

Western States Rural Transportation Technology Implementers Forum

The Nevada TSMO Program – *A Modern Approach to Solving Old Problems*

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June 14th – 16th

Overview

- Section 01 - Introduction to TSMO
- Section 02 - NDOT TSMO Implementation Progress
- Section 03 - NDOT TSMO Program
- Section 04 – Next Steps for NDOT TSMO Program
- Section 05 - NDOT TSMO Program Challenges and Lessons Learned

Section 1 – Introduction to TSMO



Section 1 - Introduction to TSMO

What is TSMO?



Figure 1: TSMO Definition

"Integrated strategies to **optimize** the performance of **existing infrastructure** through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system"

Section 1 - Introduction to TSMO

What is TSMO?

- A **shift** in how we approach the management of our transportation systems
- Provide **strategies** to address both recurring and non-recurring congestion
- Encourages all stakeholders to **consider operations** throughout the project development process
- A **collaborative effort** through multiple agencies and regional partnerships



Figure 2: What is TSMO?

Section 1 - Introduction to TSMO

TSMO Integration

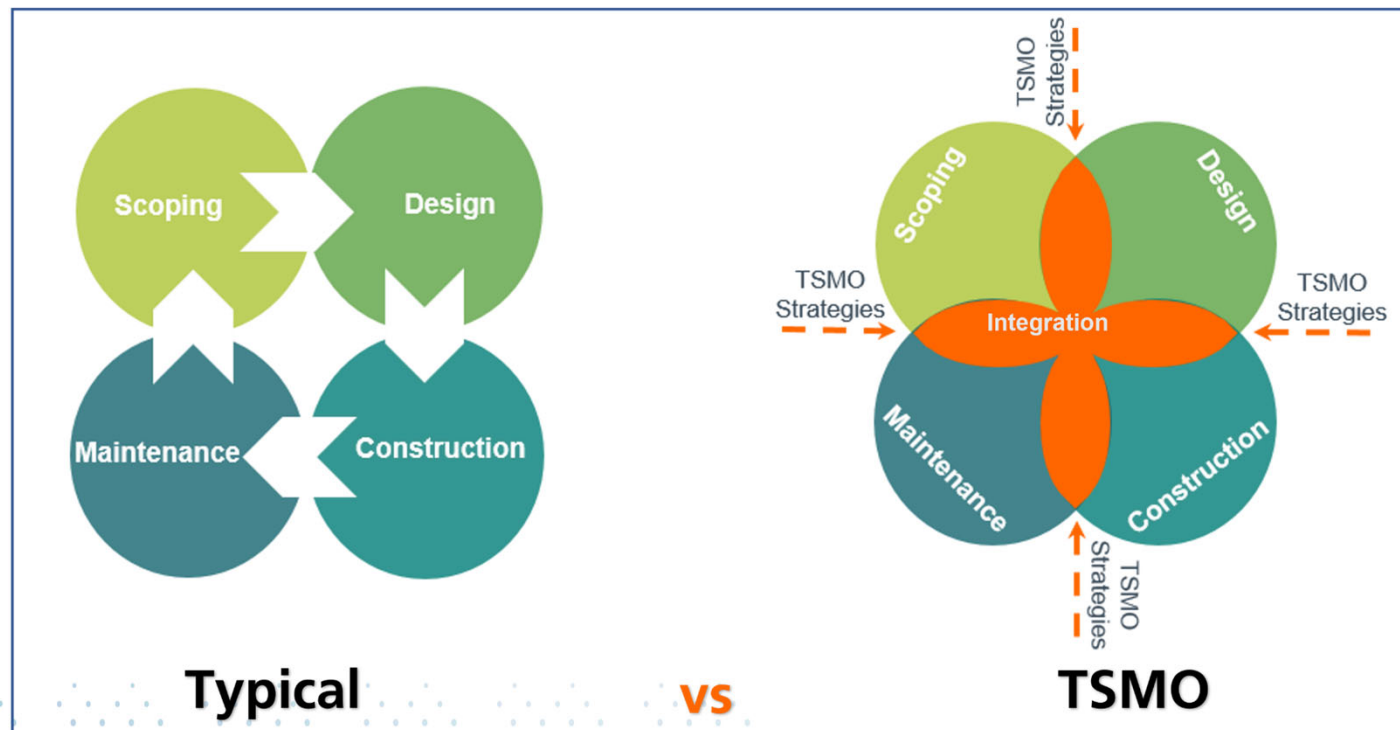


Figure 3: Comparison of Typical Project Life Cycle versus TSMO Integration

Section 1 - Introduction to TSMO

What Does Integration Mean?

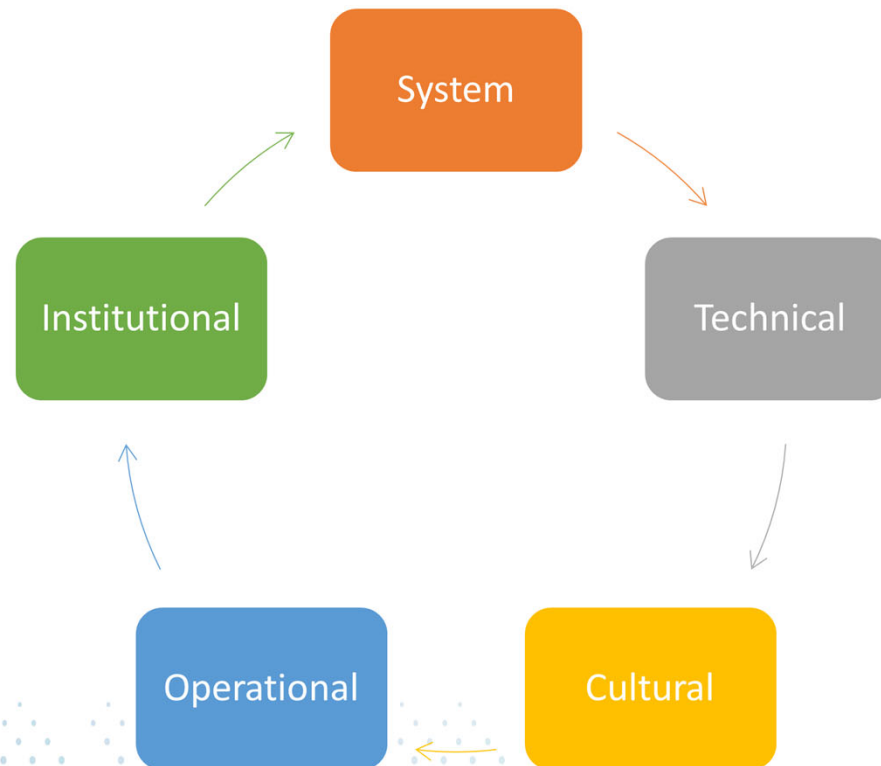


Figure 4: Integration Life Cycle

Section 1 - Introduction to TSMO

Benefits of TSMO



Figure 5: Primary Benefits of TSMO

Section 1 - Introduction to TSMO

TSMO Strategies



Figure 6: List of TSMO Strategies

Section 2 – NDOT TSMO Implementation Progress



Section 2 – NDOT TSMO Implementation Progress

NDOT's Capability Maturity Model (CMM) History

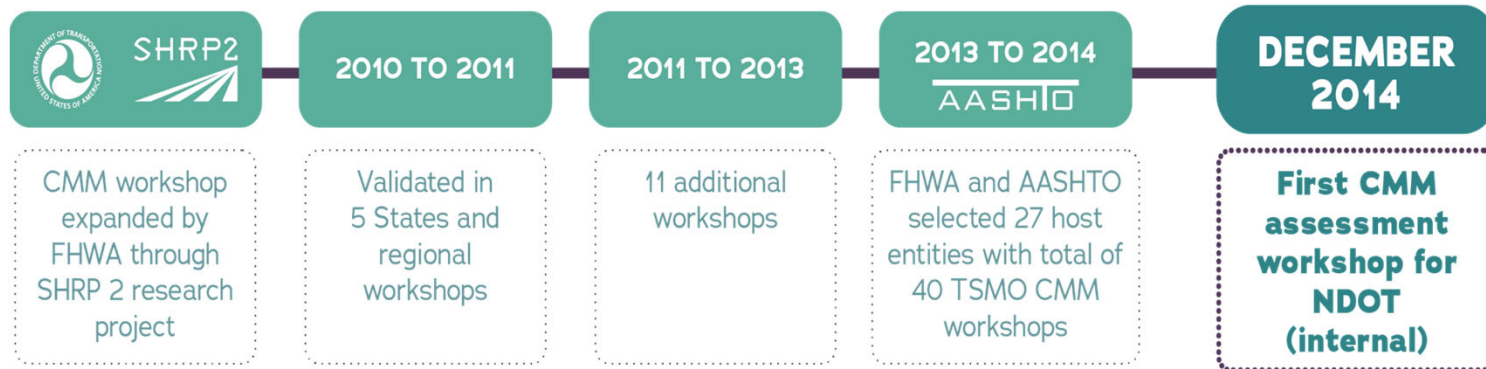


Figure 7: History of TSMO Capability Maturity Model and NDOT's First CMM in 2014

Section 2 – NDOT TSMO Implementation Progress

Capability Maturity Model (CMM) Dimensions



Figure 8: Six Key Dimensions of the TSMO Capability Maturity Model

Section 2 – NDOT TSMO Implementation Progress

Capability Maturity Model (CMM) Levels



Figure 9: Four Levels of TSMO Maturity

Section 2 – NDOT TSMO Implementation Progress

NDOT's 2014 CMM Results

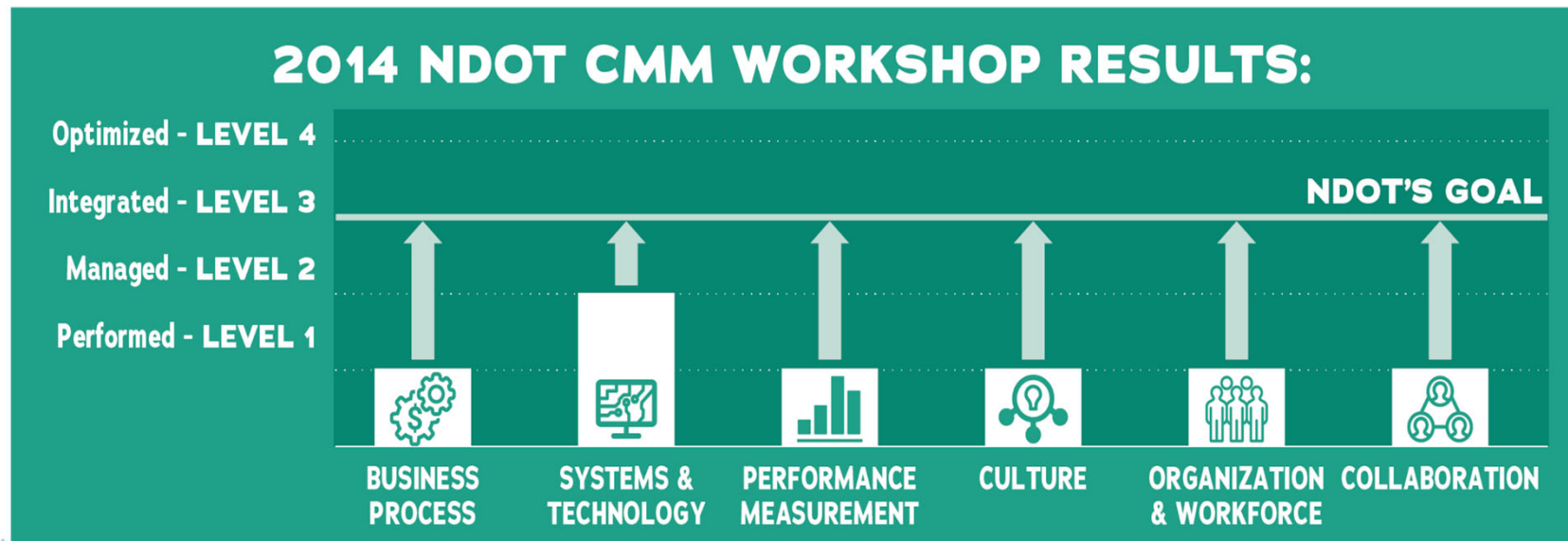
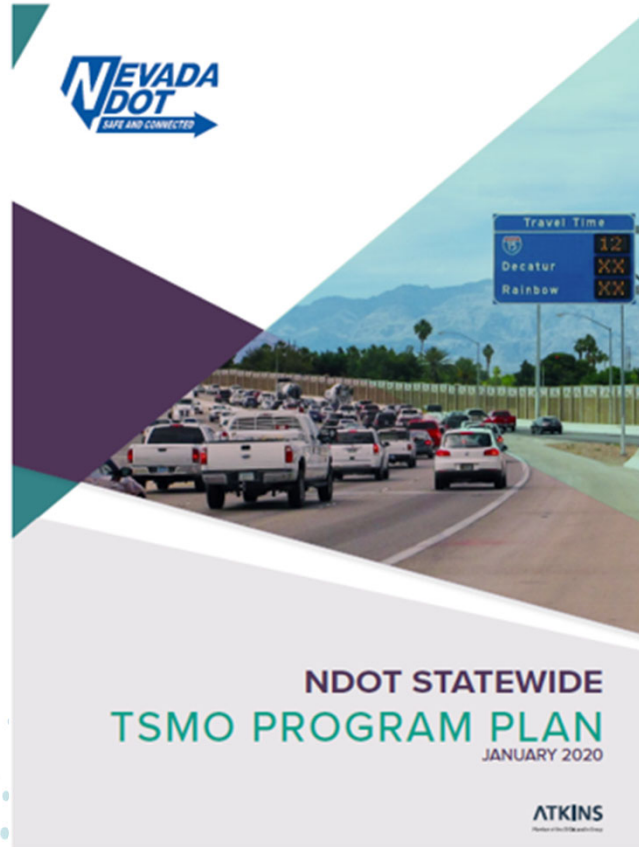


Figure 10: Bar Chart showing NDOT's 2014 CMM Workshop Results and Their Goal to Achieve Level 3 by 2024 on all Six Dimensions

Section 2 – NDOT TSMO Implementation Progress

TSMO Program Plan Publication



For TSMO Program Documents Visit:

www.nvtsmo.com

Figure 11: NDOT Statewide TSMO Program Plan, Publication's Cover Page

Section 2 – NDOT TSMO Implementation Progress

NDOT's 2020 CMM Results

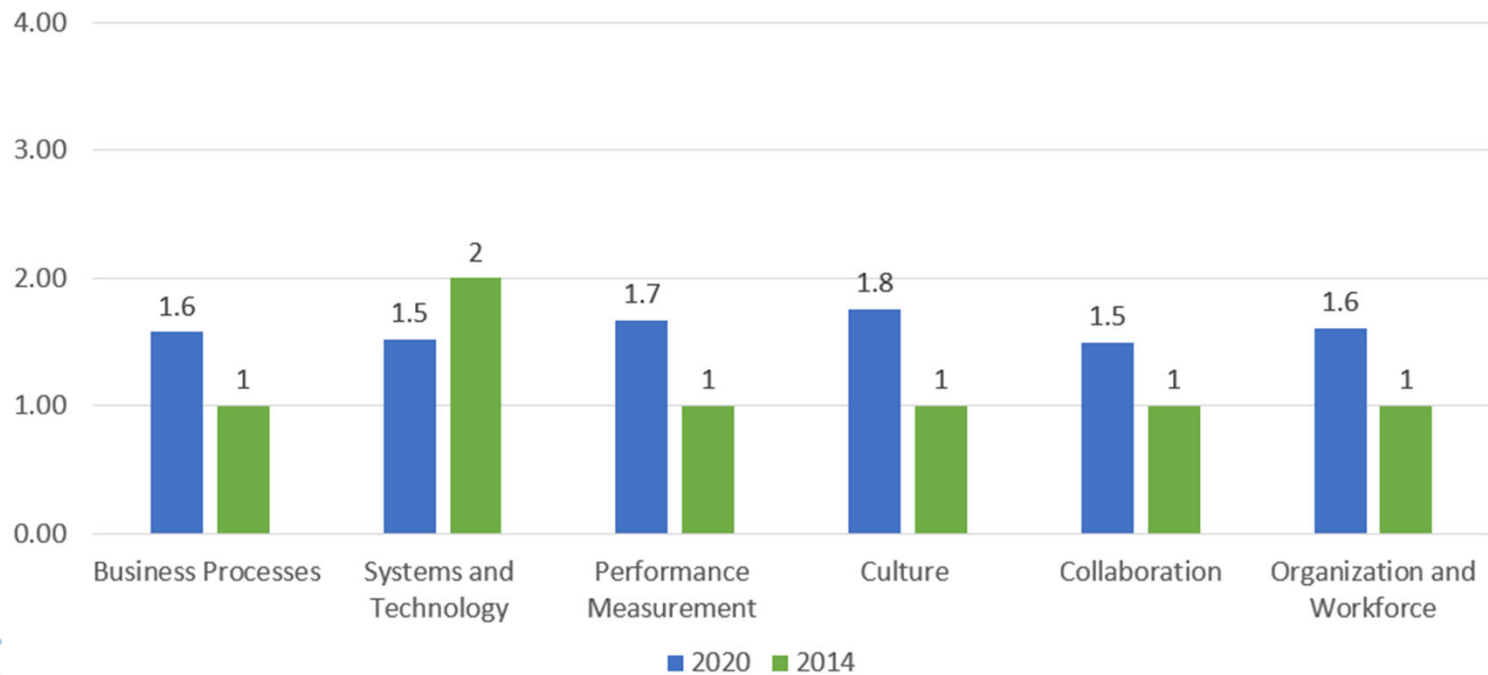


Figure 12: Bar Chart Comparing the NDOT's 2014 CMM Results (Green) versus the 2020 CMM Results (Blue)

Section 3 – NDOT TSMO Program Plan



Section 3 – NDOT TSMO Program Plan

TSMO Program Plan Development

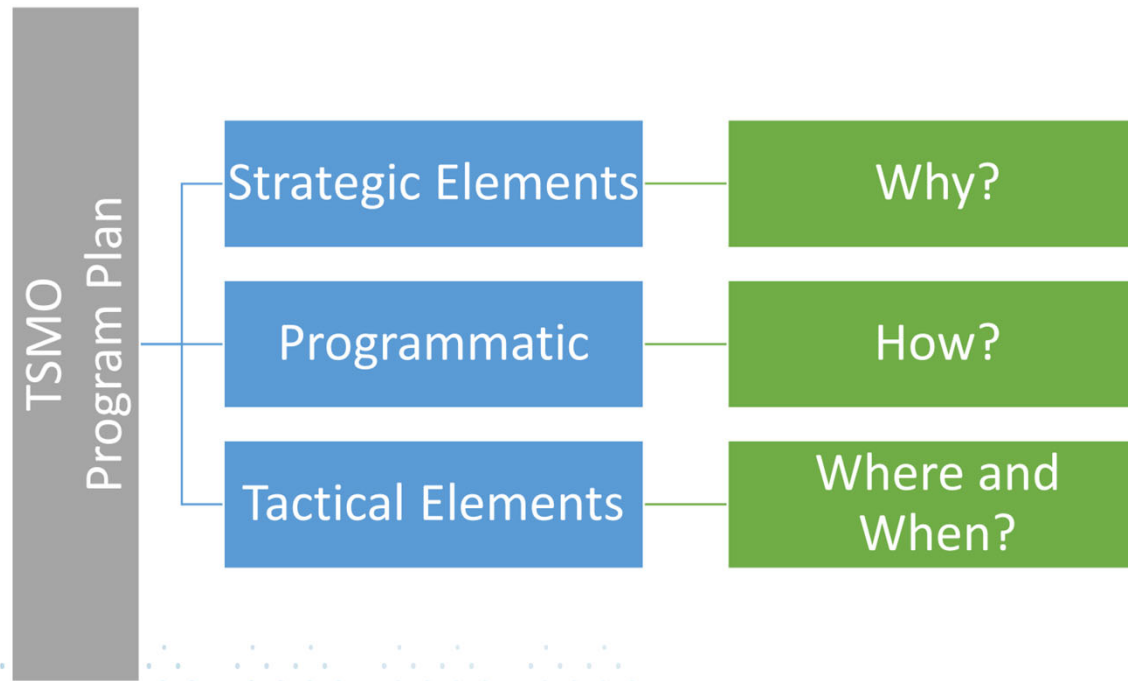


Figure 13: TSMO Program Planning Framework and Elements

Section 3 – NDOT TSMO Program Plan

TSMO Program Plan Strategic Elements

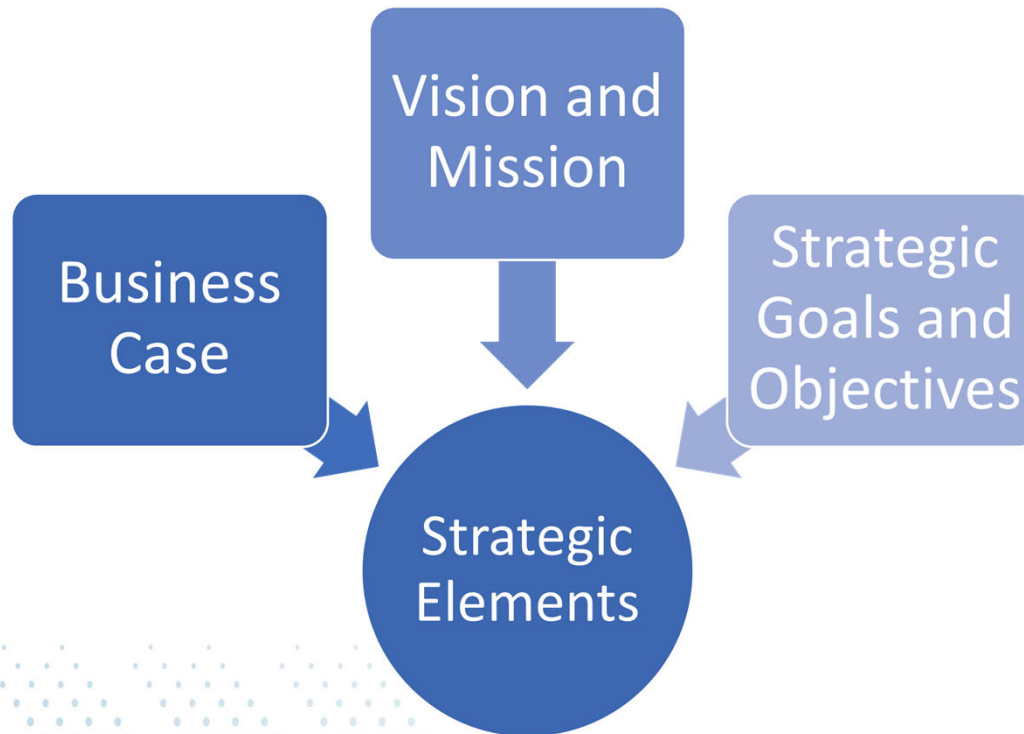


Figure 14: NDOT TSMO Program Strategic Elements

Section 3 – NDOT TSMO Program Plan

TSMO Program Plan Programmatic Elements

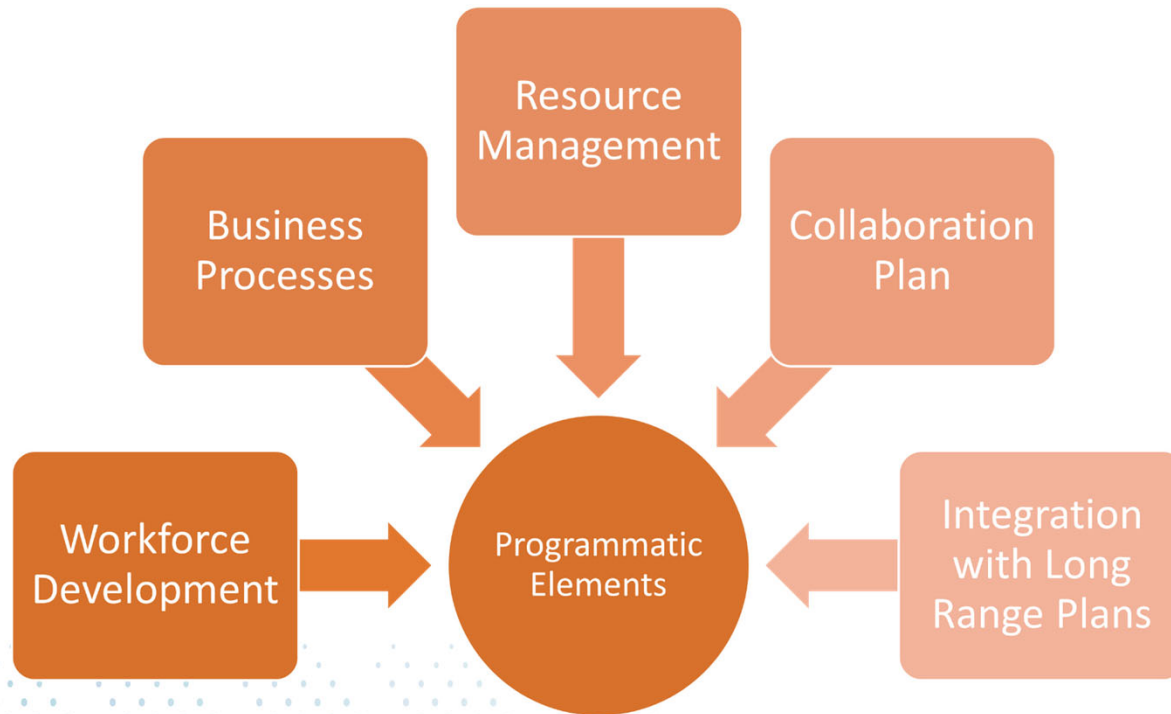


Figure 15: NDOT TSMO Program Programmatic Elements

Section 3 – NDOT TSMO Program Plan

TSMO Program Plan Tactical Elements

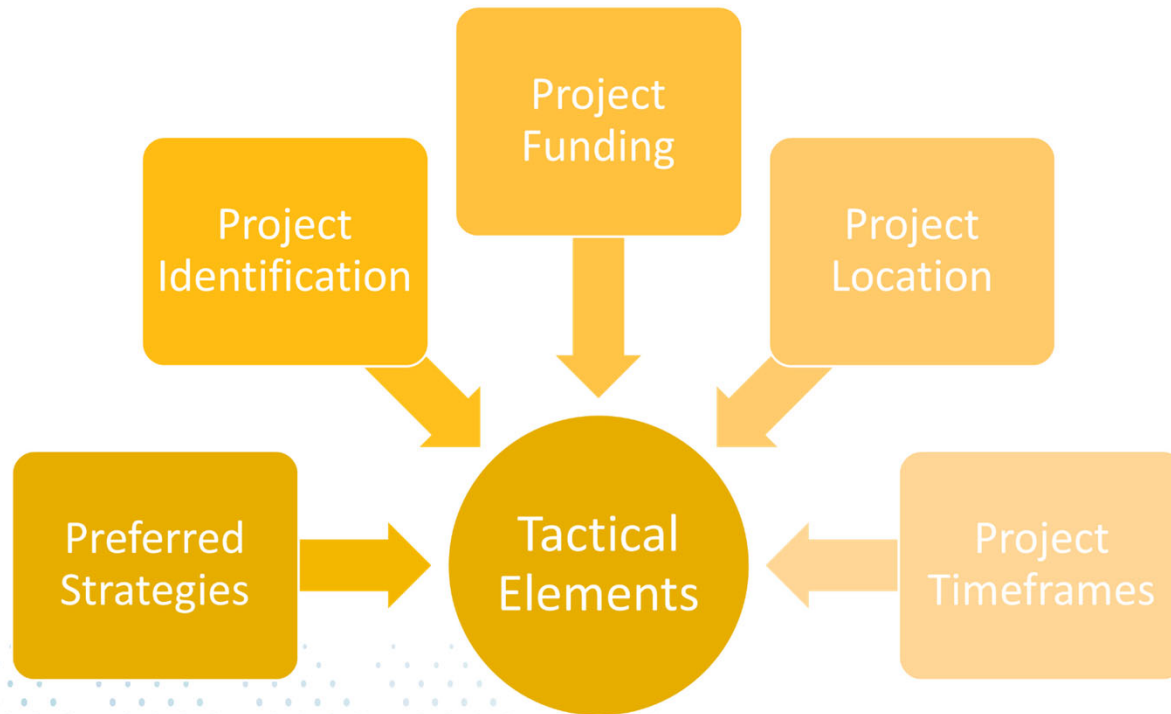


Figure 16: NDOT TSMO Program Tactical Elements

Section 3 – NDOT TSMO Program Plan

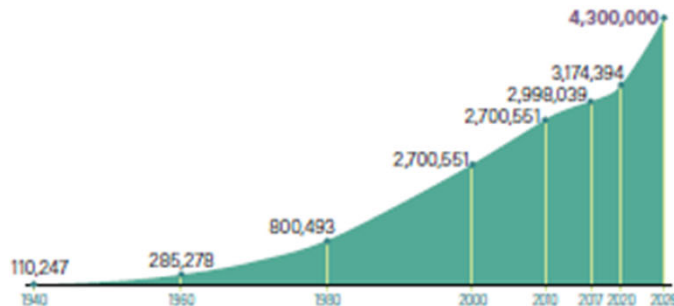
TSMO Program Plan Strategic Elements – TSMO Business Case



POPULATIONS

CURRENT CHALLENGES

↑133% 1990—2008, fastest growing State in the nation.
3 Million Population in 2018, fastest growing in the nation based on U.S. Census Bureau.
4.3 Million Projected population by 2026



NEED:

- ◀ Increase in demand, congestion, and delay
- ◀ Reduction of capacity, transportation safety, and reliability

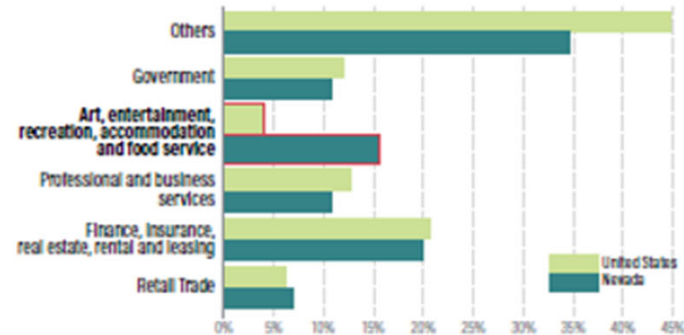


TOURISM-BASED ECONOMY

CURRENT CHALLENGES

Service sector employs about **half of Nevada's workers**

Tourism sustains **27%** of all jobs in Nevada



NEED:

- ◀ NDOT must provide, maintain, and operate a safe, reliable, and efficient transportation network for its workers and tourists

Figure 17: NDOT TSMO Business Case, Population Growth and Tourism-Based Economy Challenges and Needs

Section 3 – NDOT TSMO Program Plan

TSMO Program Plan Strategic Elements – TSMO Business Case



CONGESTION AND ASSOCIATED COSTS

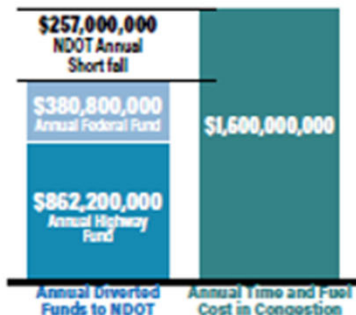
CURRENT CHALLENGES

↑\$121 B In wasted time and fuel cost in U.S. per year.

\$1,400 & 60 hrs Cost of congestion to average driver in Nevada annually.

\$1.6 Billion

Value of lost time and fuel in Nevada



Roadway incidents account for:

- 25%** of travel delay,
- 4 minutes** for every minute of congestion, and
- 2.8%** increased chance of secondary incident

NEED:

- ◀ Wasted time and vehicle operating costs
- ◀ Hundreds of lost lives
- ◀ Increased chance of secondary incidents



VEHICLE MILES TRAVELED (VMT)

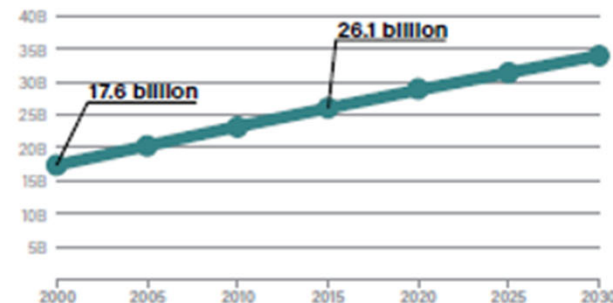
CURRENT CHALLENGES

↑48% From 17.6 billion in 2000 to 26.1 billion in 2015

Projected increase of **30%** by the year 2030 to:

34 Billion

VMT



NEED:

- ◀ With VMT demand increasing at rapid rate, the need for efficient and reliable roads to accommodate this demand is paramount.

Figure 18: NDOT TSMO Business Case, Congestion and Associated Costs, and Vehicle Miles Traveled Challenges and Needs

Section 3 – NDOT TSMO Program Plan

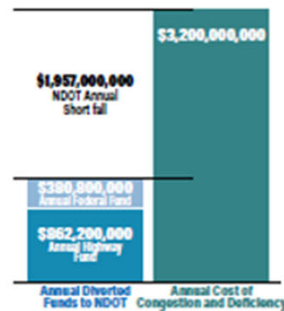
TSMO Program Plan Strategic Elements – TSMO Business Case



DEFICIENT ROADS AND BRIDGES

CURRENT CHALLENGES

\$3.2 Billion Annual cost to Nevada motorists due to inadequate roads.



\$24 M Deficit has been projected in bridge preservation by 2020

NEED:

« NDOT's yearly operating budget is not sufficient to keep up with operations and maintenance, let alone to keep up with the demands for new infrastructure.



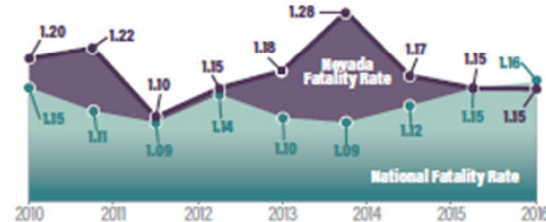
SAFETY

CURRENT CHALLENGES

331 People died in Nevada in 2018.

\$1.9 B Economic cost of traffic crashes in 2017.

\$906 M Annual cost to Nevada motorists from medical costs, lost productivity, etc.



NEED:

« Traffic crashes have a demonstrable negative effect on the operations of NDOT roadways and cost billions of dollars to the economy.

Figure 19: NDOT TSMO Business Case, Deficient Roads and Bridges, and Safety Challenges and Needs

Section 3 – NDOT TSMO Program Plan

TSMO Program Plan Strategic Elements – TSMO Business Case



TRUCKS AND FREIGHT MOVEMENT

CURRENT CHALLENGES

The efficiency of the transportation system is critical to the health of the state's economy in Nevada. The key to success is the level of access and convenience for customers and markets.

\$144 Billion

Goods and products are shipped mostly by truck to and from the state of Nevada

73%

of goods and products are carried by trucks annually.

NEED:

- ◀ Negative effect on the economy of Nevada.
- ◀ Delay has a negative effect on the cost of goods and products.



ASSET & PERFORMANCE MANAGEMENT

CURRENT CHALLENGES

NDOT Asset Management Program has identified

\$23 Billion

replacement cost for pavements, bridges, and ITS assets.

Over 20% of state pavements are more than 10 years old

Most of the state bridges have already or will soon exceed their design life of **50 years**

\$1.21 B or approximately 24% of the NDOT's annual budget in preservation activities between 2017 to 2027 to extend the assets' lives

NEED:

- ◀ Cost to maintain is increasing while funding is stagnant.
- ◀ To efficiently maintain infrastructure, NDOT needs to develop a comprehensive database and management strategies to establish priorities.

Figure 20: NDOT TSMO Business Case, Trucks and Freight Movement, and Asset and Performance Management Challenges and Needs

Section 3 – NDOT TSMO Program Plan



TSMO Program Plan Strategic Elements – Goals and Objectives

Strategic Goal: Enhance Safety

Objective: Reduce number of crashes, incidents, injuries, and fatalities.

Performance Measures:

- Number of incidents
- Incident severity
- Rate of fatalities for 100 million Vehicles Miles Traveled (VMT)
- Number of non-motorized fatalities and injuries
- Number of work zone incidents

Tactical Strategies:

- **Traffic Incident Management (TIM)** – *Reduces secondary crashes via strategies for quick clearance and safe incident scene.*
- **Active Traffic Management (ATM)** – *Strategies such as arrow-over-lane, queue warning, and speed harmonization provide advance alerts to drivers so that they can reduce their speed or change lanes.*
- **Wrong-Way Driver Detection Systems** – Provide visual warning to drivers heading wrong-way so that they can self correct, alerts to drivers on mainline.

Section 3 – NDOT TSMO Program Plan

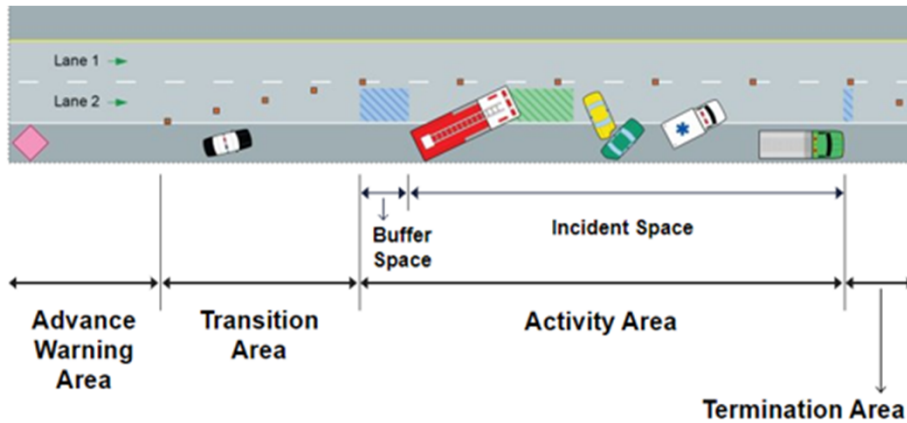


Figure 21: Wrong Way Driver Detection and Activity Zones



Figure 22: Wrong Way Driver Sign

Section 3 – NDOT TSMO Program Plan

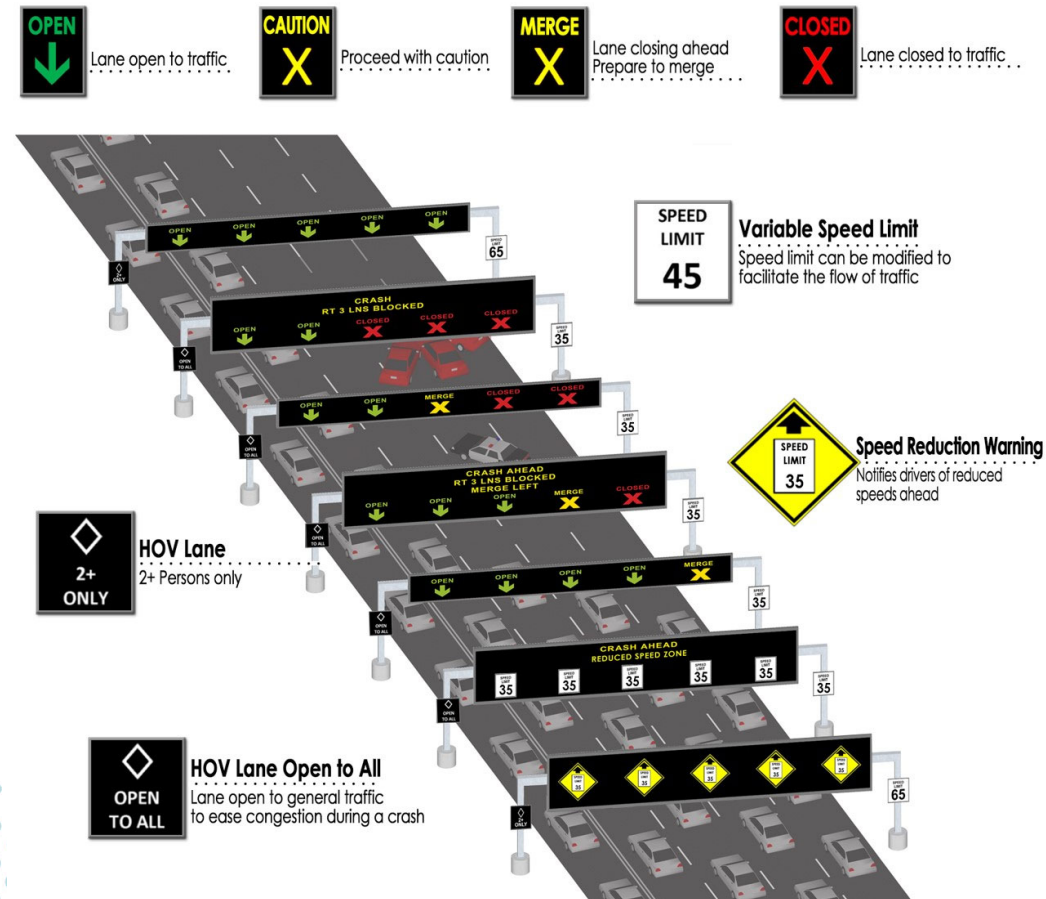


Figure 23: ATM Gantries and Associated Components

Section 3 – NDOT TSMO Program Plan



TSMO Program Plan Strategic Elements – Goals and Objectives

Strategic Goal: **Preserve Infrastructure**

Objective: Maintain transportation assets to preserve investments.

Performance Measures:

- Manufacturer Recommended Lifecycle
- Asset Status
- Communication Status
- Device specific Key Performance Indicators (KPI)

Tactical Strategies:

- ITS Asset Inventory
- Lifecycle Costing Tool
- Asset Management Program (AMP)

Age of Device	
Good	< 80% of manufacturer's recommended service life
Low Risk	> 80% of manufacturer's recommended service life < 100%
Medium Risk	> 100% of manufacturer's recommended service life < 125%
High Risk	> 125% of manufacturer's recommended service life

Current Condition	Resulting Condition After			
	Inspection	Minor Repair	Major Repair	Replacement
Good	Good			
Low Risk	Low Risk	Good		
Medium Risk	Medium Risk	Medium Risk	Low Risk	
High Risk	High Risk	High Risk	Medium Risk	Good

Figure 24: ITS Asset LCC Tool Criteria

Section 3 – NDOT TSMO Program Plan



TSMO Program Plan Strategic Elements – Goals and Objectives

Strategic Goal: Optimize Mobility

Objective: Maximize system efficiency by reducing congestion and/or promoting multi-modal transportation.

Performance Measures:

- Average Travel Time by Mode
- Vehicle Miles Traveled (VMT)

Tactical Strategies:

- High Occupancy Vehicle (HOV) Lanes
- Ride-share programs
- Complete Street projects
- Multi-modal infrastructure (pedestrian/bike paths, bus stations, crosswalk improvements)
- Connected and Autonomous Vehicle (CAV) infrastructure

Section 3 – NDOT TSMO Program Plan

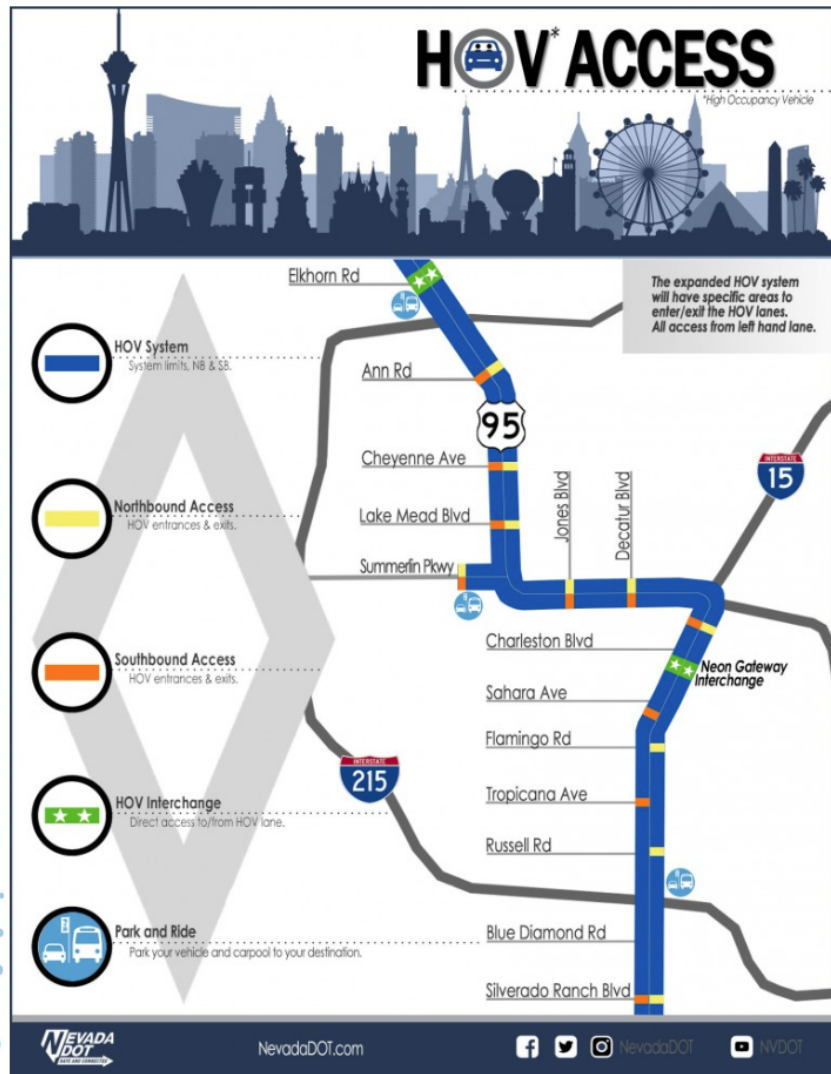


Figure 25: Project NEION HOV Access Diagram



Figure 26: HOV Lanes on US-95 in Las Vegas

Section 3 – NDOT TSMO Program Plan



TSMO Program Plan Strategic Elements – Goals and Objectives

Strategic Goal: Foster Sustainability

Objective: Develop a sustainable transportation system through sustainable and balanced design, operations, and maintenance.

Performance Measures:

- Compliance with Congestion Mitigation and Air Quality Improvement (CMAQ) program
- Annual Hours of Peak Hour Excessive Delay (PHED) Per Capita
- Percent of Non-Single Occupancy Vehicle (SOV)
- 2- and 4-year Total Emission Reductions

Tactical Strategies:

- Traffic Signal Coordination
- Ramp Metering
- Sustainable road design (LED lighting, recycled materials, and dust mitigation)
- Alternative fuel infrastructure



Figure 27: LED Lighting in the Carlin, Nevada Tunnel

Section 3 – NDOT TSMO Program Plan



TSMO Program Plan Strategic Elements – Goals and Objectives

Strategic Goal: Enhance Reliability

Objective: Improve economic competitiveness and enhance quality of life through consistent travel times.

Performance Measures:

- Level of Travel Time Reliability (LoTTR)
- Average incident-related delay
- Average duration of impact from weather-related events
- Average delay related to special events
- Roadway and incidents clearance time

Tactical Strategies:

- Freeway Service Patrol
- Traffic Incident Management (TIM)
- Towing Recovery Incentive Programs (TRIP)
- Road Weather Management
- Event Management



Figure 28: Freeway Service Patrol Vehicles

Section 3 – NDOT TSMO Program Plan



TSMO Program Plan Strategic Elements – Goals and Objectives

Strategic Goal: Optimize Customer Service

Objective: Provide timely and accurate travel information to internal and external customers to enable informed decision-making.

Performance Measures:

- Notification time to Advanced Traveler Information System (ATIS)
- Notification time to Dynamic Message Signs (DMS)
- ATIS usage

Tactical Strategies:

- Traveler Information Systems
- Integration with 3rd-party map providers
- DMS Deployments
- In-vehicle alerts



Figure 29: Dynamic Message Sign (DMS)

Section 3 – NDOT TSMO Program Plan



TSMO Program Plan Strategic Elements – Goals and Objectives

Strategic Goal: Enhance Collaboration

Objective: Maximize coordination and cooperation between NDOT divisions and partnering agencies to proactively manage and operate an integrated transportation system.

Performance Measures:

- Scheduled TSMO Steering Committee meetings annually
- Increased participation with TSMO coalitions
- Additional relevant agreements with partners and neighboring states
- Use of collaboration tools
- Results from surveys and questionnaires
- Participation in TIM coalition meetings

Tactical Strategies:

- Collaborative interagency agreements and Memorandums of Understanding (MOU)
- Action items from survey's and questionnaires

Section 3 – NDOT TSMO Program Plan



TSMO Program Plan Strategic Elements – Goals and Objectives

Strategic Goal: Strengthen TSMO Integration

Objective: Incorporate and prioritize TSMO as a core objective in NDOT’s planning, design, construction, operations, and maintenance activities.

Performance Measures:

- Executed policies, plans, and procedures that reference TSMO strategies
- Executed multi-agency activities and agreements to promote TSMO

Tactical Strategies:

- CMM assessments and action items
- TSMO evaluation tool

Section 4 – Next Steps for NDOT TSMO Program



Section 4 – Next Steps for NDOT TSMO Program

On-going Implementation

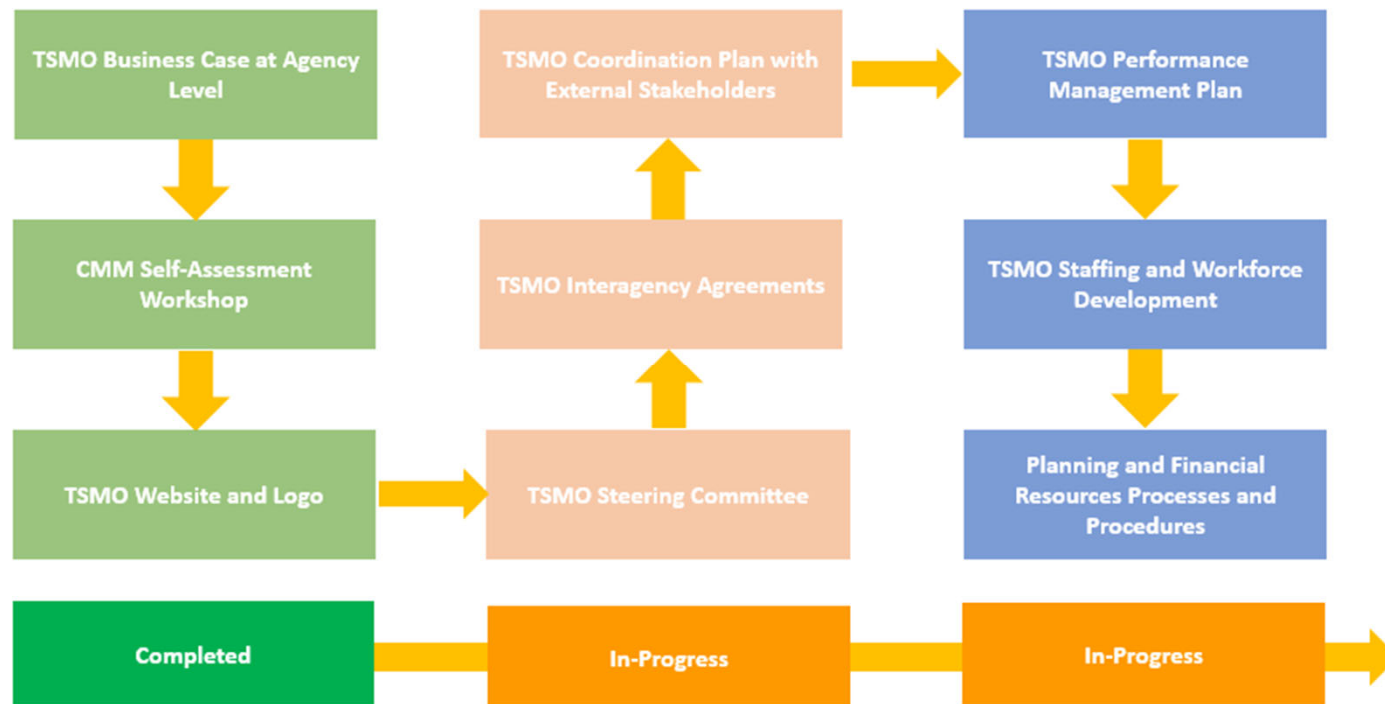


Figure 30: NDOT TSMO Implementation Process and Status

Section 4 – Next Steps for NDOT TSMO Program

TSMO Performance Management Program

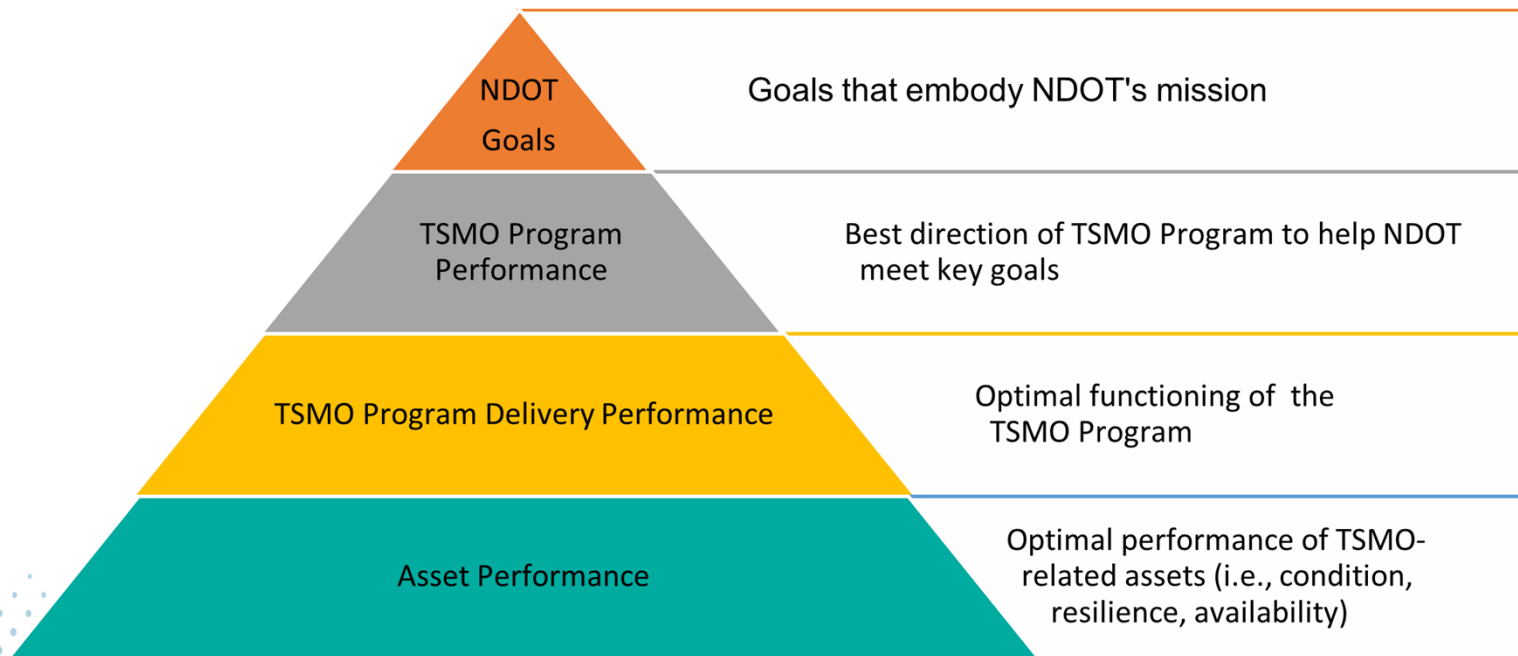


Figure 31: Levels of TSMO Performance Measures—What's Being Measured?

Section 4 – Next Steps for NDOT TSMO Program

TSMO Performance Management Example Program Performance Measures

Enhance Safety	
Decrease the projected 5-year rolling average of traffic fatalities	≥ 1
Decrease the projected 5-year rolling average of serious traffic injuries	≥ 1
Decrease the projected 5-year rolling average of traffic fatalities per 100 million vehicle miles traveled (VMT)	≥ 0.5
Optimize Mobility	
Annual hours of peak hour excessive delay per capita *	≤ 10.0
Non-injury related incidents removed from the travel lane***	< 30 mins.
Injury related incidents removed from the travel lane***	< 60 mins.
Preserve Infrastructure	
Closed-Circuit Television (CCTV) assets in Low Risk or better condition	75%
Dynamic Message Sign (DMS) assets in Low Risk or better condition	65%
Flow Detectors assets in Low Risk or better condition	65%

Table 1: Example Performance Measures for TSMO Program Performance

Section 4 – Next Steps for NDOT TSMO Program

TSMO Performance Management Example Asset Level Performance Measures

ITS Asset	Target Low Risk or Better Target
CCTV	75%
DMS	65%
Flow Detectors	65%
HAR	50%
Ramp Meter	90%
RWIS	20%

Table 2: Example Performance Measures for Assets

Section 4 – Next Steps for NDOT TSMO Program

TSMO Training Plans – Basic Package

Training Title	Targeted Audience	Delivery Method	Training Material	Frequency
NDOT Employee Orientation	New Hires (all Divisions)	On-Line with Scored Quiz	TSMO 101 Training Module	Once, at the time of hiring
NDOT Employee Orientation	New Hires (all Divisions)	On-Line with Scored Quiz	TSMO 102 Training Module	Once, at the time of hiring
Hands-On TSMO Training	New Hires (Traffic Operations Division)	Combination of On-Line with Scored Quiz and Site Visit	TSMO Training Modules, field visits	Once, at the time of hiring
NDOT Traffic Operations Forum	New Hires (Traffic Operations Division)	On-Line or In-Person Lectures on advanced TSMO topics	One-hour lecture and site visits as applicable	Once, at the time of hiring
New Hires Rotational Program	New Hires (Traffic Operations Division)	Combination of In-Person and Experimental Training	Rotational Program in Collaboration with other Divisions	Once, at the time of hiring

Table 3: NDOT TSMO Training Plan – Basic Package

Section 4 – Next Steps for NDOT TSMO Program

TSMO Training Plans – Advanced Package

Training Title	Targeted Audience	Delivery Method	Training Material	Frequency
Advanced Orientation	Current Team members of all Divisions	On-Line or In-Person Lecture on Current TSMO Topics	TSMO 201 Training Module	Once per person
Basic Practitioner Training	Current Team members of Traffic Operations Division	On-Line or In-Person Lecture	TSMO 202 Training Module	Once per person
TSMO Tools Training	Current Team members of all Divisions	Combination of In-Person and Group Exercises	TSMO 203 Training Module	Annual, and subject to the update frequency of the tools
Advanced Practitioner Training/Cross-training	Current Team members of all Divisions	On-Line or In-Person Lecture	An overview of latest updates with TSMO topics	Quarterly
National Operations Academy Trainings, Partnered Trainings	Current Team members in Traffic Operations Division	Combination of In-Person Lectures, Group Exercises, and Field Visits	To be Determined Subject to Availability	Annual, and subject to the training schedule and availability

Table 4: NDOT TSMO Training Plan – Advanced Package

Section 4 – Next Steps for NDOT TSMO Program

TSMO Training Modules



Figure 32: NDOT TSMO Training Modules

Section 4 – Next Steps for NDOT TSMO Program

TSMO Investment Prioritization Tool (IPT)

Project Information				Project Prioritization Criteria														
SDP P#	Project/Services/ Activities	Project Location	PCEMS No.	Alignment with TSMO Strategic Goals and Objectives										Dependencies, Business Risks, and Limitations	Risk Severity	Benefit/Cost Ratio	Strategic Value	TSMO Score (DO NOT FILL IN) The higher the score, the higher return on investment. (Max 17)
				Enhance Safety	Optimize Mobility	Enhance Reliability	Preserve Infrastructure	Foster Sustainability	Optimize Customer Service	Enhance Collaboration	Cost	Implementation						
D3-31	CCTV PTZ & RWIS	US 6, west D16/F16 of Ely	TBD	1	0	1	1	0	1	1	4	3	Coordination with NWS	-1	1	0	12	
D3-28	CCTV PTZ and RWIS and Weather (Signage) Chain Control	US 6, east of US 6/ SR 379 intersection	TBD	1	0	1	1	1	1	1	4	2	Comms to site required, Coordination with NWS	-1	1	0	12	
D3-19-10	RGB Full matrix Sign mounted DMS	SR 227 & MP5	TBD	1	0	1	0	0	1	1	4	3		0	0	0	11	
D3-10	DMS Type 2 (US 50 EB/WB), CCTV PTZ	US 50/SR 305 intersection	TBD	1	0	1	0	0	1	1	4	3		0	0	0	11	
D3-9	DMS Type 2 (US 50 EB/WB), Weather (Signage) Chain Control Station and CCTV PTZ	US 50/SR 278 intersection	8-00251	1	0	1	0	1	1	1	3	3	Coordination with NWS	-1	0	0	10	
D3-50	RWIS and CCTV PTZ	SR 318, South of Junction US 6	TBD	1	0	1	1	0	1	1	4	2	Coordination with NWS	-1	0	0	10	
D3-40	CCTV PTZ	US 50/SR 376 intersection	TBD	1	0	1	0	0	1	1	4	1		0	0	0	9	
D3-24	DMS Type 2 (US 93 NB), RWIS, CCTV PTZ	US 93,Ely @ McGill	8-00251	1	0	1	0	1	1	1	3	1	Comms to site required, Coordination with NWS	-1	1	0	9	
D3-33	DMS Type 2 (US 93 SB) & CCTV	US 93, near Warm Springs - US 93S SR229 Ruby Intersection	TBD	1	0	1	0	0	1	1	4	1		-1	0	0	8	

Figure 33: Screenshot of TSMO IPT for District 3 Project Prioritization

Section 4 – Next Steps for NDOT TSMO Program

2021 NOCoE TSMO Award Winners

THE RUNNER-UP OF THE 2021 TSMO AWARD FOR BEST PROJECT SELECTION AND PRIORITIZATION IS

NEVADA DOT



Nevada DOT liked

NOCoE @NOCoEOps · 3h

The 2021 TSMO Award runner up for 'Best Project Selection & Prioritization' is: @nevadadot. Read about their TSMO Investment Prioritization Tool (IPT) in this case study: bit.ly/3pltatc @aashtospeaks @ITEhq @ITS_America #TSMO



Nevada DOT's TSMO Investment Prioritization Tool aligns the project selection process with the state's transportation priorities.

By institutionalizing TSMO goals and objectives into this process, Nevada DOT improved their internal decision making skills on how best to maximize existing infrastructure and improve the transportation system.

7 views

NOCoE
National Operations Center of Excellence

CASE STUDY

NDOT TSMO INVESTMENT PRIORITIZATION TOOL (IPT)

By Nevada Department of Transportation

IN THIS CASE STUDY YOU WILL LEARN:

- 1 How Nevada DOT developed the TSMO Investment Prioritization Tool (IPT) to help identify and prioritize projects based on the state's transportation priorities, and in a manner that best help achieve the established TSMO goals and objectives.
- 2 How NDOT collaborated internally so that priorities aligned with the One Nevada Transportation Plan and held workshops with the districts to educate and train them on the utilization of the tool.
- 3 How NDOT has integrated the tool into other ITS Planning efforts and device-specific Master Plans.

BACKGROUND

The Nevada Department of Transportation (NDOT) Statewide Transportation Systems Operations and Management (TSMO) Program Plan was developed and formally adopted in 2020. As part of this program, NDOT has developed and planned for integration of TSMO business processes, procedures and tools into the DOT's day to day business. One example of the newly adopted business processes is

the TSMO Investment Prioritization Tool (IPT). The tool has been designed to help NDOT identify and prioritize projects based on the state's transportation priorities, and in a manner that best help achieve the established TSMO goals and objectives. The tool helps establish a formalized process to institutionalize TSMO goals and objectives during needs assessment and project selection for efficient resource allocation.



TSMO PLANNING, STRATEGIES AND DEPLOYMENT

Historically, project selection within NDOT Traffic Operations division has been accomplished through qualitative deliberations, negotiations, and making the business case

NOCoE Case Study 1

Figure 34: NDOT, The Runner-Up of the 2021 TSMO Award for Best Project Selection and Prioritization

Section 4 – Next Steps for NDOT TSMO Program Mainstreaming TSMO at a Statewide Level – The LCC Tool

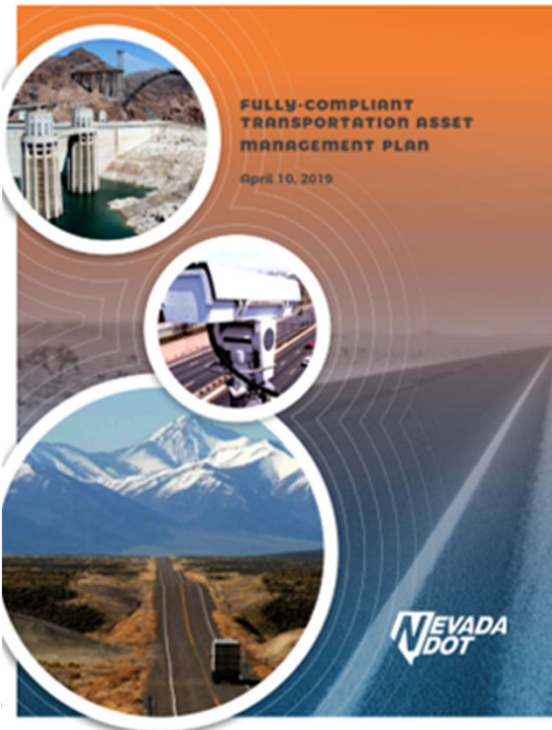


Figure 29: NDOT Fully Compliant TAMP (Cover Page)

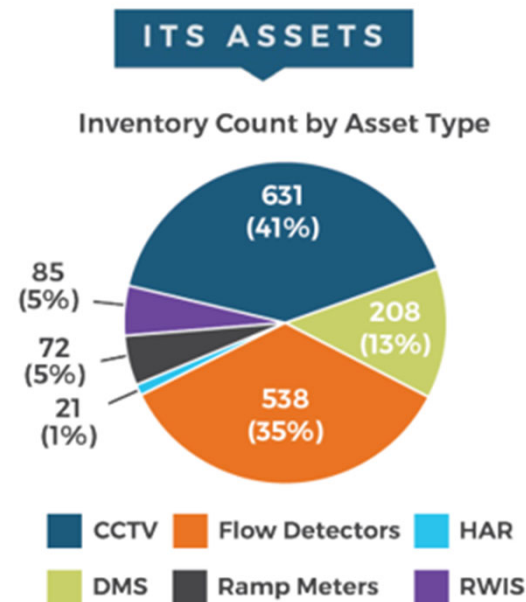


Figure 30: ITS Assets in NDOT TAMP

Section 4 – Next Steps for NDOT TSMO Program

Mainstreaming TSMO at a Statewide Level – The LCC Tool

Basic Definitions:

1- Performance Metrics for Operational Conditions

Condition Category	Condition Description
Good	Age of the device is less than 80 percent of the manufacturers' recommended service life.
Low Risk	Age of the device is between 80 and 100 percent of the manufacturers' recommended service life.
Medium Risk	Age of the device is between 100 and 125 percent of the manufacturers' recommended service life.
High Risk	Age of the device is greater than 125 percent of the manufacturers' recommended service life.

Figure 35: Performance Metrics Basic Definitions

Section 4 – Next Steps for NDOT TSMO Program Mainstreaming TSMO at a Statewide Level – The LCC Tool

Basic Definitions:

2- Assets' Operational Life Cycle

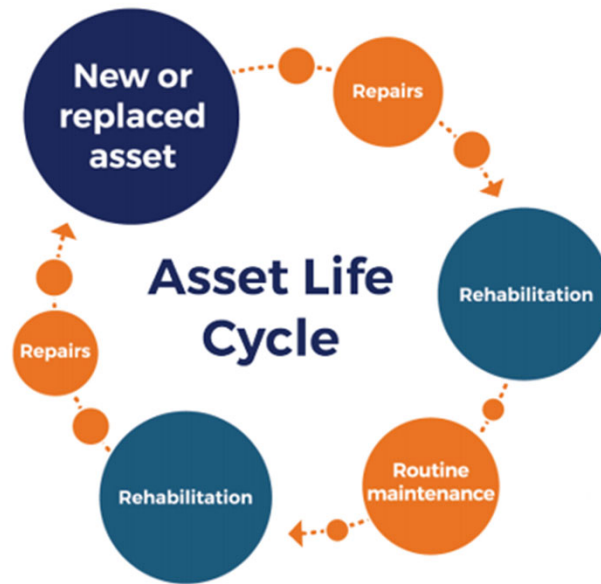


Figure 36: Assets Life Cycle

Section 4 – Next Steps for NDOT TSMO Program

Mainstreaming TSMO at a Statewide Level – The LCC Tool

Basic Definitions:

3- Life Cycle Analysis and Management

1. Inspection

- Routine maintenance of the device or typically performed annually or biannually based on type of device.

2. Minor Repairs

- Typically performed on-site and include activities such as adjusting loose cables, battery replacement, firmware upgrades.

3. Major Repairs

- Typically requires the device to be sent back to the maintenance shop or factory and involves the replacement of one or more key parts.

4. Replacement

- Complete removal and replacement of the device.

Section 4 – Next Steps for NDOT TSMO Program Mainstreaming TSMO at a Statewide Level – The LCC Tool



Determine initial devices' operational and health condition



Define general procedures and protocols



Identify appropriate activities



Determine maintenance and repair activities

Section 4 – Next Steps for NDOT TSMO Program Mainstreaming TSMO at a Statewide Level – The LCC Tool

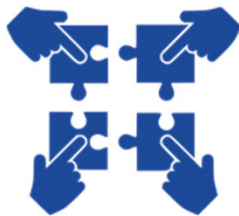
The LCC Analysis Models

- 1. Life-Cycle Cost Analysis (LCCA) Model:** Illustrates the life-cycle costs of operating and maintaining a brand-new network
- 2. 10-Year Investment Model:** Considers the current state of the network and provides estimates on the 10-year maintenance costs based on the maintenance strategy defined.

Section 4 – Next Steps for NDOT TSMO Program

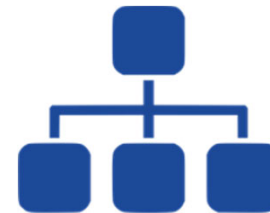
Mainstreaming TSMO at a Statewide Level – The LCC Tool

Outcomes, Learnings, and Benefits



Collaboration

- The process of formalizing the tool and integrating it into an interlocal agreement improved TSMO collaboration externally between the local partners.
- Partners' feedback on the measures and assumptions utilized by LCC tool helped better shape the upcoming update of TAMP, ensuring the definitions and standards are accurately reflecting the ITS asset management, operations, and maintenance activities.



Workforce Development

- NDOT held multiple trainings and workshops to educate the external partners' operation and maintenance team in TSMO, asset management, and performance measurement and monitoring.
- Through monitoring of operations and maintenance activities, external partners have a better understanding of staffing, workforce, and training needs for operational and maintenance needs.

Section 4 – Next Steps for NDOT TSMO Program

Mainstreaming TSMO at a Statewide Level – The LCC Tool

Outcomes, Learnings, and Benefits



Culture

- Understanding of the value of TSMO, partners have now enhanced their collaboration to operate and maintain ITS assets and stay informed regarding the assets' operational condition.
- Through multiple trainings and workshops, NDOT advanced the data-driven and performance-based culture.



Asset Management and Performance Measurement

- This tool's operational and maintenance data is helping partners attend to the maintenance and management needs in a timely manner, therefore improving the operation, life cycle, and deterioration cycle of the assets.

Section 5 – NDOT TSMO Program Challenges and Lessons Learned



Section 5 –Challenges and Lessons Learned

Example Challenge Area	Solution	Lessons Learned
TSMO Prioritization	Development of the Investment Prioritization Tool (IPT)	Development of a comprehensive tool that captures needs and prioritize of all stakeholders
IT-TSMO Coordination	Employing practices in collaboration, program delivery, staffing, and coordination	IT plays an integral part of scoping, planning, design, and delivery of TSMO strategies
Leadership Buy-In / TSMO Culture	Development of a TSMO Business Case for the Program, and a TSMO Business Case for NDOT Divisions	Demonstrating how other Divisions have or can contribute in TSMO implementation will help obtain support from leadership
TSMO Training and Outreach	Development of training modules and materials, establishment of a TSMO Steering Committee	Active engagement and involvement of stakeholders provides the agency with a great opportunity to train and educate team members, as well as highlighting the importance of their contribution in the decision-making process

Table 5: Example Challenge Areas of TSMO and Associated Solutions and Lessons Learned



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