

Improving NDOT's Organizational Capabilities Through CMM



By Nevada Department of Transportation

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Benefits Statement

NDOT's use of the Capability Maturity Model (CMM) self-assessment has saved lives by improving traffic incident management, saved time through efficient planning, and saved money by optimizing resource allocation and fostering collaboration with stakeholders. The assessments identify opportunities for improvement, streamline decision-making, and encourage external collaboration, leading to enhanced safety, efficiency, and cost-effectiveness.

In this case study you will learn:

1. How NDOT has used CMM self-assessments since 2011 to identify program improvements.
2. How CMM assessments led to tailored plans and a target of Level 3 TSMO maturity by 2024, fostering collaboration with stakeholders.
3. How NDOT's approach inspired other organizations like RTC of Southern Nevada to undertake CMM assessments for institutional improvements.

BACKGROUND

Figure 1 demonstrates Nevada Department of Transportation’s (NDOT) journey with Capability Maturity Model (CMM) self-assessment for past years and future planning. NDOT first used the CMM self-assessment in 2011. Since then, the agency has been undertaking recurring assessments to identify opportunities, translating the findings into specifications and roadmaps to organization improvements. In addition, NDOT used the Active Traffic Management (ATM) Capability Maturity Framework (CMF) to identify and assess organization capabilities, needs, and gaps for statewide expansion of ATM as part of their Intelligent Transportation Systems (ITS) and ATM Master Plan. Following this successful strategy-specific maturity assessment, NDOT planned to conduct a Traffic Incident Management (TIM) CMF self-assessment to improve the Statewide TIM Program capabilities.



Figure 1

TSMO PLANNING, STRATEGIES AND DEPLOYMENT

Recognizing Transportation Systems Management and Operations’ (TSMO) importance, NDOT conducted first CMM in 2011, identifying critical processes and institutional arrangements, tailoring them to the unique features of TSMO applications. This raised internal awareness of TSMO’s value.

NDOT held the second CMM self-assessment in 2014 (Appendix 1) to further tailor actions for TSMO Program Planning. Participants included the Federal Highway Administration (FHWA)

and internal stakeholders. Under FHWA and American Association of State Highway and Transportation Officials (AASHTO) supervision, and through research conducted by the Second Strategic Highway Research Program (SHRP 2), NDOT became one of the first agencies to conduct a self-assessment workshop. Under the Program Plan’s Programmatic Elements, NDOT developed an implementation actions roadmap (Figure 2) featuring timeframes based on the 2014 CMM findings and demonstrated CMM dimensions and TSMO capabilities’ anticipated improvements.

TSMO Programmatic Elements	Immediate Actionable Items	Short-Term Actionable Items	Long-Term Actionable Items
Operational Structure	<ul style="list-style-type: none"> Identify key processes within Traffic Operations to include TSMO capabilities. Develop key elements and requirements for TSMO Program Manager. Develop a TSMO strategy consistent with the Statewide Program Plan. Identify key elements of all the managing agencies with external agencies and partners. Identify additional management agreement needs. 	<ul style="list-style-type: none"> Develop a plan to identify key data for traffic operations performance management. Develop a plan to identify key data for traffic operations performance management. Develop a plan to identify key data for traffic operations performance management. Develop a plan to identify key data for traffic operations performance management. Develop a plan to identify key data for traffic operations performance management. 	<ul style="list-style-type: none"> Develop additional TSMO positions within TSMO Program Manager.
Business Processes and Program Management	<ul style="list-style-type: none"> Define the performance management criteria. Develop key data and use data needs for traffic operations performance management. Develop the performance management indicators. 	<ul style="list-style-type: none"> Develop a plan to identify key data for traffic operations performance management. Develop a plan to identify key data for traffic operations performance management. Develop a plan to identify key data for traffic operations performance management. Develop a plan to identify key data for traffic operations performance management. Develop a plan to identify key data for traffic operations performance management. 	<ul style="list-style-type: none"> Review TSMO results and address elements to improve TSMO results and address elements to improve TSMO results. Review TSMO results and address elements to improve TSMO results. Review TSMO results and address elements to improve TSMO results.
Staffing and Resource Development	<ul style="list-style-type: none"> Identify current needs of the TSMO resources staff and figures for additional staff. Review and revise existing job elements and KPIs. Identify operational needs for TSMO capacity and staffing requirements. Implement TSMO 1 transfer of organizational structure. 	<ul style="list-style-type: none"> Identify the required additional staff and capabilities to implement TSMO. Develop TSMO training program for staff. Develop TSMO training program for staff. Develop TSMO training program for staff. Develop TSMO training program for staff. 	<ul style="list-style-type: none"> Identify required TSMO training opportunities for staff. Identify required TSMO training opportunities for staff. Identify required TSMO training opportunities for staff.
Financial Resource Management	<ul style="list-style-type: none"> Identify available funding sources for TSMO activities. 	<ul style="list-style-type: none"> Apply the TSMO investment contribution tool for project selection on annual basis. Develop financial plan to ensure TSMO capacity needs for capacity planning activities. Include TSMO contribution in capital in TSMO. Develop TSMO capital plan. Develop funding plan for TSMO funding, including both description of funding requirements and operational elements. 	<ul style="list-style-type: none"> Develop regular scheduled meetings to review financial plan of TSMO funding.
Communication and Collaboration	<ul style="list-style-type: none"> Develop requirement of TSMO staff to development of the strategic plan. Develop a TSMO strategy to ensure access to both internal and external stakeholders to ensure TSMO effectiveness. Develop Statewide TSMO Strategic Committee. 	<ul style="list-style-type: none"> Identify existing means of internal communication and collaboration and the existing data for effective communication. Develop communication plan to identify and maintain TSMO issues for the Program Manager TSMO Committee. Develop training program for internal and external agencies. Develop training TSMO committee and capacity training and internally. Identify and develop required emergency processes and protocols. 	<ul style="list-style-type: none"> Develop strategies required meetings to enhance collaboration with external agencies.

Figure 2

NDOT adopted a recurring schedule of CMM self-assessments (Figure 3) within the TSMO Program Plan for continuous application of the self-assessment framework, along with an update cycle of other plan elements.

Plan/Program Description	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
TSMO Strategic Elements					✓					✓
TSMO Program Elements					✓					✓
TSMO IPT		✓		✓		✓		✓		✓
CMM Self-Assessment	✓			✓					✓	
TSMO Program Actionable Items		✓		✓		✓		✓		✓
TSMO Tactical Actionable Items		✓		✓		✓		✓		✓

Figure 3

The NDOT TSMO Program Plan was formally adopted in 2020, and NDOT conducted their third CMM self-assessment (Appendix 2 – 2020 CMM tech memo) in preparation for the TSMO Implementation Planning phase. NDOT expanded participation to external stakeholders and reviewed and adjusted targeted action items for the Implementation Planning phase based on the TSMO maturity level across all

six dimensions. NDOT then developed several TSMO Plans:

- TSMO Staffing and Workforce Development Plan – identified strategies to recruit, train, and retain a TSMO workforce and opportunities to integrate TSMO into local educational institutions
- TSMO Stakeholder Engagement Plan – adapted the FHWA framework for TSMO collaboration to statewide application of structure, processes, products, resources, and performance measures with general and project-specific approaches
- TSMO Planning and Financial Resources Processes and Procedures Plan – identified TSMO integration opportunities, and developed TSMO-specific planning and financial processes, procedures, and strategies
- TSMO Performance Management Program Plan – reviewed and identified agency-wide and TSMO-specific performance measures for alignment, taking a 3-tiered approach to performance management (Figure 4)

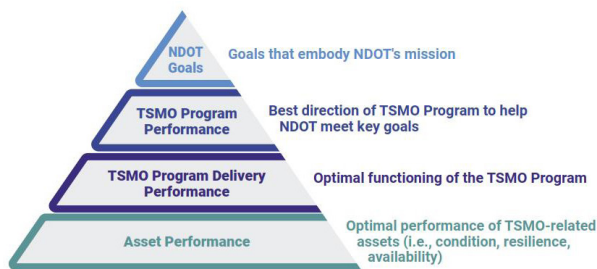


Figure 4

Figure 5 shows comparison between 2014 and 2020 CMMs and increase in Program maturity in 6 years.



Figure 5

Following the 2020 CMM, NDOT developed their Statewide ITS and ATM Master Plan and included an ATM-CMF, conducted in 2022 with participation from NDOT districts and statewide

stakeholders (Figure 6). Findings were incorporated into the qualitative recommendations of the ITS and ATM Master Plan’s deployment recommendations, targeting improvements specific to ATM organizational capabilities (Appendix 3 - ATM-CMF technical memo).

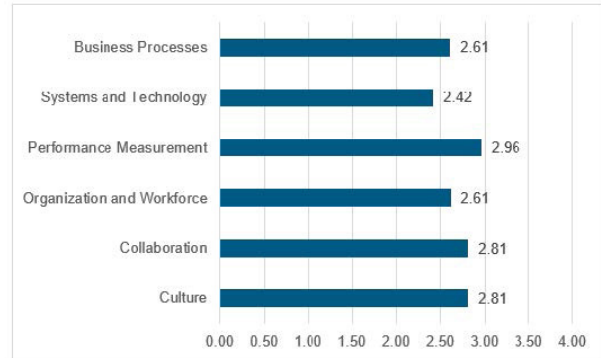


Figure 6

COMMUNICATIONS PLANNING AND EXECUTION

Prior to conducting CMM workshops, NDOT scheduled multiple meetings with stakeholders through leveraging their TSMO Steering Committee (TSC) meetings. These meetings occur quarterly and are intended to provide an opportunity for stakeholder’s education, knowledge share, and presentation of next steps for statewide TSMO implementation.

In 2020, NDOT used the TSC meeting to conduct three virtual CMM workshops. Although it was challenging, NDOT decided to conduct virtual workshops to maximize participation of key stakeholders. NDOT then used the TSC as a platform to communicate the CMM results, discuss, and achieve consensus on next steps.

Following this success, NDOT used the same methodology in conducting the ATM-CMF workshop. For this workshop, NDOT included key internal and external stakeholders, operations and maintenance staff, and senior leadership of all partners to ensure inclusion of stakeholders at all levels.

Through the TSC meeting in April 2023, NDOT communicated their plan for conducting the next CMM self-assessment in 2024, encouraging all stakeholders' participation. The 2024 CMM will further expand the participation to all regional and local agencies such as metropolitan planning organizations (MPO), counties, and cities in alignment with the recurring schedule of CMM self-assessment (Figure 3).

Currently, NDOT is also working on organizing a TIM-CMF including participation from TIM Program stakeholders such as law enforcement, emergency/first responders, consultants, towing companies, etc. This will be conducted in collaboration with the FHWA.

OUTCOME, BENEFITS AND LEARNINGS

- The 2011 and 2014 CMM results enabled NDOT to accurately organize improvements in all six CMM dimensions and create the Programmatic Elements and Actionable Items Roadmap.
- Using the 2020 CMM results, NDOT tailored and modified TSMO Implementation Planning phase tasks. By setting a target of Level 3 in TSMO maturity for 2024 and including external stakeholders, NDOT communicated the importance of working collaboratively, identified stakeholders' roles and responsibilities, and created action items for the next steps in the TSMO Program's statewide implementation.
- Through the 2020 CMM self-assessment's granular analysis, NDOT demonstrated and communicated stakeholder groups' assessment of the six key dimensions (Figure 7). The need to focus on specific

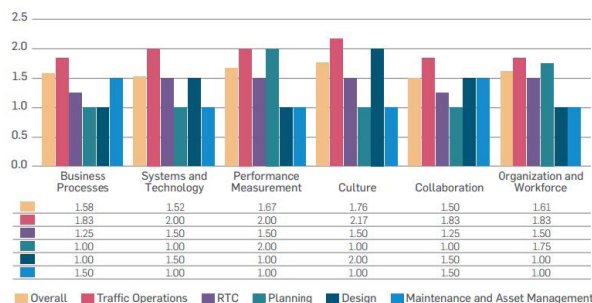


Figure 7

audiences, and in what areas, was a major finding from a TSMO culture perspective.

- NDOT developed an innovative and granular methodology for their 2020 CMM, which was also adopted to the ATM-CMF, and used a combination of questionnaires (a list of specific questions regarding capabilities under each dimension) and single self-assessment questions. Figure 8 presents the comparison between CMM levels of maturity from the questionnaire versus self-assessment, showing that in five dimensions participants gave NDOT a higher maturity level on the questionnaire than on the self-assessment.

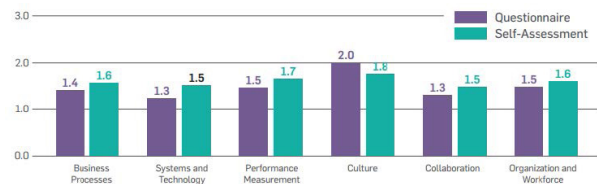


Figure 8

- Per 2020 assessment results, NDOT Traffic Operations Division is the most versed with TSMO activities. They have laid the foundation for specific strategies, performance metrics, and business processes and completed action items already established. Other divisions, such as Planning and Design, were familiar with the benefit of TSMO per their responses to the Culture dimension. This can be considered a "grass-roots" improvement, enabling participants to provide an educated review of other dimensions.
- A future goal of Level 3 maturity has been established for NDOT. While the Traffic Operations Division will likely accomplish this first, NDOT's CMM assessment results will only reflect this if all divisions and stakeholders are considered in all aspects of program implementation.
- Through the 2020 assessment, NDOT suggested action items to further enhance the TSMO Program and support implementation. Figure 9 shows how each action item supports one or more existing statewide goals and transportation planning documents.

Dimension	MATURITY LEVEL				Statewide Goals	Transportation Planning Document Reference
	Level 1 Ad-hoc	Level 2 Processes Developing, Staff Training, Limited Accountability	Level 3 2024 TARGET Processes Documented, Performance Measures, Partners Aligned, Program Budgeted	Level 4 Performance-Based Improvement, Formal Program, Formal Partnerships		
Business Processes	*Develop TSMO Business Case.	*Communicate the TSMO Business Case to statewide transportation agencies.	Communicate the TSMO Business Case at the state legislative level.	Continued communication of institutional, Organizational and Procedural (IPO) changes at a statewide level. Interactive presentation of TSMO benefits. Ensure continuous availability and willingness to employ TSMO strategies, fostering a greater understanding of the IPO aspects to advance TSMO.	Enhance external and internal communications.	NDOT Strategic Plan
	*Identify internal challenges to integrating TSMO with existing agency processes.	Develop mitigation plan to achieve engineering and operations missions without interference from existing agency processes.	Implement mitigation plan, document successes and additional challenges. Seek continuous improvement to further align processes.	Recurring measurement of performance in implementation of mitigation plan, review and update of action items, assignment of responsibilities (internal and external).	Reduce project delivery delays.	MAP-21

- The 2022 ATM-CMF was another successful example of internal and external collaboration and collectively identify level of maturity and focus areas within the ITS and ATM MasterPlan.
- Following NDOT's success, RTC of Southern Nevada was encouraged to conduct their own CMM assessment and develop a regional business case. The RTC completed their internal CMM in 2022 and identified institutional, organizational, and procedural actions.

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Business Processes	*Identify criteria for project evaluation for TSMO strategies.	*Develop Project Evaluation Tool.	Integrate the Regional ITS Architecture and Systems Engineering Process with the TSMO Project Evaluation Tool. Document before/after lessons learned from Project Evaluation Tool deployment.	Archive project performance and incorporate findings into evaluation tool. Integrate historical data into project evaluations.	Strengthen TSMO integration.	TSMO Program Plan
	*Identify need to include TSMO applications in the agency's planning processes.	Develop TSMO applications, tools and strategies for integration into planning.	Update agency planning documents to refer to/normalize TSMO Program Plan and applications.	Integrate TSMO applications in the agency's planning documents and decision-making processes.	Strengthen TSMO integration.	TSMO Program Plan
Systems & Technology	Develop list of alternative options for reducing project budgets without removing ITS components.	*Prioritize ITS on all projects if they align with the regional ITS Architecture.	Track performance of projects in which ITS is deployed.	Use before/after studies on all projects that deploy TSMO strategy or ITS devices. Archive study data and integrate with TSMO Evaluation Tool.	Strengthen TSMO integration.	TSMO Program Plan
	*Identify security issues related to TSMO implementation.	Develop privacy policies and security requirements related to data for TSMO implementation.	Implement privacy policies and security requirements. Define access, roles, and responsibilities (internal), perform monitoring.	Define access, roles, and responsibilities (external). Develop and implement strategies to enable decision-making.	Manage data consistently and effectively	NDOT Strategic Plan

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Systems & Technology	*Identify processes for maintenance activities as part of TSMO systems.	Document processes for maintenance activities as part of TSMO systems.	Implement functional, performance-based criteria for deployed TSMO systems.	Use functional performance metric values to re-strategize maintenance processes and activities.	Inventory infrastructure condition.	TSMO Program Plan MAP-21
	*Identify issues relevant to the procurement of infrastructure to support TSMO strategies.	Develop mitigation plan to address procurement challenges.	Document infrastructure procurement process and distribute to applicable agency divisions.	Recurring monitoring and revision of procurement processes.	Reduce project delivery delays.	MAP-21
	*Asset uptime and reliability is identified in the field as issues occur.	*Identify list of assets to be monitored and develop recurring inspection schedules.	Employ wireless/fiber communications and recurring inspections and report. Asset performance to be monitored regionally and replaced based on tracked lifetime cycles and performance.	Asset uptime reports are reviewed against regional transportation challenges to determine effectiveness of assets. High performing or high benefits assets are identified and incorporated into all projects.	Inventory infrastructure condition.	MAP-21 TSMO Program Plan
Performance Measurement	Facilitate workshops with partner stakeholders to discuss regional TSMO performance measures.	Gain consensus on regional TSMO performance measures and document performance metric criteria.	Employ TSMO strategies based on performance measure criteria. Update performance metric plans as needed to meet the demands of the transportation system.	Enhance internal and external communications.	NDOT Strategic Plan TSMO Program Plan	

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Performance Measurement		*Identify and document TSMO performance-based project deployment processes and procedures.	Documented TSMO performance-based project deployment processes and procedures are aligned region-wide. Funding established for TSMO deployments.	Project deployment metrics are continuously tracked and used to inform future deployments region-wide.	Strengthen TSMO integration.	TSMO Program Plan
	*Identify barriers to establishing TSMO performance measurement needs.	Develop mitigation plan for overcoming barriers to performance measure needs.	Coordinate with regional partners for sharing performance measure data. Gain buy-in and support from senior executive leadership to revise processes in support of performance measure needs.	Barriers no longer exist and if they become present amendments are made to mitigation plans. Frequent changes in barriers are tracked and evaluated for continuous improvement.	Efficiently operate and maintain the state transportation system.	NDOT Strategic Plan
	*Identify MAP-21 performance metrics which align with MAP-21 goals.	*Develop regional performance measures which align with MAP-21 goals.	*Document regional performance measures as they relate to goals in MAP-21 and align TSMO program with MAP-21 Goals	Performance measures are utilized to inform and decide on future projects	Strengthen TSMO integration. Ensure system reliability.	TSMO Program Plan MAP-21