •Also include recurring – one time items that may need to be assessed	•Identify your fatal flaw – example is Microsoft cloud went down – what is your back up/disaster recovery/COOP •Example: Lane Use system on SR 1 – x and arrow – what is backup when power goes out	When assessing software deployment – evaluate if it is training for operators or software capability
1.Do **baseline** assessment first – decide what is important to assess first – priority order One example – ATMS software deployment	For example, ATMS software deployment: Breakdown into component parts: •Staff assessment •Software assessment	
2. Once you have the initial assessment: determine the **maturity level**	Evaluate performance measures / metrics Evaluate how people are using the technology Do stakeholder workshops prior to deploying ATMS Develop faith in the system	Evaluate the time it takes to do given tasks – could be different for each TMC
Plan for consistent **funding sources**	Have strategic plan that identifies long time plan and makes the case for funding	Funding for ATMS, staffing, ITS device maintenance
3. Do **gap analysis**	Look at how to address the gaps – training, technology,	
Assess/Review **data quality** – data sources - data governance – data validation How to explain the 'why' - at every step of the assessment process	How does the data quality affect operations Document and track measures of effectiveness	•Different TMC operators might have different perceptions of data quality •To the operators trust the data source •Sensor data v probe data v video analytics •Incident detection

Topic 3: TMS CMF Dimension 1 & 2: Business Process and Systems and Technologies

TMS CMF Dimension 1: Business Process					TMS CMF Dimension 2: Systems & Technologies			
Possible additional dimensions needed to assess a TMS:	**Subdimensions agencies such consider when assessing each dimension:**	**Information and analysis needed for assessing each dimension and supporting subdimension:**	**Other issues to consider:**		**Possible additional dimensions needed to assess a TMS:**	**Subdimensions agencies such consider when assessing each dimension:**	**Information and analysis needed for assessing each dimension and supporting subdimension:**	**Other issues to consider:**
Asset management and maintenance (important for performance measures and business process in particular)	Each one of the dimensions needs a business process, must be funded somehow	The other technologies and opportunities to update the TMS (e.g. emerging technologies)	Procurement processes (e.g. delays due to procurement process requirements)			Annual technology review plan (to make sure systems are "current,", up-to-date, and maintained)	Information inputs to vehicle are changing as vehicle technologies change	Technology maturity (pilot and perform assessment before deploying)
The other dimensions should have business process	Dimensions 7, 8, and 9 might be actually be subdi mensions?	IT as a separate business process	Full systems engineering procurement tends to deviate from off-the-shelf products			IT governance, cybersecurity in particular		Practical resources and needs for *every* agency need to be a level 4 in all dimensions
Perhaps "business process" is embedded into other processes		Short-term and long-term planning as part of programmatic business process				Cybersecurity		Need for business process guidance
Missing policy changes & legislation, need power to implement		SOPs that align with TMS operation, (especially IT SOPs)				Repair/maintenance so that a broken asset does not stagnate, remain unused		Data integration technologies are constantly changing as other
						Business process		Conflicting business practices across partner agencies
						Inventory devices and rank them relative poor, acceptable, good, etc. Integrating emerging technology (sensor data to probe data, traveler use of journey planners e.g. Google Maps) Emerging technology		

Topic 4: TMS CMF Dimensions 3 & 4: Performance Measurement + Workforce

TMS CMF Dimensions 3 & 4: Performance Measurement + Workforce			
Possible additional dimensions needed to assess a TMS:	**Subdimensions agencies such consider when assessing each dimension:**	**Information and analysis needed for assessing each dimension and supporting subdimension:**	**Other issues to consider:**
Subdimension under D9: Defining the assessment Team (multi Discipline)	D4: Staff empowerment	D4: Career Ladders	D3: What resonate/important with each state holder
Subdimension under D1: Funding and programing, procurement	D4: Staff classification, title and uniformity	D4: Number of Job Classification and Roles and Responsibility	D3: PII – Personally Identity Information (Privacy)
Subdimension under D9: Involving Stakeholder Early One (Identify which one)	D3 Express success in performance Measures	D3: Cultivation of workforce development link with educational system	
	D3: Other TMS performance measure such as social equity, non attainment area measures	D3: Synergize resources among agencies	
	D4: Create and formalize a workforce development process	u[	

Topic 5: TMS CMF Dimensions 5 & 6: Culture + Collaboration

TMS CMF Dimensions 5 & 6: Culture + Collaboration			
Possible additional dimensions needed to assess a TMS:	**Subdimensions agencies such consider when assessing each dimension:**	**Information and analysis needed for assessing each dimension and supporting subdimension:**	**Other issues to consider:**
CULTURE: No changes	TMS integration; agency understanding of benefit, roles, and responsibilities. Is there understanding and acceptance? Does it connect with overall TSMO effort?	Improved ROI Make the business case and demonstrate how the Program meets the agency's goals	Consider other CMM framework; are there other assessments that should occur?
COLLABORATION: No Changes	Understand and communicate who should be at the table? (MPO, LEO, IT, Municipalities, front-line, etc.) Shared resources within the agency e.g., Inventory and integration of different data within the agency for repurpose	What agreements are in place (3rd party data)?	Consider other CMM framework; are there other assessments that should occur?

Topic 6: TMS CMF Dimensions 7, 8, 9: Mgmt. & Operations + Maintenance & Repair + Sharing/Using Data

TMS CMF Dimensions 7, 8, 9: Mgmt. & Operations + Maintenance & Repair + Sharing/Using Data			
Possible additional dimensions needed to assess a TMS:	**Subdimensions agencies such consider when assessing each dimension:**	**Information and analysis needed for assessing each dimension and supporting subdimension:**	**Other issues to consider:**
Redundancy, Accessibility, and Integration **Redundancy plan and ability to securely operate remotely, integrated with the asset management system**	Redundancy	How many systems have redundancies?	
	System Accessibility	How many systems have remote access?	
	Integration	Are remote systems in compliance with cybersecurity standards?	
	Asset Management	Is there two-way integration available between TMS and asset management?	
Standardization, Transparency, and Accessibility Standardization between APIs, providing transparency on the accuracy and timeliness, and multiple levels of data access control to protect sensitive data	Standardization	How many APIs that are in use apply a standard data framework?	
	Availability of accuracy details	Are accuracy / timeliness information provided by 3rd party providers?	
	Availability of data timeliness (granularity)	Are accuracy / timeliness evaluations available for sensor-based data?	
	Levels of access control		
Workforce Development Strategy **Workforce development to provide the necessary IT support to handle and prepare for upcoming needs and necessary redundacy implications**	Number of IT / Data Science Support Staff	How efficiently are IT requests completed?	
	Contingency planning to prepare for challenges	Are new technologies evaluated for redundancy / fallback before they are implemented?	

Questions?

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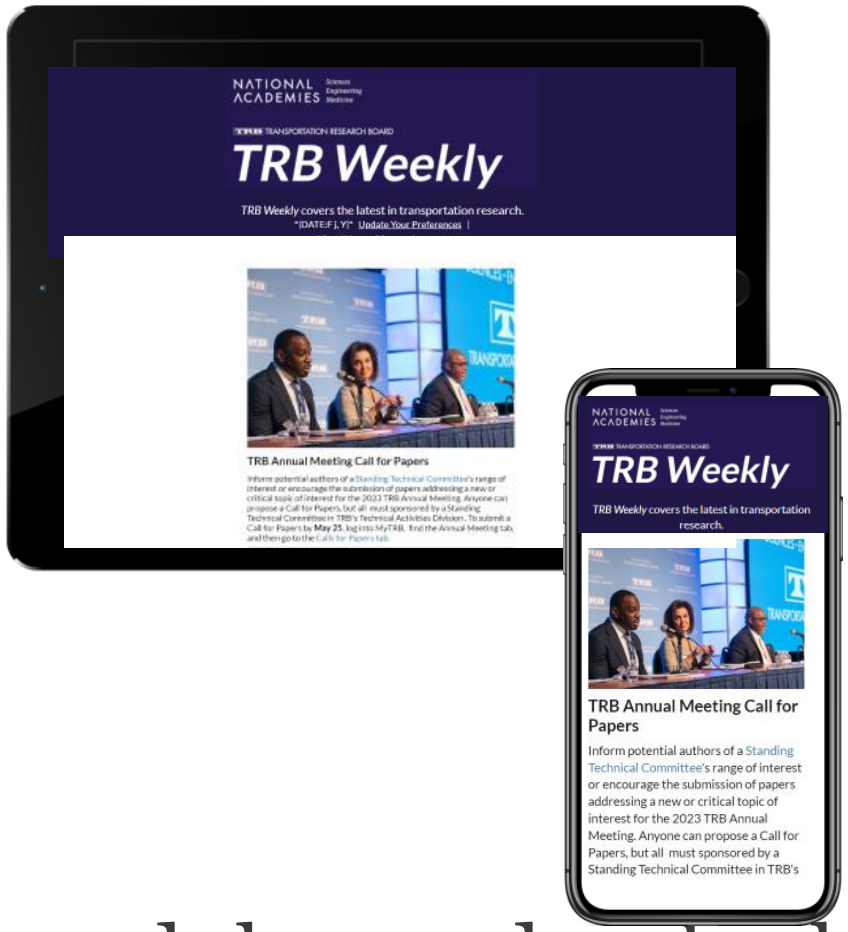

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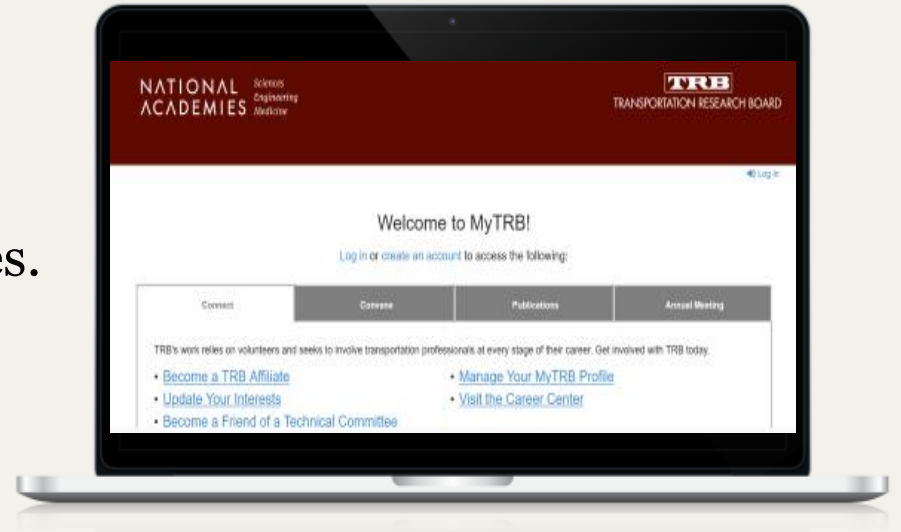

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