

TRB ANNUAL MEETING 2022 WORKSHOP #1002 SUMMARY – **ASSESSING TRAFFIC MANAGEMENT SYSTEMS (TMSs) CAPABILITIES AND PERFORMANCE**

Sunday, January 9, 2022, 9:00am – noon EST

Sponsoring Committees:

- TRB Intelligent Transportation Systems Committee (ACP15)
- TRB Freeway Operations Committee (ACP20)
- TRB Traffic Signal Systems Committee (ACP25)
- TRB Regional Transportation Systems Management & Operations Committee (ACP10)
- TRB Joint Subcommittee on Active Traffic Management (ACP20-5)
- TRB Artificial Intelligence and Advanced Computing Applications Committee (AED50)
- AASHTO Committee on Transportation System Operations, ITS Working Group
- ERTICO Traffic Management 2.0 Innovation Platform
- European Association of Operators of Toll Road Infrastructures (ASECAP)
- International Bridge, Tunnel and Turnpike Association (IBTTA)
- Traffic Management Center Pooled Fund Study (TMC PFS)

Workshop Summary and Resources:

This summary of the workshop, presentations, and other resources are available electronically on the [National Operations Center of Excellence's \(NOCoE's\) web page on Assessing Traffic Management Systems \(TMSs\) Capabilities and Performance.](#)

Workshop Planning Volunteers:

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Greg Krueger	<i>HNTB</i>	Raj Ponnaluri	<i>Florida DOT</i>
Joe Stanford	<i>USDOT Volpe Center</i>	Susanna Zammataro	<i>Int'l Road Federation – Geneva</i>
Jon Obenberger	<i>USDOT FHWA (workshop lead)</i>	Yinhai Wang	<i>Univ. of Washington</i>
Leslie Jacobson	<i>WSP</i>	Lisa Burgess	<i>Kimley-Horn</i>

Introduction

The next generation of traffic management systems (TMSs) and their operations centers (TMCs) offer agencies the potential to improve safety and mobility. To effectively manage and operate a TMS, it is essential to have information about the capabilities and performance of the TMS, as well as an understanding of how agencies can act on that information. Such information can be used to inform action plans, allocate resources, and improve how agencies manage and support these systems. This information is also instrumental for communicating the TMS's value to stakeholders, as well as for planning, programming, and allocating the necessary resources to make improvements or to prepare for the next generation of an agency's system.

On Sunday, January 9, 2022, during the Transportation Research Board's 101st Annual Meeting, a three-hour workshop focused on agencies' practices for assessing the capabilities and performance of traffic management systems. This document provides a brief summary of: (i) each of the workshop's sessions; (ii) feedback from participants provided during the breakout session; and (iii) action items recommended for co-sponsoring committees to consider advancing in 2022 and beyond.

State of the Practice (Session 1)

Mark Muriello (IBTTA and TRB Freeway Operations Committee) indicated the purpose of Session 1 was to frame the value proposition and key issues agencies may consider when assessing the capabilities and performance of TMSs. The presentations in Session 1 provided overall context, along with discussions of methods and issues to consider when assessing TMSs and identifying opportunities to use the findings to improve TMSs. Presenters provided a shared understanding of the workshop topics, clarified the meaning and intent of each topic, and provided a sample list of issues to consider when assessing TMS capabilities and performance.

- **Framing the Discussion, Dan Lukasik (Parsons)**

This presentation described "capabilities" and "performance" with respect to the workshop:

- Capabilities – what a TMS is designed to do, the conditions it will support, and an agency's ability to support, manage, and operate the system
- Performance – how well a TMS does what it is designed to do, if it is meeting expectations, and what are its benefits.

The next three presentations described the workshop's three major topics, as follows:

- *Assessing the Capabilities of TMSs*, Les Jacobson (WSP)
- *Assessing the Performance of TMSs*, Yinhai Wang (Univ. of Washington)
- *Identifying TMS Improvement Opportunities*, Pete Marshall (HDR)

Each presenter touched on three discussion-areas for each of these topics: issues for agencies to consider, successful practices, and existing or needed resources to help agencies apply these practices. Session 1's presentations are available on the TMS portal located on the National Operations Center of Excellence ([NOCoE webpage](#)).

Discussions (Session 2)

Lisa Burgess (TRB Joint Subcommittee on ATM, Kimley-Horn) described the breakout groups (four for each of the three topics) formed to discuss information presented in Session 1 and exchange new ideas regarding the workshop's three topics:

- 1) Assessing TMS Capabilities
- 2) Assessing TMS Performance
- 3) Identifying TMS Improvement Opportunities

Each breakout-group discussed the key issues to consider, successful practices, and available or needed resources for their respective topic. At the end of the session, each group identified their top three items to report on during Session 3. Breakout groups were encouraged to discuss and comment on items identified for these topics in the framing presentations in Session 1; they were also encouraged to introduce new items.

Report-out (Session 3)

Lisa Burgess moderated this session in support of each breakout group reporting the top three items they identified for their respective topic. **Bold text indicates mutual interest among more than one breakout group.** The following is a summary of the priorities the breakout groups identified:

Topic 1: Assessing TMS Capabilities

Discussion area 1 – Issues to Consider

- **Current Services:** Assessing TMS services can reveal capabilities, compare inventory of needs, and reveal service gaps, and possibly identify services that are not used (and agencies must seek to understand why: if they are broken, simply underutilized, etc.)
- **Metrics:** Assessments require baseline metrics to characterize the current TMS (and measure intended improvements)
- **Methods:** It's important to have clear/established methods for conducting a self-assessment

Discussion area 2 – Successful Practices

- **Periodic Assessments:** Develop an inventory of both current and desired TMS functions (knowing the capability it provides, what it is missing, what works well, and what does not)
- **Plan:** Develop strategies to address the gaps identified—to achieve the capabilities needed (e.g., include staffing and organizational needs)
- **Monitor:** Observe TMS performance continuously, observations in real-time, can illustrate individual asset performance and the system as a whole

Discussion area 3 – Existing or Needed Resources

EXISTING RESOURCES:

- **USDOT:**
 - *Configuration Management for TMSs**, TMC PFS
 - *TMC Information Technology Security**, TMC PFS
 - *Recovery and Mitigation for TMCs**, TMC PFS
 - *TMC Operator Requirements and Position Descriptions**, TMC PFS
 - *Virtual TMC Development**, TMC PFS
 - *Regional, Statewide, and Multi-State TMC Concept of Operations and Requirements**, TMC PFS(* Resources available via TMC PFS website: <https://tmcdfs.ops.fhwa.dot.gov/completedproj.htm>)

NEEDED RESOURCES:

- **Data:** Information about a TMS's capabilities must be recorded, retained, and expressed accurately
- **Documentation:** Institutional knowledge of capabilities (and agency practices) supports TMS planning
- **Funding:** A well-funded TMS can afford staff and time needed for high-quality assessments
- **Tools:** Tools to assess TMSs are needed

Topic 2: Assessing TMS Performance

Discussion area 1 – Issues to Consider

- **Automated Reporting:** Tools are available to generate reports quickly
- **Implementation:** Plan how performance assessment results will be operationalized
- **Data:** Awareness of the minimum performance data threshold is critical to understanding and performing comparative studies; third-party data sources should be leveraged whenever possible

- Objectives: Performance reporting and obtaining proper data requires an agency to set TMS goals
- Reporting Needs: Create different reports for the public, agency leadership, and researchers – these groups have different reporting needs

Discussion area 2 – Successful Practices

- **Cybersecurity**: Digital security needs have markedly evolved since moving away from localized disconnected systems to connected, shared, and more-open systems, and cloud systems
- **Workforce**: Invest in existing workforce with training, knowledge transfer, public outreach, training, and conferences
- Co-Location: Multiple groups (emergency services, freeway, and local agencies) in the same building improves efficiency, performance, and knowledge transfer
- Collaboration: Obtain stakeholder buy-in and address key UX/UI business questions; MOUs can help address the needs of all stakeholders (e.g., USDOT Pilot program, NITTEC and the DC area GIS sharing)
- Data: Combine open-source data (3rd party) with internally collected data
- Monitor: Real-time monitoring improves incident management
- Centralization/Decentralization/Standardization: Greece went from one system to eight individually managed systems, but they set up a central assessment function. Efficiency was improved with standardized performance reports and data needs.
- Workforce: Investments in workforce and systems support continuity of service (pandemic is good example) and reduces overall risk to TMS performance

Discussion area 3 – Existing or Needed Resources

EXISTING RESOURCES:

- Automated Traffic Signal Performance Measures (ATSPM)
 - State DOTs and USDOT:
 - *Coordinated Highways Action Response Team Dashboard*, Maryland DOT
 - *Services Provided by Region*, North Carolina Department of Transportation
 - *Traffic Management Center (TMC) Performance Dashboards**, TMC Pooled-Fund Study (PFS)
 - *Performance Measure and Health Index of ITS Assets**, TMC PFS
 - *Consideration of Current and Emerging TMC Data**, TMC PFS
 - *Procuring, Managing, & Evaluating Performance of Contracted TMC Services**, TMC PFS
 - *TMC Staffing and Scheduling for Day-to-Day Operations**, TMC PFS
- (*Resources available at TMC PFS website: <http://tmcdfs.ops.fhwa.dot.gov/completedproj.htm>)

NEEDED RESOURCES:

- Installation: Technical resources are needed to aid in timely installation of hardware

Topic 3: Identifying TMS Improvement Opportunities

Discussion area 1 – Issues to Consider

- **Commitment**: Without solid commitment to improving TMSs, agencies may face several challenges, including: a lack of dedicated support for performance measurements to make real time improvements focused on outcomes; challenges managing staff and actions to make indicated changes in systems management.
- **Cybersecurity**: Holistic approaches should be considered for cybersecurity integration with TMS system (both physical and logical).
- **Funding**: A lack of funds to understand improvement opportunities exacerbates existing funding challenges associated with technology improvements
- **Operating Policies and Procedures**: Operating policies or guidelines (SOGs) can provide consistent operations across regions
- **Frequency**: Agencies should reduce the time between assessments and consider conducting them on more of a continuous basis
- **Collaboration**: Next-generation TMS knowledge should be “mainstreamed” across disciplines, such as DOT/Emergency response/State patrol, etc.
- **Data**: Issues need to be addressed related to reliability/accuracy of data, existing data and supporting infrastructure, adequate data resolution (data quality concerns), availability of data, data storage capabilities, resources to manage data, the utilization of large data sets, and providing and managing access to data
- **Integration**: Methods are needed to incorporate arterial/signal systems as part of TMS improvements
- **Procurement**: It is important to consider the constraints related to procurement processes
- **Transition**: Today’s “reactive” systems are evolving to be more predictive and take preemptive actions on a network-wide basis and how to integrate automated control actions in real time
- **Timing**: Political atmosphere and circumstances out of agency’s control should be responsible
- **Organization**: TSMO business model hampered by general purpose governments (fragmented jurisdictions), need a privately managed regional transportation management authority like other public utilities with public accountability

Discussion area 2 – Successful Practices

- **Collaboration**: Agencies can be co-located into one TMC or center/shared platform, incorporating emergency management. There may be opportunities for cross-border standardization and normalization of operations (e.g., C-Roads organization in the EU)
- **Data**: Develop a common data set and data hub
- **Enforcement**: Establish central monitoring of real-time performance (e.g., UK, Netherlands)
- **Grants**: Coordinate with FHWA on grant opportunities
- **Leadership**: Identify a champion to help move improvements forward and obtain agency support
- **Integration**: Incorporate predictive data into traffic management (e.g. Waycare, Inc.)
- **Pilots**: Pilot approaches manage risk and demonstrate timely results of different improvements; with pilots, consider using system engineering approach and remain flexible and adaptable
- **Plan**: Develop strategic plans/action plans, working groups/task teams to improve collaboration and communication—these can also help balance resources
- **Software**: Building an open source software platform offers opportunity to reduce costs

Discussion area 3 – Existing or Needed Resources

EXISTING RESOURCES:

- **National & International Programs** – NOCoE, NCHRP, AASHTO CTSO, Pooled Fund Studies.
(Informational webinars for staff are available but also need for more educational based material)
- **USDOT:**
 - *TMC Operations Manual**, TMC PFS
 - *Role of TMCs in Emergency Operations Guidebook**, TMC PFS
 - *Roles of TMCs in Incident Management on Managed Lanes**, TMC PFS
 - *Managing Travel for Planned Special Events*, FHWA
 - *Connecting TSMO and Asset Management*, FHWA
 - *Impacts of Technology Advancements on TMC Operations**, TMC PFS(*Resources available via TMC PFS website: <https://tmcdfs.ops.fhwa.dot.gov/completedproj.htm>)

NEEDED RESOURCES:

- **Internal: Internal experience and capability**
- **Funding:** Funds are needed for start-up, implementation, and operations and management
- **Testing/Piloting:** Agencies need access to infrastructure/facilities for testing and piloting new concepts

Action Planning & Immediate Next Steps (Session 4)

Raj Ponnaluri (AASHTO CTSI ITS Working Group, FDOT) requested feedback from participants on the list of possible next steps and activities the co-sponsors may consider advancing in 2022 and 2023.

Workshop co-sponsors expressed significant interest in further collaboration, to continue exchanging information and conduct other activities in support of agencies assessing the TMSs capabilities and performance. The co-sponsors expressed their support for conducting a workshop during the 2023 TRB Annual Meeting focusing on opportunities to plan for future improvements to existing TMSs and the evolution toward agencies next generation of TMSs. The proposed future actions are provided below.

Actions Co-sponsors Support:

1. Conduct workshop at 2023 TRB Annual Meeting—examples of topics to consider:
 - Opportunities to Integrate and Use New Data Sources in TMSs
 - Planning for and Developing Plans to Guide Strategic Direction & Future TMS Investments
2. Participate in the “Innovation Advances Toward the Future of Managing Traffic” International Symposium, June 26-30, 2023, in Vienna, Austria
 - Share best practices, identify research needs, and opportunities to pool resources and pursue topics
 - Sponsors: AASHTO CTSO, ASCE TD&I, ASECAP, CEDR, IBTTA, ERTICO TM2.0, IRF-Geneva, and TRB
3. Facilitate the sharing of TMS information and highlight successful practices:
 - Share information on the TMS portal on the National Operations Center of Excellence website
 - Volunteer to answer questions or provide limited assistance to agencies
 - Support peer-to-peer exchanges (e.g., TRB or NOCoE webinars) on key TMS topics
4. Encourage agencies to join and contribute funds to TMC Pooled Fund Study to address needs for resources to support improving how they manage and operate TMCs (Extended to April of 2027):
 - Completed, current, and new TMC PFS projects can be found at: <https://tmcdfs.ops.fhwa.dot.gov>
 - TMC PFS provides an annual process to identify needs and develop proposals for future projects (e.g., 15 proposals identified for consideration; new projects will be selected and begin in 2022)

5. Identify technical resources to develop and support agencies preparing for and conducting TMS assessments, as well as considering system enhancements based on assessment results.
6. Explore partnerships to share information and conduct research to advance TMSs:
 - Collaborate to advance jointly sponsored NCHRP research proposals (e.g., FHWA, TMC PFS, TRB Committees)
 - Identify and prioritize needs for possible research and development of technical resources—topics could include:
 - Capabilities, Requirements, Planning, and Preparing to Virtually Operate TMSs (Submitted FY 2023 NCHRP Research Problem Statement)
 - Assessing and reporting on TMS capabilities, assets, and performance
 - Planning, designing, procuring, and managing data to meet current and evolving TMSs needs
 - Planning, designing, procuring, and managing software to meet current and evolving TMS needs
 - TMS data management plans and practices—collecting, compiling, using, and archiving data

Closing: (Session 5)

As the Chair of the TRB ITS Committee, who was the lead sponsor for this workshop, Greg Krueger (HNTB) thanked participants, volunteers, and other co-sponsors of this year's workshop. Greg introduces a video of the closing remarks provided by other co-sponsors of this workshop. This video recording of the co-sponsors remarks is available at: <https://youtu.be/7ILF7tzbME8>.