
TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS



PROGRAM PLAN FOR PENNSYLVANIA

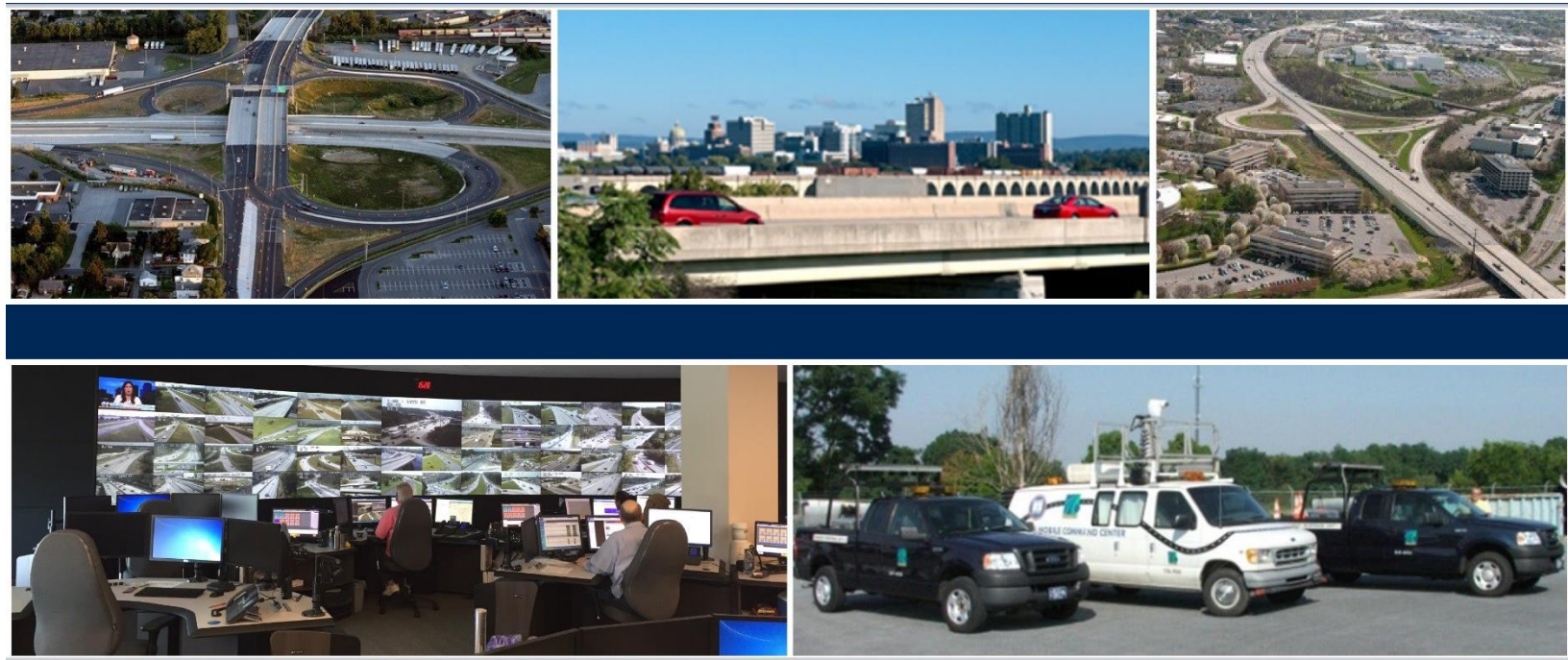


TABLE OF CONTENTS

Introduction	pg. 3
What is Transportation Systems Management and Operations (TSMO)?	pg. 3
Why TSMO?	pg. 3
The TSMO Business Case	pg. 3
Developing A TSMO Program Plan for Pennsylvania	pg. 3
TSMO Strategic Direction	pg. 4
TSMO Vision, Mission, and Goals	pg. 5
TSMO Program Plan Needs	pg. 6
TSMO Strategies	pg. 13
Business Processes	pg. 14
System and Technology	pg. 27
Performance Management	pg. 34
Organization and Staffing	pg. 40
Culture	pg. 46
Collaboration	pg. 51
Appendix	pg. 58

INTRODUCTION

What is Transportation Systems Management and Operations (TSMO)?

According to the Federal Highway Administration (FHWA), TSMO is “a set of integrated strategies to optimize the performance of operations on existing infrastructure through implementation of multimodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of a transportation system.” In simplest terms, TSMO is a way to increase reliability and mobility of our roadways by using a wide-range of strategies rather than adding capacity to manage congestion.

Why TSMO?

Nationally, delays from congestion caused and extra 6.9 billion hours of travel and the purchase of an extra 3.1 billion gallons of fuel in 2014, totaling \$160 billion on congestion costs. In Pennsylvania, motorists spend more time in congestion, spend more money on congestion, and burn more excess fuel than the national average in both rural and urban areas.

The TSMO Business Case

We cannot build our way out of congestion. Additionally, capacity-adding projects generally cost more and provide a lower return on investment compared to operations solutions. Traditional road capacity adding projects have generally shown benefit/cost ratios of 2:1 to 5:1, while TSMO strategies that target specific causes of congestion at a specific location are extremely cost effective with benefit cost ratios as high as 60:1.

Developing A TSMO Program Plan for Pennsylvania

Pennsylvania’s TSMO effort was initiated by the national movement to create a statewide TSMO program as well as PennDOT’s participation in the second Strategic Highway Research Program (SHRP2) Organizing for Reliability workshop. During this workshop, PennDOT and other key transportation management stakeholders around the state established a collaborative baseline for the state’s current level of operations and identified preliminary actions to improve operations utilizing the Capability Maturity Model (CMM), a process traditionally associated with the optimization of processes in computer software projects.

Pennsylvania generally identified anywhere between a Level 1 and Level 2 for the dimensions during the self- assessment. The initial CMM assessment is crucial to building a successful TSMO program in Pennsylvania. It establishes a baseline and allows PennDOT and their stakeholders to develop a series of strategies to improve transportation operations and address the challenges and special demands of congestion management. Using the initial assessment and subsequent reassessments will allow Pennsylvania to track the progress and success of the strategies that have been implemented to date.

The development of the TSMO program also included a series of workshops intended to collect feedback and issues from stakeholders that pertain to the development and advancement of the program in Pennsylvania. Stakeholders included PennDOT Central Office and Districts, FHWA, the Pennsylvania Turnpike Commission, Metropolitan Planning Organizations (MPOs), Rural Planning Organizations (RPOs), and Transportation Management Associations (TMAs). The stakeholder input was summarized and needs were developed to classify the issues that surfaced during the stakeholder workshops.

TSMO STRATEGIC DIRECTION HOW TO USE THIS DOCUMENT

The development of the TSMO Program in Pennsylvania will consist of three major elements: TSMO Strategic Framework, TSMO Program Plan (and associated Action Plan), and the TSMO Guidebook. The TSMO Strategic Framework is intended to engage stakeholders and build interest in creating a TSMO program in Pennsylvania by presenting the overarching business case along with the vision, mission and goals.

The TSMO Program Plan will be built from the TSMO Strategic Framework and will present the Capability Maturity Model-based approach to reach the vision.

Part I of the TSMO Guidebook will serve as guidance for planning partners to develop their regional operations plan and PennDOT’s congestion-related business areas to assist in developing business plans. The Guidebook will also help planning partners identify connections between their current operations planning documents and the TIP, which will help ensure proper planning for operations.



TSMO STRATEGIC FRAMEWORK

The Strategic Framework is designed to make the case for TSMO in Pennsylvania to improve mobility and reliability, safety, and funding dedicated to operations. This document is intended to be used by PennDOT, Planning Organizations, and Stakeholders, but should also be used as a public-facing tool to increase awareness on the benefits of TSMO. Each page of this document was designed to also be a standalone fact sheet to address the What?, Why?, and the Current State of TSMO in Pennsylvania.

TSMO PROGRAM PLAN

The Program Plan is based on needs, strategies, and actions that were created during stakeholder outreach and are specific to the development and advancement of the TSMO program in Pennsylvania. The TSMO Program Plan also includes an Action Plan to advance each CMM dimension by delegating responsibilities to the PennDOT Business Areas. The plan also identifies what dimension it will advance, dependencies with other strategies, and a listing of additional resources needed to accomplish the strategy/action. This document is intended to be used by PennDOT Central Office and Districts to help identify what actions are necessary from business area and PennDOT Unit to advance the CMM.

TSMO GUIDEBOOK

Part I: Planning, seeks to strengthen and provide a clear connection between planning processes such as the Congestion Management Process (CMP), LRTP, ROP, and the TIP. Both standalone TSMO projects as well as the implementation of TSMO solutions in other projects will benefit from a strong connection to the TIP, and, as a result, can be prioritized during project planning. The audience of this document includes the professionals responsible for transportation planning and operations within the state working for or on behalf of PennDOT, Metropolitan Planning Organizations (MPOs), Rural Planning Organizations (RPOs), or local municipalities. It is intended that these stakeholders use this guidance document throughout the development and implementation of their transportation operations plans and programs.

TSMO VISION, MISSION, AND GOALS

During the development of the TSMO Strategic Framework, the vision, mission, and goals were developed to guide the program and measure progress. The vision statement serves as the optimal and desired state of the program. The mission statement identifies the purpose of the program. The goals are the expected outputs and outcomes that demonstrate how the success of the program will be measured.

The success of TSMO in Pennsylvania will be measured by two sets of goals: outputs and outcomes. The outputs will be measured by how Pennsylvania moves up the Capability Maturity Model (CMM) in each of the dimensions. The effectiveness of TSMO will essentially be tracked by completing CMM self-evaluations on a regular basis. The outcomes will be delivering improved mobility and reliability of the transportation network from three main perspectives: recurring congestion, planned events, and unplanned events/incidents.

TSMO VISION

The vision statement serves as the optimal and desired state

PennDOT's TSMO vision is a less congested, more reliable network.

TSMO MISSION

The mission statement identifies the purpose of the program

The PennDOT TSMO mission is to move people and goods, from Point A to Point B, as efficiently, safely, and reliably as possible.

TSMO GOALS

The goals identify how the success of the program will be measured

Internal (Outputs)

- Move up the Capability Maturity Model (CMM) - Moving up the CMM in some or all of the six dimensions will serve as the internal means to measure the effectiveness of the TSMO Program. PennDOT will perform periodic self-assessments to determine the areas of the TSMO Program that need to be improved and make changes accordingly.

External (Outcomes)

- Mitigate recurring congestion - Focuses on congestion and delays resulting from bottlenecks and traffic signals.
- Maintain mobility during planned events - Focuses on congestion and delays resulting from work zones and special events.
- Minimize traffic impacts of unplanned incidents/events - Focuses on congestion and delays resulting from traffic incidents and inclement weather.

TSMO PROGRAM PLAN NEEDS

To fully incorporate the stakeholders' current roles in TSMO and overall levels of understanding into the Strategic Framework and Program Plan, the project team held two introductory workshops in the fall of 2016. The first workshop was with key PennDOT and planning partner staff and the second focused on PennDOT Central Office Business Area leaders. Both workshops were preceded by a survey to assess stakeholders' top priorities and projects, as well as their own CMM dimension self-assessment. Those surveyed showed regional differences in the CMM self-evaluation, but as a whole, PennDOT stakeholders did concur with the 2014 self-assessment. It can be concluded from this second evaluation that over the course of two years, little progress was made in institutionalizing operations in Pennsylvania.

In February and March of 2017, regional stakeholder workshops were held in each of PennDOT's four Regional Traffic Management Center (RTMC) regions to capture overarching TSMO issues. The goal of the workshops was to ensure that stakeholders, particularly PennDOT district and planning partner staff, had the opportunity to provide input for the program. Again, there were differences in the level of TSMO implementation throughout the state, but there were clear deficiencies in all CMM dimensions. The lack of consistency throughout PennDOT's organization reinforced the "Performed/Level 1" rating that was pervasive throughout the initial SHRP II workshop.

While there are notable TSMO Practices occurring statewide, the lack of consistency and potential for program improvement led to the identification of nine overarching TSMO Program Plan needs:

- Need A** – Consider Operations Throughout Project Life Cycle
- Need B** – Provide Adequate Funding and Guidance
- Need C** – Establish Performance Measures
- Need D** – Foster Knowledge and Provide Training
- Need E** – Improve Intra-Agency Coordination
- Need F** – Improve Interagency Coordination
- Need G** – Provide Appropriate Staffing and Organizational Structure
- Need H** – Provide Proper Documentation and Tools
- Need I** – Document Operations Policies and Procedures.

As the needs are discussed, references to the strategies identified to address the needs can be found at the end of each section and are categorized by the following capability maturity dimensions:

- BP** – Business Processes
 - SYS** – System & Technology
 - PM** – Performance Management
 - ORG** – Organization and Staffing
 - CUL** – Culture
 - COL** – Collaboration.
-

NEED A – CONSIDER OPERATIONS THROUGHOUT PROJECT LIFE CYCLE

Although transportation operations has been recognized as an important piece of the project development process, it frequently becomes an afterthought. Successful operation of a transportation network should start during the planning stages and continue through design, construction, maintenance, and operations. Because of this disconnect, many of the documents and processes used by the planning partners do not include an evaluation of potential operations strategies, or have not been updated within a reasonable time frame to be included in the project development process cycle.

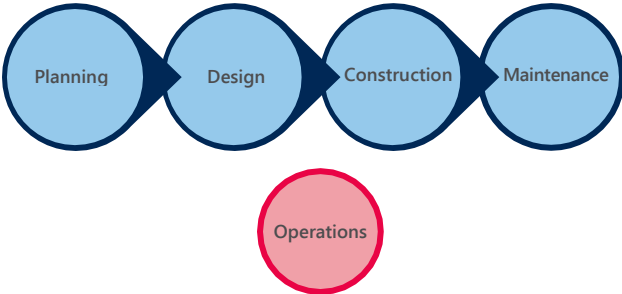
Most planning partners across the state have not updated their Regional Operations Plans (ROPs) since the mid-2000s with the exception of the Delaware Valley Regional Planning Commission (DVRPC) and Southwestern Pennsylvania Commission (SPC). This document plays an important role in the Long-Range Transportation Plan (LRTP) and Transportation Improvement Program (TIP), helping to plan and secure future funding for operations projects. Planning organizations indicated that they find the ROPs helpful and have used the guidance to plan and program projects. PennDOT Central Office led the initial ROP development in the mid-2000s; however, there was no clear direction regarding whose responsibility it was to update the documents after they were created and approved. Without a formalized process to update the ROPs, most operations projects fall short of being programmed in a region’s TIP and only become ad hoc additions to larger capital improvement projects.

Additionally, in the majority of the planning regions throughout the state, there are no clear connections between planning processes such as the CMP, LRTP, ROP, and the TIP. On many projects, operations is an afterthought which results in improper planning and funding. Standalone operations projects, as well as the implementation of operations solutions in other projects, lack a strong connection to the TIP and are typically not prioritized during project planning. This may be due to a lack of input from local stakeholders during project development because they are unfamiliar with operations solutions and their effectiveness.

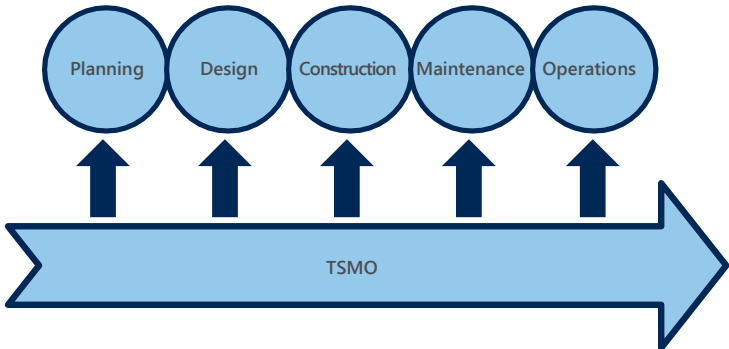
STRATEGIES

- BP01** – Update the Regional Operations Plans
- BP02** – Identify clearly defined ties between ROPs & other plans
- BP03** – Integrate TSMO into PennDOT Connects
- BP04** – Consider operations strategies in project development process
- CUL01** – Make operations strategies competitive in program development process

PROJECT LIFE CYCLE – REALITY



PROJECT LIFE CYCLE – IDEAL



NEED B – PROVIDE ADEQUATE FUNDING AND GUIDANCE

The Federal Highway Administration (FHWA) has suggested that transportation agencies invest 5% of their budgets into TSMO. Most regions in the Commonwealth do not regularly program funds for the implementation of operations solutions or projects. There is a general recognition that CMAQ as a funding source is somewhat aligned with providing operations solutions, but in many cases these funds are utilized to subsidize public transportation. Other general funding sources are primarily programmed to improve bridges and pavements, with these programs also struggling with budget challenges. Therefore, dedicated and consistent funding for operations solutions falls short of federal guidance.

There are TSMO-related programs, such as Green Light- Go, but the restrictions on the funding sometimes make it difficult to apply it to priority locations. Dedicating portions of this type of funding in a manner that allows flexibility at the regional level would be helpful.

Even when operations solutions have been deployed, proper budgeting has been largely unsuccessful because operations technologies are not adequately incorporated into an asset management system to account for initial capital costs, maintenance costs, and life cycle durations. These costs need to be identified in order to make the case for operations strategies and to budget for future deployment funding.

STRATEGIES

BP02 – Identify clearly defined ties between ROPs & other plans

BP05 – Identify steady source and appropriate level of funding

BP06 – Track ITS maintenance and operations costs

NEED C – ESTABLISH PERFORMANCE MEASURES

There are no standardized performance measures to capture the effectiveness of operations solutions. It is difficult to continue the development of a TSMO program without performance measures that showcase the successes of deployments and allow for data-driven decisions.

Performance measurement is currently mandated by FHWA as part of the MAP-21/FAST Act requirements. Agencies that do not meet self-established targets are subject to constraints on future funding. However, the mandated performance measures do not fully meet the robust requirements of a TSMO program. Satisfying the federal requirements and expanding to meet state and local needs will help the program to flourish.

Tying the performance measures to those in executive leadership will ensure TSMO's success in Pennsylvania. Currently, PennDOT District Executives are tracked against metrics that include structurally deficient bridges, pavement smoothness, safety, and winter. Therefore, executive decisions that allocate

limited resources are based on the Executive measures for operations.

Other traditional measures of success, such as volume- to-capacity ratios and levels of service, are designed to favor widening and capacity-adding projects and are not well suited for promoting alternative congestion management strategies. These performance measures are focused on reducing delay, but there are some cases where delay may be desirable to make the public right of way safer for pedestrians and bicyclists and support economic development by reducing travel speeds. A shift to mobility and reliability as metrics will further enhance economic vitality.

STRATEGIES

PM01 – Continue to develop performance measurement program

PM02 – Identify performance measures to meet Map-21 criteria

PM03 – Develop metrics for District Executive dashboard

NEED D – FOSTER KNOWLEDGE AND PROVIDE TRAINING

Most TSMO direction comes from the Federal level and is not as prevalent at the state level as traditional civil engineering applications. The first step that PennDOT can take to transfer this knowledge is the creation of an actionable plan that lays out the framework for a TSMO program. PennDOT can then bridge the gap between the traditional “boots on the ground” and the federal agencies by being the conduit of information. As it exists, the lack of TSMO background and training available at the state level will hinder the growth of the TSMO program in Pennsylvania.

The pool of graduating students within engineering lacks the exposure and knowledge of TSMO, requiring agencies to invest a significant amount of resources to develop the skill-sets needed. Pennsylvania TSMO stakeholders do not actively work with any colleges or universities to provide a TSMO-related curriculum or program. The traditional civil engineering curriculum does not support some of the skills and background required to plan and implement operations solutions. A cross-cutting curriculum incorporating systems engineering, electrical engineering, logistics, computer networking, and other technology-based skills is needed to support the diverse needs of a TSMO program.

However, the knowledge of TSMO and the benefits of its solutions need to go beyond the workforce deploying and maintaining it. PennDOT and stakeholders are traditionally inconsistent and deficient in their branding and promotion of TSMO to the traveling public. At times, project performance measures are not clearly aligned with public interest, which directly leads to a lack of recognition of the benefits. This is regularly displayed when road construction activities cause significant delays and backlogs at the expense of reducing project costs.

Those regularly involved in operations often have insights to potential solutions to the problems. These concepts are developed and recommended by mid-level management at the transportation agencies in Pennsylvania but are not consistently integrated into the strategic direction of the Department.

STRATEGIES

- ORG03** –Collaborate with colleges and universities to develop TSMO curriculum
- CUL02** – Integrate TSMO concepts at local level
- CUL03** – Implement TSMO with top-down and bottom-up approach
- CUL04** –Educate public on benefits of TSMO

NEED E – IMPROVE INTRA-AGENCY COORDINATION

Currently, there is no formal process in place to support coordination within PennDOT at the District or Central Office level regarding the implementation of operations solutions. The limited TSMO coordination that does exist is mostly ad hoc and champion-driven. Frequently one region may be doing something that it finds successful, but that is not shared with other regions so that the state as a whole can improve. Further, there are different driver experiences when crossing regional boundaries, so PennDOT is not operating as a cohesive unit. Strengthening the internal communication and coordination will benefit PennDOT employees and the customers driving on its roadways.

STRATEGIES

- COL02** – Identify opportunities for coordination within PennDOT

NEED F – IMPROVE INTERAGENCY COORDINATION

There are currently 23 MPOs and RPOs throughout the state, but outreach with them, along with Transportation Management Associations (TMAs) in the SPC and DVRPC regions, is inconsistent. In many areas of the state, planning partners may have difficulty in prioritizing operations solutions since their effectiveness in reducing congestion has not been well documented and communicated among stakeholders. Regular engagement between PennDOT and its planning partners can help in identifying operations projects and bolster the visibility of TSMO, allowing it to get a seat at the table when projects are planned and programmed.

These stakeholders often look to PennDOT for TSMO guidance, but there is no formal outreach available to engage all stakeholders similar to the PA Safety Symposium or PA Traffic Incident Management (TIM) Summit. This type of event fosters the education of stakeholders, encourages collaboration, and provides an opportunity to exchange successes and challenges. Large forums of stakeholders also give an arena for executives to voice their support for the program.

Some planning partners engage in regular coordination activities, specifically related to incident management. However, statewide planning partners are inconsistent with the level of outreach to the emergency responder community. All regions recognize the benefits of implementing regional TIM Team meetings and conducting TIM related activities similar to those hosted quarterly by DVRPC and SPC. The regions are interested in further promoting TIM teams, by corridor, to cover responder training, After Action Reviews (AAR), and planning for construction staging and detouring.

Additionally, PennDOT Central Office must support legislative changes that are required to operate the Commonwealth's transportation system as efficiently as possible, including strategies such as centralized control of traffic signals, quick clearance policies, and other incident management techniques.

STRATEGIES

COL01 –Foster development of regional TIM teams

COL03 –Identify opportunities for coordination with planning partners

COL04 –Develop and implement annual TSMO summit

NEED G – PROVIDE APPROPRIATE STAFFING AND ORGANIZATIONAL STRUCTURE

The current organizational structure within PennDOT Central Office and the Districts promotes design, construction, and maintenance. Operations functions within Central Office are located in two separate divisions and three sections under the Bureau of Maintenance and Operations, the Highway Safety and Traffic Operations Division, and the Maintenance Technical Leadership Division. The organizational structure within the Districts has grown and adapted to meet the needs within their own boundaries related to operations. However, operations does not have well defined boundaries like design, construction, and maintenance. Statewide guidance is therefore necessary to encourage consistency in the way operations is addressed from a staffing, capabilities, and resources standpoint.

One example of this is Publication 911 which is intended to educate PennDOT personnel, emergency responders, towing agencies, and municipal agencies on TIM practices.

At the District level, operations functions are generally several levels deep within the organization under the District Engineer, Assistant District Engineer, and District Traffic Engineer. Not all Districts have a Regional Traffic Management Center, and District Traffic Management Centers operate at various hours throughout the work week.

When attempting to fulfill TSMO-related job duties, the current job descriptions, at the Central Office and District level do not address the skill set necessary to support TSMO functions. The descriptions have been defined to meet the qualifications of a traditional civil engineering position. However, the personnel needed to support the TSMO program require different skill sets and background such as data analytics, systems engineering, and IT support.

STRATEGIES

- ORG01** – Clarify operations functions within BOMO, IT and the Districts
- ORG02** – Develop and implement TSMO training
- ORG04** – Establish statewide TIM Coordinator
- ORG05** – Standardize job descriptions for operations positions

NEED H – PROVIDE PROPER DOCUMENTATION AND TOOLS

There is a need to provide all planning partners with the proper tools necessary to evaluate and execute operations strategies. Although much of the necessary congestion and mobility data exists, it is not easily accessible by planning partners and other applicable agencies throughout the state. MPOs and RPOs feel they could benefit from having congestion, incident, and other data available to support their project decisions. However, there is no statewide platform to visually show congestion issues throughout the state.

Several planning partners claim that they find the ITS Architectures useful and would use them more frequently if they were updated regularly and proper training was provided to fully utilize them. DVRPC performs frequent updates to its ITS architecture while SPC recently completed a major update in 2016 with plans to keep the architecture current. The remaining architectures were produced concurrently with the ROPs between 2007 and 2008.

When ITS projects are designed, the systems engineering process is not being properly utilized during the design process in many engineering Districts in Pennsylvania outside the aforementioned DVRPC and SPC. There is a lack of strong support and accountability from Central Office to ensure these processes are followed and completed properly.

And since most ITS deployments are add-ons, procurement is typically achieved through roadway construction projects or capital improvement projects. This process is lengthy and may result in the deployment of dated products. Therefore, alternative procurement strategies to optimize project delivery for operations projects should be explored.

Technology and deployments change rapidly, and to champion TSMO in Pennsylvania, PennDOT must be a leader in the development of appropriate tools to manage the state’s infrastructure as well as the testing and deployment of new technologies including connected and autonomous vehicles and other smart city strategies.

STRATEGIES

- SYS01** – Develop tools to assist with operations
- SYS02** – Update regional ITS Architectures
- SYS03** – Develop Concept of Operations template
- SYS04** – Develop alternative procurement system(s)
- SYS05** – Develop new technologies test program

NEED I – DOCUMENT OPERATIONS POLICIES AND PROCEDURES

Operations policies and procedures within the Department are limited, scattered throughout many documents, and are inconsistent and/or vague. Because of this, accountability for those tasked with carrying out operations functions is sometimes lacking. Additionally, the linkages to planning and programming are especially weak as a result of this situation.

Given the unavoidable turnovers in workforce, the lack of policies and procedures also results in the inability to transfer institutional knowledge

effectively from employee to employee to ensure that consistent service is delivered to the consumer, the traveling public.

STRATEGIES

- BP07** – Identify and develop comprehensive operations policies and procedures

TSMO STRATEGIES

In the previous section, needs were identified by transportation stakeholders that limit the ability for integrating TSMO into the way we do business. In this section, strategies and actions are offered to address the needs and outline a road map for providing a higher level of emphasis for operations and to move PennDOT up the CMM.

The following sections summarize the strategies and actions for each CMM dimension, along with a reference to the need that each strategy satisfies. At the beginning of each section, a graphic depicts what strategies are necessary to move up the CMM scale for that particular dimension.

BUSINESS PROCESSES



- BP01** – Update the Regional Operations Plans
- BP02** – Identify clearly defined ties between ROPs & other plans
- BP03** – Integrate TSMO into PennDOT Connects
- BP04** – Consider operations strategies in project development process
- BP05** – Identify steady source and appropriate level of funding
- BP06** – Track ITS maintenance and operations costs
- BP07** – Identify and develop comprehensive operations policies and procedures

STRATEGY BP01 – UPDATE THE REGIONAL OPERATIONS PLANS

STRATEGY ADDRESSES NEED A – Consider Operations Throughout Project Life Cycle

DESCRIPTION

In order to integrate operations solutions into the planning process, updates to the Regional Operations Plans must be completed. Statewide, most of these plans have not been updated since 2007-2008 and may not reflect the current needs of the region. Currently, the majority of planning organizations (excluding DVRPC and SPC) are operating at a Level 1 for this Business Process dimension. This level equates to each jurisdiction operating according to their individual priorities and capabilities and not operating as a regional entity.

Consolidating ROP regions to align with the RTMC regions will streamline the regional planning process, encourage operations to occur at the regional level, and promote communication between the regional stakeholders. These stakeholders include the PennDOT RTMC, member Districts, planning agencies, and municipalities in each of the regions. Regular updates of the ROP will provide the planning agencies with region-specific operations project ideas and will encourage regions to take a more unified approach toward TSMO.



EXAMPLE TSMO PRACTICES

- Washington State DOT’s Statewide Intelligent Systems Plan provides the vision and goals for TSMO strategies. It describes the current state of deployment of crucial TSMO activities: plans and architecture, centers, field devices, communications, and data collection approaches. It then presents plans pursuant to four general strategies: integrated networks, improved safety, incident clearance, and Active Traffic Management (ATM). For each of these areas the plan describes corresponding opportunities, benefits, challenges, actions, research, and policy. The plan concludes with a “long view” regarding funding and policy implications.
- SPC mainstreamed the ROP into its regional LRTP processes and now updates the ROP every time the LRTP is updated, most recently in 2015. SPC, its member planning departments, PennDOT’s Engineering Districts, PennDOT Central Office, ten regional transit operators, three regional transportation management associations, and other regional stakeholders are working to implement initiatives from priority areas in the 2015 ROP.
- DVRPC considers their operations plan to be a major contributing factor to getting operations projects planned throughout the region. This provides them with the incentive to update this document on a regular basis, and it also feeds their Congestion Management Process.

ACTIONS

BP01.01	Deploy plan to consolidate ROP regions to mimic RTMC operations regions.
BP01.02	Update the Regional Operation Plans every two years.

STRATEGY BP02 – IDENTIFY CLEARLY DEFINED TIES BETWEEN ROPS & OTHER PLANS

STRATEGY ADDRESSES NEED A – *Consider Operations Throughout Project Life Cycle*

DESCRIPTION

To facilitate the program planning and funding for operations solutions, transparent and enforceable links between strategic plans addressing regional congestion and operations and the short and long-term funding plans need to be established. Currently operations planning documents, such as CMPs, ROPs, and ITS Master Plans exist but are not explicitly integrated with the LRTP, UPWP, or similar region specific documents that feed the TIP. This level of ad hoc planning equates to a statewide CMM Business Process Level 1.5.

Mandating ROP updates and requiring that the TIP and LRTP/UPWP processes include ROP strategic direction will help build a stronger relationship between operations planning and the TIP. FHWA defines the LRTP and similar documents as a Performance-Based Planning and Programming (PBPP) approach. Since the ROPs will serve as the mechanism that feeds the LRTP or similar planning documents and the TIP from an operations standpoint, they will need to include measures that evaluate the effectiveness of these strategies, ensuring operations projects will receive the same priority as bridge and pavement asset management and other safety projects. Other regional planning documents, such as CMPs, should also incorporate performance measures and design, build, operations, and maintenance costs for operations solutions. Tying the CMP's congested corridors to the ROP projects and onto the TIP allows for priority corridors, intersections, and multimodal hubs to be funded, improved, and evaluated.

EXAMPLE TSMO PRACTICES

DVRPC began producing their Transportation Operations Master Plan that includes a 26-year financial plan that is responsible for the allocation of federal money in transportation operations.

- The document includes a financial plan that outlines the initial cost, operational cost, and maintenance cost.
- The financial plan was developed in close coordination with DVRPC's LRTP called Connections. The financial analysis directly feeds into the Connections document and is broken down into three time periods.
- DVRPC's Connections document outlines various goals that essentially steer the funding throughout the region. The plan includes a goal of improving transportation operations and makes the case for providing proper planning and funding for transportation operations.

STRATEGY BP02 – IDENTIFY CLEARLY DEFINED TIES BETWEEN ROPS & OTHER PLANS (CONTINUED)

STRATEGY ADDRESSES NEED A – *Consider Operations Throughout Project Life Cycle*

ACTIONS

BP02.01	Produce a financial analysis that outlines the installation operational, recurring maintenance, and lifecycle/replacement costs, to be fed into the Long-Range Transportation Plan.
BP02.02	Clearly identify operations-related goals throughout the region so they can be incorporated into the LRTP or other region-specific documents and eventually can be accounted for during the TIP process and in the ROP update.
BP02.03	Include requirements to evaluate operational strategies in the following planning and programming documents: Financial Guidance, Procedural Guidance, UPWP, Investment Plan, and Interstate TIP.
BP02.04	Finalize and publish Planning for Operations document.

STRATEGY BP03 – INTEGRATE TSMO INTO PENNDOT CONNECTS

STRATEGY ADDRESSES NEED A – Consider Operations Throughout Project Life Cycle

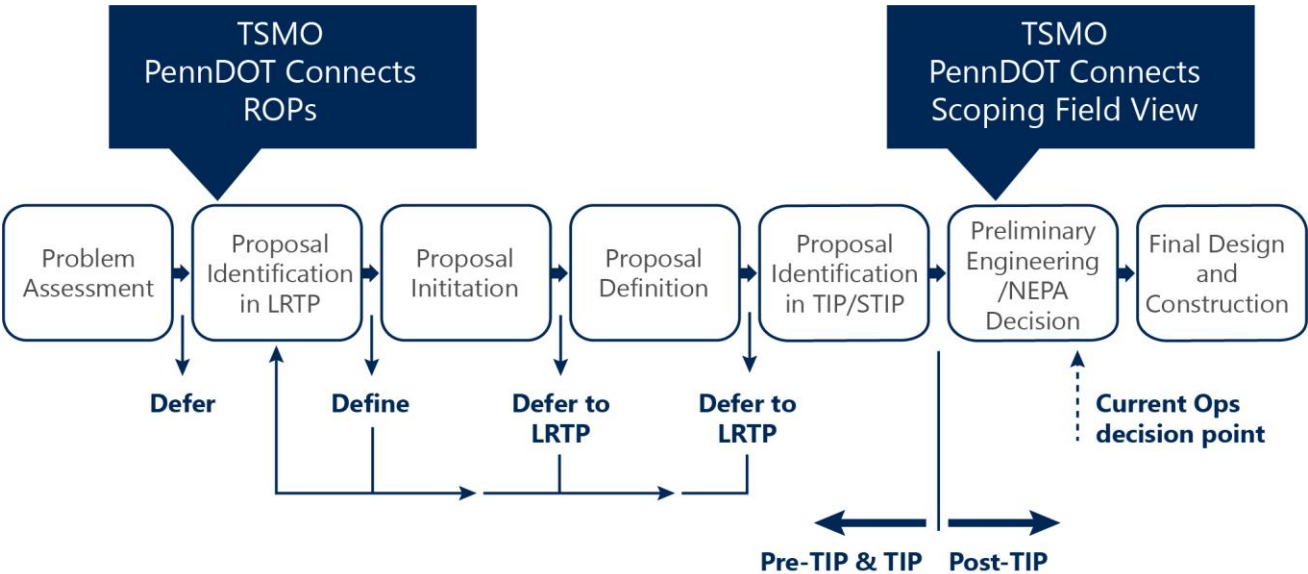
DESCRIPTION

The PennDOT Connects initiative will foster a new level of coordination between local stakeholders (municipalities, advocacy groups, etc.) and their planning organizations. These collaborative opportunities will occur between planners and engineers during the Pre-TIP and Post-TIP portion of the planning process. By providing these opportunities, PennDOT is hoping to foster the expanded MPO/RPO leadership role throughout the planning process and create a shared responsibility/ ownership among all stakeholders. Many planning regions throughout the state are currently operating independently and fragmented. Planning organizations and their local stakeholders need to utilize the PennDOT Connects program to address issues and plan for solutions as a region.



PennDOT Connects and the Pennsylvania TSMO Program Plan were developed on the same time-frame. This presented the opportunity to incorporate some of the TSMO objectives in PennDOT Connects. The PennDOT Connects project initiation form was developed with a TSMO and ITS section with several enhancements to be considered during project planning and requires the person completing the form to choose from a list of reasons why operations solutions were not considered.

TRANSPORTATION PROGRAM DEVELOPMENT AND PROJECT DELIVERY PROCESS



STRATEGY BP03 – INTEGRATE TSMO INTO PENNDOT CONNECTS (CONTINUED)

STRATEGY ADDRESSES NEED A – *Consider Operations Throughout Project Life Cycle*

EXAMPLE TSMO PRACTICES

- Colorado DOT: TSMO staff coordinate extensively with external stakeholders, such as Colorado State Patrol, cities, counties, Metropolitan Planning Organizations, and local law enforcement, to promote and foster systematic statewide operations and a new paradigm that emphasizes and places a priority on “Thinking Operations First.”
- Iowa DOT: A primary goal of comprehensive TSMO program planning is to integrate TSMO into the core mission and culture of the Department, as well as TSMO stakeholders. TSMO program planning is an ongoing, iterative process with other departmental plans, initiatives, and stakeholders. Program planning addresses not only internal, but also external coordination and collaboration to deliver a cohesive program.
- Caltrans: Their institutional integration approach involves coordination and collaboration between various agencies and jurisdictions that transcends institutional boundaries.

ACTIONS

BP03.01	Utilize PennDOT Connects to identify congestion-related needs and suggested operations solutions.
BP03.02	Provide educational outreach to stakeholders on the effectiveness of operations solutions using PennDOT Connects.
BP03.03	Create a TSMO checklist to follow during project development (similar to Ped/Bike and roundabout).

STRATEGY BP04 – CONSIDER OPERATIONS STRATEGIES IN PROJECT DEVELOPMENT PROCESS

STRATEGY ADDRESSES NEED A – *Consider Operations Throughout Project Life Cycle*

DESCRIPTION

Many times, operations solutions may not be considered until well into the design process when capacity adding improvements have already been programmed and designed (including right-of-way acquisition or utility relocations). These costs potentially could have been lessened by implementing an operations solution.

Involving staff with knowledge of operations solutions throughout the project development process will result in more efficient allocation of resources and funding as well as projects that better meet the need of the region.

EXAMPLE TSMO PRACTICES

- PennDOT District 9-0 uses field views to ensure that single-projects are meeting multiple needs. They include different business units early on because success in receiving funding may depend on the individuals involved.

ACTIONS

BP04.01	Include District-level TSMO representative in all facets of project development process to ensure that operations solutions are considered.
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STRATEGY BP05 – IDENTIFY STEADY SOURCE AND APPROPRIATE LEVEL OF FUNDING

STRATEGY ADDRESSES NEED B – *Provide Adequate Funding and Guidance*

DESCRIPTION

Operations improvements have been funded through a variety of sources: Congestion Mitigation Air Quality (CMAQ), Automated Red Light Enforcement funding (ARLE), Green Light-Go (GLG), Congested Corridor Improvement Plan (CCIP), and Traffic Signal Enhancement Initiative (TSEI), as well as being incorporated into typical capital projects. Planning partners see these sources of funding as a key piece of the TSMO solution, particularly for small, local projects. Because not every operations solution will be integrated into a capital project, appropriate levels of funding need to be available for planning partners to use.

In addition, planning partners, especially municipalities, may be aware of the funding sources available to them but are not familiar with the application processes, deadlines, and requirements. A multi-faceted outreach effort that provides up-to-date information and guidance would be helpful in allowing them to take full advantage of these opportunities.

EXAMPLE TSMO PRACTICES

Portland, Oregon - Since 2009, the Portland region has set aside funding from Metro's Regional Flexible Fund program to support implementation of TSMO. Metro is currently in its fourth sub-allocation process for TSMO, and it is still strongly supported by Metro members. Metro promotes this program by documenting project benefits and demonstrating program successes. Metro's Metropolitan Transportation Improvement Program (MTIP) includes a line item for the TSMO Program which "coordinates both the planning and implementation of the regional system management and operations strategies to enhance multi-modal mobility for people and goods." This program is funded by a combination of Federal STP and local dollars in the annual amount of \$1,671,682 for 2014 and 2015, respectively.¹

¹ <https://ops.fhwa.dot.gov/publications/fhwahop13050/s11.htm>
<https://www.oregon.gov/ODOT/TD/AT/Pages/Project-Funding.aspx>

STRATEGY BP05 – IDENTIFY STEADY SOURCE AND APPROPRIATE LEVEL OF FUNDING (CONTINUED)

STRATEGY ADDRESSES NEED B – Provide Adequate Funding and Guidance

MPO	TSMO Programs/Projects with Funding Set-Aside	Set-Aside Amount
DRCOG - Denver Regional Council of Governments	ITS Travel Demand Management (TDM) Traffic Signal System Improvements Program (TSSIP)	\$4.1M (2012-2017) \$7M (2012-2017) \$14.8M (2012-2017)
GTC - Genesee Transportation Council (New York)	Highway Emergency Local Patrol Regional Traffic Operations Center	\$2.61M (2014-2017) \$5.67M (2014-2017)
MAG - Maricopa Association of Governments (Arizona)	ITS projects	\$105M (2011-2015)
MetroPlan Orlando	Non-capacity projects Road Ranger Program	\$4M/year \$500k/year
NCTCOG - North Central Texas Council of Governments	Regional ITS Funding Pool	\$4M (2013-2016)
PPACG - Pikes Peak Area Council of Governments	TSMO Maintenance and Operations	35% of annual sales tax revenue
Portland Metro	Maintenance and Operations	\$1.6M/year
SANDAG - San Diego Association of Governments	Congestion reduction, including operations	70% of sales tax revenue

ACTIONS

BP05.01	Develop a long-term funding program, with a steady stream of funding, for operations projects.
BP05.02	Coordinate PennDOT outreach to municipalities on a regular basis, or set up a mechanism where District or MPO/RPO staff can assist with outreach.
BP05.03	Develop a highly interactive web tool to allow for easy understanding of the program, the cost/benefit of operations solutions to encourage participation, and simplified application process.
BP05.04	Finalize the Appropriation 582 Program 143 Funding Guidance Document.

STRATEGY BP06 – TRACK ITS MAINTENANCE AND OPERATIONS COSTS

STRATEGY ADDRESSES NEED B – Provide Adequate Funding and Guidance

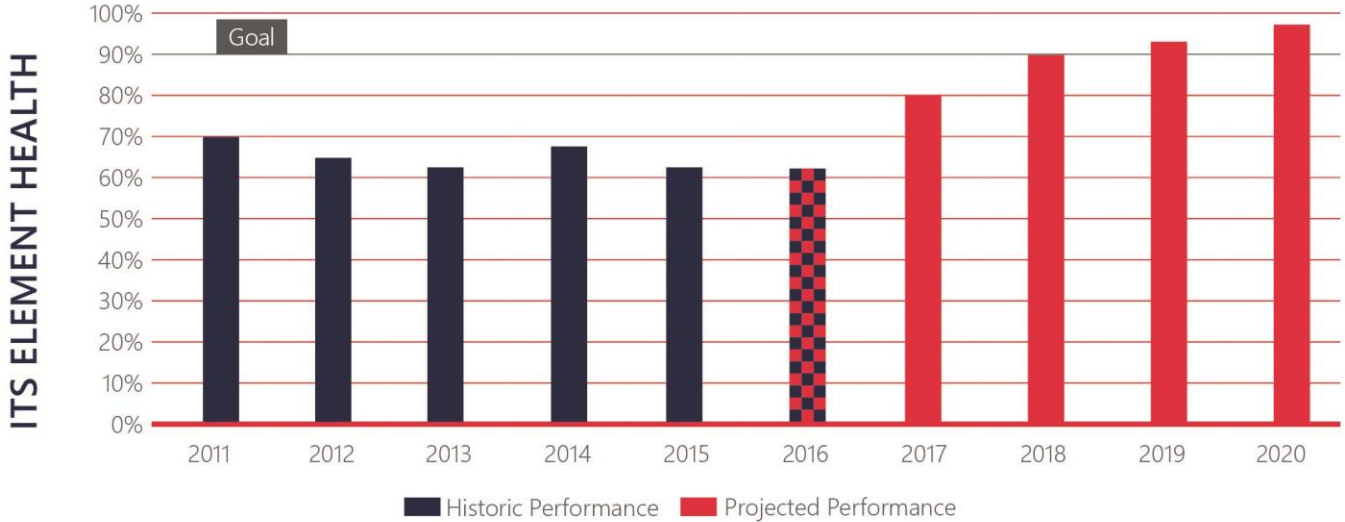
DESCRIPTION

Asset management is key for any system and the ITS equipment deployed by PennDOT to date has not been installed with a long-term life-cycle maintenance or replacement plan. PennDOT Central Office intends to incorporate ITS asset management into the statewide Traffic Signal Asset Management Software (TSAMS). However, Central Office does not have accurate historical design, build, maintenance, and operations cost data from the Districts where ITS has been deployed for more than 20 years. This data needs to be compiled and developed into a useful tool for planning and programming.

EXAMPLE TSMO PRACTICES

- Maricopa County expressed that for years the region has been focused on implementing and deploying new ITS technologies. Now the region is at a point where they have to begin operating and maintaining their systems with maximum efficiency. This has led agencies to become more involved in creating regional and cross jurisdictional operational plans early on in the project lifecycle.²
- Florida DOT District 6 creates a monthly ITS Operations Summary Report that includes their DMS message types, ITS device maintenance, and TMC operations statistics. The reports show the systems availability for their TMC systems, detectors, CCTV, DMS, and traveler information systems.
- Caltrans incorporates their ITS assets in their annual Asset Management Performance Report. They track the performance or health of their ITS assets and show projected performance of ITS element health for the next 5 years. A threshold is set to gauge the performance of their ITS assets and provide explanations and solutions to resolve the ITS health issues.

CALTRANS 10 YEAR ITS ELEMENT HEALTH PERFORMANCE TREND



² https://ntl.bts.gov/lib/47000/47600/47681/FHWA-JPO-13-067_Final_Pkg_508.pdf

STRATEGY BP06 – TRACK ITS MAINTENANCE AND OPERATIONS COSTS (CONTINUED)

STRATEGY ADDRESSES NEED B – *Provide Adequate Funding and Guidance*

ACTIONS

BP06.01	Create an ITS Device Statewide Asset Management Program or incorporate into TSAMS.
BP06.02	Begin tracking the following costs exclusive to ITS: <ul style="list-style-type: none">• Design/Construction Cost• Operations/Maintenance Cost
BP06.03	Make historical design/construction and maintenance/operations cost information available to the regional planners and stakeholders so it can be used to leverage more funding for operations-related projects.
BP06.04	Develop plan to properly budget for maintenance and operations costs of ITS devices (life-cycle analysis).

STRATEGY BP07 – IDENTIFY AND DEVELOP COMPREHENSIVE OPERATIONS POLICIES AND PROCEDURES

STRATEGY ADDRESSES NEED I – Document Operations Policies and Procedures

DESCRIPTION

In order for job functions and processes to be carried out effectively in any organization, prescriptive policies and procedures must be documented and followed. They should provide a clear understanding of the roles and responsibilities of the personnel tasked with carrying out operations functions within the Commonwealth.

Each operational Business Area within the Department (traffic signals, incident management, work zones, etc.) has conducted a gap analysis to determine what policies and procedures are missing or need strengthened/modified. Once the development of the new or revised documents is undertaken, consideration must be given to how they affect or are influenced by the needs of the planning partners.

EXAMPLE TSMO PRACTICES

- The I-95 Corridor Coalition has identified the importance of procedures and operating guidelines relative to Traffic Incident Management. They cite the best practices of a number of states that have adopted some form of operating procedures including Connecticut, Florida, Maine/New Hampshire, Massachusetts, North Carolina, and Wisconsin.

ACTIONS

BP07.01	Develop Fiber/Communication Deployment Policies and Procedures <ul style="list-style-type: none"> • Consider deployment of fiber in various locations • Opportunities for deployment of fiber to state and partner facilities • Identify need to deploy fiber for CV/AV testing facilities • Fiber versus wireless communication considerations • Fiber connection standards/specifications
BP07.02	Develop Connected/Autonomous Vehicle (CV/AV) Policies and Procedures <ul style="list-style-type: none"> • Review and approval of all CV/AV deployments • CV/AV Strategic Plan • Requirements and guidelines for installation of CV/AV infrastructure
BP07.03	Develop Comprehensive Work Zone Policies and Procedures <ul style="list-style-type: none"> • Address requirements of the FHWA Independent Oversight Policy (IOP) regarding work zones • Revise Publication 46 (Traffic Engineering Manual) and Design Manual 2 to analyze work zone impacts earlier in the project development process • Work zone speed limit policies • Type of road and time of day lane closure restriction policies
BP07.04	Develop Comprehensive Incident Management Policies and Procedures <ul style="list-style-type: none"> • Establish After Action Review (AAR) Program based on incident duration • Consideration for incentive towing programs • County maintenance incident management policies

STRATEGY BP07 – IDENTIFY AND DEVELOP COMPREHENSIVE OPERATIONS POLICIES AND PROCEDURES (CONTINUED)

STRATEGY ADDRESSES NEED I – *Document Operations Policies and Procedures*

ACTIONS

BP07.05	Develop Comprehensive Traffic Management Center (TMC) Policies and Procedures <ul style="list-style-type: none"> • Quality Assurance Program for RTMCs • TSMO Guidebook – Part V: Operations • Update regional Traffic Operations Plans (TOP) to reflect Part V: Operations • Update DMS guidelines to include work zones and better-defined travel times • Update the video sharing policy to include criteria for recording • Highway Advisory Radio (HAR) Repurposing Policy • Update 511PA Operations Policy
BP07.06	Develop IT/ITS Policies and Procedures <ul style="list-style-type: none"> • Develop policies for IT oversight and telecommunications associated with ITS and traffic signal equipment deployments
BP07.07	Develop Traffic Signal Policies and Procedures <ul style="list-style-type: none"> • Establish policy for minimum functionality of traffic signals on critical corridors, including detour timing plans • Establish criteria for connecting key signals to the Commonwealth network and the ATMS signal command and control module
BP07.08	Develop TSMO Guidebook and its parts, each focused on the respective parts of TSMO project delivery, from planning through operations/maintenance

SYSTEMS AND TECHNOLOGY



STRATEGY SYS01 – DEVELOP TOOLS TO ASSIST WITH OPERATIONS

STRATEGY ADDRESSES NEED H – *Provide Proper Documentation and Tools*

DESCRIPTION

For PennDOT and the planning organizations to recommend operations projects as a potential solution, a system is needed to give officials the ability to identify congestion problem areas. Data is available to PennDOT through their agreements with companies like INRIX and Waze; however, it is not in a format that can be easily used by planning partners and other interested agencies throughout the state. MPOs/RPOs feel they could benefit from having the data available to support their project decisions.

Creating a congestion mapping system will help PennDOT and their external stakeholders make performance-driven project decisions to address the needs of specific congestion issues such as bottlenecks, inadequate signal timing, inclement weather, and many other issues. This system will also allow PennDOT to re-evaluate the effectiveness of operations-related recommendations that were made while updating planning documents such as the ROP, CMP, LRTP, and during the TIP development process. Using this data, PennDOT can pinpoint the effectiveness of those solutions in a format that can be easily used and can determine if they should be recommended in the future.

Additionally, municipal ownership of traffic signals inhibits the opportunity to identify issues related to their operation on a corridor or regional basis. A stronger Central Office role will provide the ability to assess operations more effectively and implement meaningful improvements.

EXAMPLE TSMO PRACTICES

- VDOT developed a robust dashboard website that shows the current state of Virginia’s transportation systems. The dashboard shows measurements pertaining to the safety, performance, and financial investment of the state’s infrastructure. The performance page shows congestion, travel speed, travel time, incident duration, and hours of delay for various parts of the state during user-specified dates/times.
- Oregon DOT’s Portland Oregon Regional Transportation Archive Listing (PORTAL) was created in 2004 to archive several data sources in the Portland area. PORTAL includes archived data from freeway detectors, VMS messages, weigh-in-motion data, arterial detectors, traffic signal data, bike/pedestrian counts, air quality data, and historical weather data.³
- CDOT has developed a public facing website that shows a long-range congestion goal (average delay in minutes per traveler) and whether the congested corridors in Colorado met that goal on a yearly basis. The website also shows a map of the corridors that are considered congested and what actions CDOT has been executing to resolve the congestion issues.⁴

³ https://www.oregon.gov/ODOT/TD/Pages/Data_Portal.aspx

⁴ <http://dtdapps.coloradodot.info/otis/YCD/Mobility>

STRATEGY SYS01 – DEVELOP TOOLS TO ASSIST WITH OPERATIONS (CONTINUED)

STRATEGY ADDRESSES NEED H – *Provide Proper Documentation and Tools*

ACTIONS

SYS01.01	Integrate congestion maps showing areas for potential operations projects into PennDOT’s MPMS IQ Portal.
SYS01.02	Work with MPOs/RPOs to recommend projects that include operations solutions geared toward mitigating specific congestion issues.
SYS01.03	Evaluate the effectiveness of these recommendations by tracking the before and after performance of specific corridors.
SYS01.04	Establish statewide command and control for traffic signals.
SYS01.05	Continue Green Light-Go efforts of operations and maintenance of traffic signals along critical corridors.
SYS01.06	Support the development of standardized interoperable communications platform (radio, software, etc.) to be used by all responders on PennDOT roads (First Net).
SYS01.07	Develop lane reservation system for work zones.

STRATEGY SYS02 – UPDATE REGIONAL ITS ARCHITECTURES

STRATEGY ADDRESSES NEED H – Provide Proper Documentation and Tools

DESCRIPTION

In order to integrate operations solutions into the planning process, an update to the Regional ITS Architectures must be completed. Statewide, most of these plans have not been updated since 2007-2008 and do not reflect the current needs of the region.

Realigning the original ITS Architecture regions to match RTMC regions will streamline the regional planning process and promote communication between regional stakeholders. These stakeholders include the PennDOT RTMC, member Districts, planning agencies, and municipalities in each of the regions. Regular updates of each region’s architecture will provide the planning agencies with region-specific information pertaining to the existing and planned functions, entities (technology), and data flows. Updating the architecture on a regular basis will encourage the Central and Eastern Regions to take a more unified approach toward TSMO. Updating the architectures will also help prepare the state of Pennsylvania to be on the forefront of emerging technologies such as CV/AV by providing an accurate account of the functions and agreements that are in place between stakeholders.

EXAMPLE TSMO PRACTICES

- SPC updated their Architecture in 2016 and will be making regular changes as any significant projects are rolled out in the area.
- DVRPC maintains their architecture in house and updates it when regionally significant projects mandate a change.
- Utah DOT has a strong ITS architecture with robust interoperability among nearly all jurisdictions (e.g., camera sharing) based on a legacy of strong architecture planning. ConOps existed and were applied to new technology design (e.g., variable speed limit deployments), and procurement processes were consistent statewide.
- The MD SHA CHART system is fully integrated and interoperable statewide and includes local partners with agreements and up-to-date architectures in place. Systems architectures are in place and used regularly, including in the budgeting process. CHART has a systems integration manager on staff with an established relationship with the Division of Information Technology (DoIT), which can be beneficial when DoIT places constraints on procurements. The system has advanced data management and warehousing capabilities (with the Regional Integrated Transportation Information System (RITIS)), which facilitates intrastate coordination.

ACTIONS

SYS02.01	Deploy plan to consolidate ITS Architecture regions to mimic RTMC Operations regions.
SYS02.02	Update the ITS Architectures to ensure they stay current based on each region’s needs.
SYS02.03	Develop ITS Architecture change forms to be submitted when a project will change an aspect of the Architecture.

STRATEGY SYS03 – DEVELOP CONCEPT OF OPERATIONS TEMPLATE

STRATEGY ADDRESSES NEED H – Provide Proper Documentation and Tools

DESCRIPTION

A Concept of Operations (ConOps) is a key part of the FHWA-mandated Systems Engineering Process. The ConOps describes how a system will be used and identifies the use from the standpoints of various stakeholders throughout a region. Although currently a ConOps is developed for every project that utilizes Federal funding, there is inconsistency in how they are prepared and how they relate to operations on a statewide basis.

Additionally, the absence of a statewide ConOps results in inconsistencies in how each of the Districts and RTMCs operates and approaches similar issues. A statewide ConOps would clearly define roles and responsibilities and PennDOT’s role in operations.

EXAMPLE TSMO PRACTICES

- FHWA California Division created a Concept of Operations template that breaks down the purpose of the document, how to tailor the document to a specific project, a checklist to ensure the critical information is covered, and a sample table of contents with a description of each section’s requirements.⁵
- In 2003, FDOT developed several System Engineering template documents that will be used by ITS engineers during design.⁶
- ODOT effectively applies a long-standing systems engineering process, and projects generally have ConOps. Architectures are coordinated well with regional strategic plans, having been originally developed as components of the plans. The TSM&O plan was developed using the statewide architecture, which promotes implementation standardization. Interoperability of systems is a goal and priority at ODOT and other agencies in Oregon.



ACTIONS

SYS03.01	Create a statewide ConOps template.
SYS03.02	Develop a statewide Concept of Operations.

⁵ https://www.fhwa.dot.gov/cadiv/segb/views/document/sections/section8/8_4_5.cfm
⁶ http://www.fdot.gov/traffic/its/projects_deploy/sempr.shtm

STRATEGY SYS04 – DEVELOP ALTERNATIVE PROCUREMENT SYSTEM(S)

STRATEGY ADDRESSES NEED H – *Provide Proper Documentations and Tools*

DESCRIPTION

PennDOT, like many other State DOTs, generally utilizes a traditional Design-Bid-Build project delivery method. Some project exceptions include the alternative Design-Build system and the recent Public Private Partnership (P3) that was enacted as part of Act 88 in 2012. This act allows PennDOT and other transportation authorities to enter into agreement with a private sector entity to participate in the delivery, maintenance, and financing of transportation-related projects. As part of the Rapid Bridge Replacement Project, there have been at least 48 bridges replaced and opened to traffic since the program’s inception. Although PennDOT has explored new procurement processes, the majority of their projects are still delivered using the traditional Design-Bid-Build system.

This strategy will help PennDOT advance the Systems and Technology dimensions of the CMM by utilizing more applicable procurement systems that are catered to the deployment of operations projects. PennDOT must first evaluate the possibility of using difference types of procurement systems in use by other state DOTs around the country. Once these best practices are identified, PennDOT can choose the new types of procurement systems to test as well as identify any necessary legislative changes to support the use.

EXAMPLE TSMO PRACTICES

- PennDOT’s Rapid Bridge Replacement Project – PennDOT explored the P3 project delivery system to help expedite the replacement of 558 structurally deficient bridges throughout the state. This system allows PennDOT to retain ownership of the bridges while the private entity is responsible for project design, construction, and financing.
- Caltrans Alternative Procurement Guide – Caltrans developed an alternative procurement guide in 2008 that explored the possibility of using alternative project delivery systems. Caltrans has traditionally used the Design-Bid-Build system, but, using this guide, they evaluated systems such as Design-Sequencing, Design-Build, and Construction Manager At-Risk.
- MDOT followed a multi-step process to select the contractor for their TMC project. The first stage involved a prequalification step. Contractors who are deemed acceptable at the prequalification step were issued a Request for Construction Bid Proposal (RCBP). Bidders were then asked to submit a technical proposal and a separate price proposal. Technical proposals were scored based on key factors. The sealed cost proposals were then opened for all bidders receiving a score of 60 or above (on a scale of 0 to 100) on the technical proposals. A composite score was then calculated for each bid by dividing the total proposed cost by the technical proposal score. The proposal with the lowest composite score was then selected and the contract was awarded as a fixed-price contract. This procurement technique was designed to provide the agency with the best value for their investment.

ACTIONS

SYS04.01	Explore new procurement strategies to support more effective operations project delivery.
SYS04.02	Evaluate the legislative and other changes necessary to implement the procurement strategy(ies).
SYS04.03	Utilize procurement strategy(ies) on new operations projects and evaluate effectiveness and lessons learned.

STRATEGY SYS05 – DEVELOP NEW TECHNOLOGIES TEST PROGRAM

STRATEGY ADDRESSES NEED H – *Provide Proper Documentation and Tools*

DESCRIPTION

PennDOT does not currently have any formal agreements in place to test new operations technologies. These agreements are crucial to a state DOT’s ability to implement new technologies quickly and effectively. The ability to test these technologies in the proper environment before approving their use on Pennsylvania’s transportation system will better ensure the technology’s effectiveness and safety for the roadway users.

FHWA has recently approved two locations in Pennsylvania to act as proving grounds for autonomous vehicle technology: The City of Pittsburgh and Thomas D. Larson Pennsylvania Transportation Institute. Since these sites have already been approved as proving grounds by the FHWA, an additional agreement could be developed to test other operations technologies at these locations. Testing these new technologies in a safe and controlled environment that is capable of handling various types of vehicles will help promote faster implementation. It is also important that PennDOT develops a standardized template for testing procedures for new technologies.

EXAMPLE TSMO PRACTICES

- FDOT has developed a system test plan template and test procedures template. These documents are meant to be used as a starting point for testing plans for newer technologies and are meant to promote uniformity between future testing documentation.

ACTIONS

SYS05.01	Continue effort to establish Technology Testing Corridor along I-99.
SYS05.02	Develop a standardized testing procedure template that can be customized for new technologies.
SYS05.03	Explore use of city of Pittsburgh and Pennsylvania Transportation Institute testing facilities.

PERFORMANCE MANAGEMENT



STRATEGY PM01 – CONTINUE TO DEVELOP PERFORMANCE MEASUREMENT PROGRAM

STRATEGY ADDRESSES NEED C – *Establish Performance Measures*

DESCRIPTION

In order to use data-based decision making to implement operational strategies, a Performance Measurement program must be developed and implemented. Without performance measurement, decisions are made anecdotally based on perception and complaints. Perception can be skewed based on when individuals use the transportation system, such as commuters who think a roadway is too congested, but they travel during the same peak each day. Ultimately, measuring performance will help determine if existing and historical policies and procedures produce the desired outcomes for the expenditure of public funds.

The limited performance measurement which currently occurs is typically done on a project-by-project basis, such as to quantify the level of benefit from a particular project. For traffic operations, level of service is typically calculated within a project study area, but not at a system-wide level. The cost of data collection has been a barrier to expanded performance measurement. In some cases, “big data” sources can replace the need for site-specific data collection. For example, travel time runs can be replaced by INRIX probe data. The data quality of changing sources should be evaluated. The analytics for “big data” sources need to be considered to ensure performance measures can be compared accurately over time.

Project-level performance measurement is more of a reactive process, whereas system-level performance measurement would be a proactive process. Because of the public input process involved in project selection, the squeaky wheel is more likely to get funding. Also, project-level analysis may be avoided in some cases due to a fear of bad results. In many cases, funds are not available to complete a post-implementation study to determine whether a project had any measurable impact on operations, especially for developer-led projects.

The Congestion Management Process (CMP) of MPOs measures performance and recurring/non-recurring congestion, but it is not used as a tool very often due to resource constraints. The CMP is very labor-intensive. In some cases, the CMP serves as a “check box” activity which is not integrated into decision-making, and the CMP would be more useful if it is linked to a bigger process, such as becoming part of long-range plans. For some MPOs, the CMP process is not timed to feed into project selection.

Data quality depends on the source. For example, the incident timeline requires self-reporting by emergency responders. Since their primary focus is elsewhere, the accuracy of the times they record may be an issue.

The magnitude of data becoming available can be a barrier to calculating performance measures as the data exceeds the capability of spreadsheet-based analysis tools. Analytics require a specialized platform, with training for users to understand how to generate metrics and interpret the results. The results produced should consider different types of users, such as those who prefer paper vs. electronic results, or one-page briefing for executive-level decision makers.

STRATEGY PM01 – CONTINUE TO DEVELOP PERFORMANCE MEASUREMENT PROGRAM (CONTINUED)

STRATEGY ADDRESSES NEED C – *Establish Performance Measures*

Politicians frequently hear complaints from constituents about traffic operations and congestion, which lead to requests for agencies to solve the problem. Data-driven performance measures can provide justification for whether the perceived issue deserves further attention and provide documentation for the politicians to respond appropriately.

EXAMPLE TSMO PRACTICES

- SPC’s SINC-Up program to retime and upgrade traffic signals has included project-level performance measurement in a summary report which is succinct, easy to read, and reported to the public.
- PennDOT’s recently-developed Traffic Signal Asset Management System (TSAMS) provides a tool for measuring asset performance.
- The York County Planning Commission prepares an annual report for Interstate 83, including incident frequency and clearance time.
- WSDOT has been a national leader in Performance Measurement for many years. Its Gray Notebook, a public quarterly, tracks the performance related to project development, infrastructure condition, safety and operations. Performance Measurement data is consistently utilized in programming and long-term planning at WSDOT. The TSM&O program has successfully used operational outcome data to secure more funding for additional TSM&O projects. WSDOT has also started to set performance targets for many activities, such as incident clearance.
- GDOT has a relatively comprehensive program that encompassed several (but not all) Performance Measurement functions. They have a long history of publishing weekly and monthly reports on TSM&O activities with a focus on TIM, but also including 511 calls, traveler information web site “hits,” and device health. They have used the incident performance data to adjust service patrol intensity and duration in corridors and to identify bottlenecks and to locate potential locations for ramp metering. They are also using commercially provided travel time data to fill in gaps and as a basis for their Regional Traffic Operations Program. Whenever GDOT implements a new TSM&O strategy, the agency evaluates its effectiveness by using their extensive detector network. GDOT has also developed an agency wide performance dashboard that includes a TSM&O measure (service patrol response time) and summary outcome measures for congestion. The front page of the dashboard allows users to drill down to obtain details regarding each top-level measure.

STRATEGY PM01 – CONTINUE TO DEVELOP PERFORMANCE MEASUREMENT PROGRAM (CONTINUED)

STRATEGY ADDRESSES NEED C – *Establish Performance Measures*

ACTIONS

PM01.01	Promote system-wide performance measures of which the calculation can be automated using available data sources.
PM01.02	Project-level performance measurement should compare the expected benefit with the actual benefit in addition to quantifying before and after results.
PM01.03	A centralized performance measurement platform should be developed that is easy to use and provides all performance measures in one location without requiring separate logons.
PM01.04	Provide training to users of performance measures to learn how to generate metrics and interpret results.
PM01.05	Develop traffic signal performance measures.
PM01.06	Develop incident clearance and secondary crash performance measures.
PM01.07	Develop tool to more accurately predict work zone congestion.

STRATEGY PM02 – IDENTIFY PERFORMANCE MEASURES TO MEET MAP-21 CRITERIA

STRATEGY ADDRESSES NEED C – Establish Performance Measures

DESCRIPTION

Performance measurement is mandated by FHWA as part of the MAP-21/FAST Act requirements. Agencies that do not meet self-established targets are subject to constraints on future funding. Therefore, successful navigation of the federal requirements is critical to keep funds flowing. A major thrust of the MAP-21 performance measures is to shift the focus of congestion management from delay to also consider reliability.

Meeting these federal requirements brings with it several challenges. These include:

- Establishing targets which are achievable but will not be affected by uncontrollable fluctuations in system performance
- Reaching state and regional consensus regarding segment definitions targets
- The federally-mandated focus on aggregate rather than corridor level measures
- Software analytics requirements for dealing with the National Performance Management Research Data Set (NPMRDS), which exceed the capabilities for single-user desktop analysis to develop the related analytics. There are 23,248 TMC segments in Pennsylvania with speed data reported every 5 minutes, resulting in 2.4 trillion records per year to be analyzed.

The basic thrust of the mandated MAP-21 performance measurement program is to report aggregate changes and encourage states to utilize performance measurement in their overall planning and programming. However, the requirements are not directly suitable for project-level decision making. To overcome this problem, PennDOT has a relationship with the specialized expertise provided by the UMD CATT lab to develop the data base and analytics such that measures important to PennDOT can be developed from, and be consistent with, those required by federal reporting.

The MAP-21 performance measures begin to shift the focus of congestion management from delay to also consider reliability.

EXAMPLE TSMO PRACTICES

- The University of Maryland CATT Lab developed automated tools for calculation of draft MAP-21 performance measures within the Probe Data Analytics (PDA) Suite (formerly known as the Vehicle Probe Project or VPP).

ACTIONS

PM02.01	Establish achievable targets for MAP-21 performance measures by May 2018.
PM02.02	Monitor progress toward achieving MAP-21 targets and utilize mid-period performance reports to adjust targets as needed.

STRATEGY PM03 – DEVELOP METRICS FOR DISTRICT EXECUTIVE DASHBOARD

STRATEGY ADDRESSES NEED C – Establish Performance Measures

DESCRIPTION

Currently, PennDOT District Executives are held accountable for structurally deficient bridges, pavement smoothness, and other metrics. There is no comparable accountability for system operations. Therefore, these initiatives take priority over traffic operations in the competition for scarce resources.

There has not been agreement on what measures to use for traffic operations, and these measures aren't as simple to produce as the number of SD bridges. In addition to selecting measures, ranges of "good" and "bad" values must be defined so the measures are interpreted correctly. For bridges, a threshold sufficiency rating is set, below which the bridge is considered structurally deficient and the need for a project is triggered. Bridges are inspected on a regular cycle to generate sufficiency ratings. Similar thresholds and recurring measurement are needed for traffic operations measures.

Traffic operations performance measures used for the District Executive dashboard need to consider regional differences when setting targets, as traffic operation goals for urban and rural districts are very different.

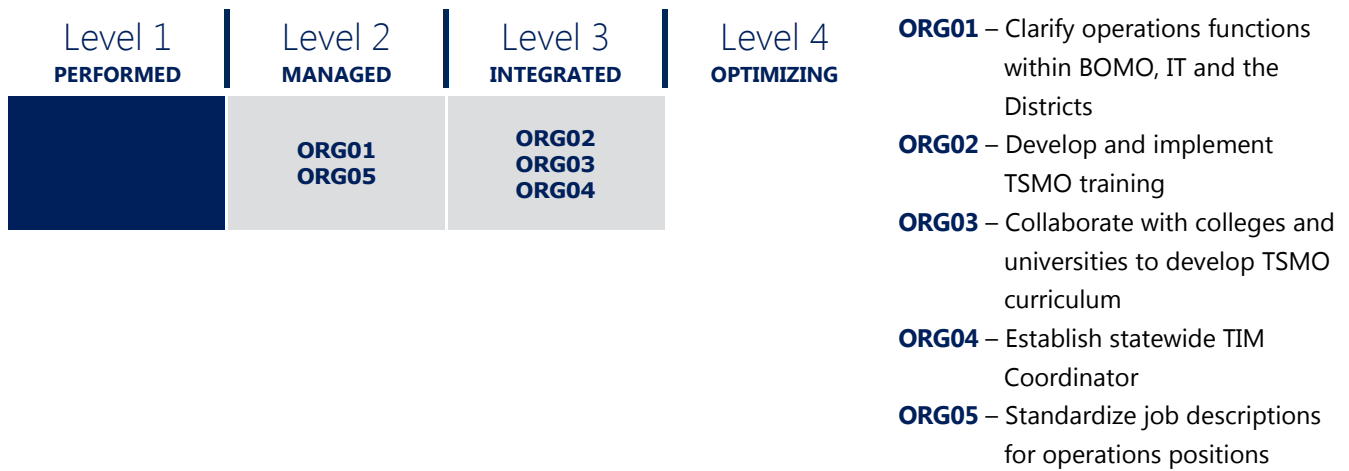
EXAMPLE TSMO PRACTICES

- The use of SD bridges, Pavement IRI, and Let Date adherence on the District Executive dashboard has been effective in making progress to improve these measures.
- WSDOT's quarterly publication of The Gray Notebook provides performance tracking for asset and operational management – for both internal and external purposes. The origin of the notebook was an effort to increase public confidence in WSDOT by making the business case for transportation improvement through comprehensive performance reporting. The Gray Notebook includes information on the performance of various systems in general, some even on a corridor basis, and those where TSM&O strategies have been implemented and can be tracked. The publication is used for both internal and external purposes and includes time-series information about the cost and effectiveness of TSM&O investments and activities, as well as for capacity and maintenance improvements.

ACTIONS

PM03.01	Choose/define appropriate traffic operations metric(s) to be included on the District Executive dashboard.
PM03.02	Choose/define appropriate traffic operations metric(s) for Assistant Districts Executives (ADEs) as appropriate.

ORGANIZATION AND STAFFING



STRATEGY ORG01 – CLARIFY OPERATIONS FUNCTIONS WITHIN BOMO, IT AND THE DISTRICTS

STRATEGY ADDRESSES NEED G – *Provide Appropriate Staffing and Organizational Structure*

DESCRIPTION

In order to allow for a holistic approach to operations applied uniformly across the state, operations functions should be clarified within the Department. This will help institutionalize TSMO within the organizational structure and result in a more effective program direction, while also achieving statewide consistency, improved resource allocation, and better regional operations planning. A better-defined reporting structure should focus on strengthening connections between:

- Traffic Operations with the Program Center, IT, and RTMC regions.
- RTMC regions and their member Districts.
- STMC and RTMCs.
- Central Office and Districts.

EXAMPLE TSMO PRACTICES

- Based on a survey of DOTs who have implemented TSMO, eighty percent have gone through some level of organizational restructuring to better integrate operations into their business processes.
- The Iowa Department of Transportation recently created an Office of Traffic Operations (OTO) which houses all primary TSMO responsibilities. Prior to the reorganization, TSMO staff were distributed across the organization. This has allowed better coordination related to weather management, traffic incident response, and emergency transportation operations.
- Florida DOT reorganized to consolidate and elevate their operations bureau to the same level as all of the major bureaus within the Department, which has resulted in the delivery of higher quality ITS design and deployment services.
- Several states have indicated that the reorganization has helped bridge the gap between operations and planning/ project development, and other states have also reorganized to advance TSMO, including Vermont, New Hampshire, Colorado, Tennessee, and Arizona.
- PennDOT District 6 is nearing the completion of a reorganization to create an ADE – Operations position. This position will be responsible for all operations functions including traffic operations, signals and safety, and traffic services.
- The Pennsylvania Turnpike Commission has recently reorganized their operations functions within one unit to promote better coordination and management.

ACTIONS

ORG01.01	Establish a task force, including District Executive and Human Resources representatives, to evaluate organizational changes necessary within PennDOT to clarify TSMO functions and relationships.
ORG01.02	Monitor new operations organizational structure in District 6.

STRATEGY ORG02 – DEVELOP AND IMPLEMENT TSMO TRAINING

STRATEGY ADDRESSES NEED D – Foster Knowledge and Provide Training

DESCRIPTION

Numerous training programs and sessions are currently offered to PennDOT personnel to provide for the basic needs necessary to function within their operational unit or to provide enhanced understanding and capabilities in specific areas of expertise. These programs have been very successful in preparing employees in the traditional areas of design and construction.

As the concept of TSMO is relatively new, training does not exist for TSMO processes and strategies. A TSMO training program should be implemented directed to design and planning staff of all affected agencies (PennDOT, MPOs/RPOs, etc.) to provide a common understanding and foundation for TSMO activities across the state. The program should outline why TSMO is important, TSMO strategies, how TSMO is integrated into the project development process, and the organizational elements related to TSMO for each agency. This could possibly be combined with PennDOT Connects training.

EXAMPLE TSMO PRACTICES

- The National Operations Center of Excellence (NOCoE) offers an array of peer exchanges, webinars, assessments, on-call assistance, and training on operations topics such as integrated corridor management, active traffic management, traffic management centers, and incident response. The NOCoE is a collaboration of AASHTO, the Institute of Transportation Engineers, and the Intelligent Transportation Society of America, with support from FHWA.
- The I-95 Corridor Coalition provides two training program tracks to share best practices and advance new programs; Coordinated Incident Management and Traveler Information Services.
- FHWA offers workshops, courses, and webinars to advance awareness, understanding, and application of planning for operations concepts and approaches.
- ITS Heartland delivers a Regional Operations Forum Training Program encompassing subjects such as workforce development, performance measurement, and stakeholder communications.

ACTIONS

ORG02.01	Identify training needs at the District and Central Office level.
ORG02.02	Identify existing TSMO training opportunities.
ORG02.03	Identify new TSMO training course needs.
ORG02.04	Develop new TSMO training courses as needed.
ORG02.05	Offer TSMO training to planning partners.
ORG02.06	Integrate TSMO into PennDOT Academies.
ORG02.07	Execute TMC Training and continuing education program.

STRATEGY ORG03 – COLLABORATE WITH COLLEGES AND UNIVERSITIES TO DEVELOP TSMO CURRICULUM

STRATEGY ADDRESSES NEED D – *Foster Knowledge and Provide Training*

DESCRIPTION

There are currently no Pennsylvania colleges or universities that provide a TSMO-related curriculum/program. PennDOT should work with select colleges and universities to develop a pilot undergraduate level TSMO classes, or a graduate level TSMO curriculum. Students who graduate with a TSMO background will be better prepared to enter the workforce with the skill set necessary to complete operations tasks/projects.

EXAMPLE TSMO PRACTICES

- While no universities offer a TSMO program, the Pennsylvania State University offers graduate level courses (Masters and PhD) in transportation engineering that focus on transport system planning, traffic engineering, transportation safety, and the maintenance and operation of transportation facilities. Students graduate with a sound theoretical and practical understanding of transportation engineering systems.

ACTIONS

ORG03.01	Reach out to select colleges (including community colleges) and universities to gauge interest.
ORG03.02	Work with colleges and universities to develop curriculum.

STRATEGY ORG04 – ESTABLISH STATEWIDE TIM COORDINATOR

STRATEGY ADDRESSES NEED G – *Provide Appropriate Staffing and Organizational Structure*

DESCRIPTION

Incident management activities within Pennsylvania are currently addressed on a local or regional level. While this is effective for those areas, the ability to maintain consistency across the state is limited. Strong PennDOT Central Office and regional leads for TIM will result in better traffic management on state facilities and sharing of best practices among stakeholders.

EXAMPLE TSMO PRACTICES

- Many states have successfully utilized Statewide TIM coordinators including Wisconsin, Iowa, Ohio, Arizona, Oregon, Michigan, and New Jersey
- Southwest Pennsylvania Commission facilitates a TIM Program that includes the establishment of three regional TIM Teams. These teams meet on a regular basis to discuss upcoming planned events, new local initiatives, information and resource sharing, training, after action reviews, successes, and national best practices.
- DVRPC instituted and formalized a TIM Program that includes the management of seven Incident Management Task Forces (IMTFs) and supports three others in the region. The IMTFs helps emergency responders overcome challenges by building relationships with each other. In addition, DVRPC has offered training to nearly 1,000 responders in the region.



ACTIONS

ORG04.01	Identify statewide TIM coordinator in PennDOT BOMO, along with roles and responsibilities.
ORG04.02	Identify TIM liaison in each operations region to coordinate TIM Teams, build relationships with planning and design staff, and intake best practices from the regions.
ORG04.03	Develop formal TIM stakeholder training and develop content for future website.

STRATEGY ORG05 – STANDARDIZE JOB DESCRIPTIONS FOR OPERATIONS POSITIONS

STRATEGY ADDRESSES NEED G – *Provide Appropriate Staffing and Organizational Structure*

DESCRIPTION

Job descriptions for positions within the District Traffic Units or BOMO that are responsible for operations functions do not address the skill sets necessary to fully carry out TSMO activities. Standardized job descriptions should be developed that include operations specific technical and management skill requirements. This will allow the hiring of personnel with the appropriate skill set to perform operations functions.

EXAMPLE TSMO PRACTICES

- Missouri DOT identified the need to develop standard job descriptions as part of the development of their TSMO program.
- A series of white papers prepared by NOCoE discuss TSMO workforce development needs including the identification of staff/workforce core technical and managerial needs and experience and educational requirements.

ACTIONS

ORG05.01	Identify necessary operations positions.
ORG05.02	Develop TSMO-related job descriptions.

CULTURE

Level 1
PERFORMED

Level 2
MANAGED

Level 3
INTEGRATED

Level 4
OPTIMIZING

CUL01
CUL02
CUL03
CUL04

CUL01 – Make operations strategies competitive in program development process

CUL02 – Integrate TSMO concepts at local level

CUL03 – Implement TSMO with top-down and bottom-up approach

CUL04 – Educate public on benefits of TSMO

STRATEGY CUL01 – MAKE OPERATIONS STRATEGIES COMPETITIVE IN PROGRAM DEVELOPMENT PROCESS

STRATEGY ADDRESSES NEED A – *Consider Operations Throughout Project Life Cycle*

DESCRIPTION

Operations projects are currently completed ad hoc through traffic engineering budgets at PennDOT, through the Unified Work Plan of the MPO, or as part of other construction or capital improvement projects. They do not typically receive line-item funding through the long-range plan or the transportation improvement plan. Operations elements should be considered as part of the overall project planning process, including projects that are already in the pipeline for completion. Moving forward, a procedure should be created for amplifying operations project needs through the development process. The current MPO/RPO project prioritization scoring systems should be revamped to include an evaluation of operations strategies. This will create a culture where TSMO is ingrained into the project development process and is part of the way PennDOT does business. It will also strengthen the relationship between operations and planning.

EXAMPLE TSMO PRACTICES

- The Northern Virginia Transportation Authority (NVTA) uses a quantitative score and assigns points based on an evaluation of how each project rates in terms of specific factors including improving the management and operation of existing facilities through technology applications.
- Colorado DOT has modified its project development process to include steps designed to ensure that operational considerations are identified and evaluated via a multidisciplinary project review. This Operational Assessment is required for all CDOT projects. The Division of TSM&O developed a web application platform used to input project information into the existing CDOT workflow process. It includes notifications to the project engineer/ project manager and the project review team. When the Operations Clearance (OC) review and approval process is complete, the OC is automatically generated and sent to the project engineer/project manager and the Region’s Business Office.

ACTIONS

CUL01.01	Work with MPOs/RPOs to develop project ranking systems that include an evaluation of operations solutions.
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STRATEGY CUL02 – INTEGRATE TSMO CONCEPTS AT LOCAL LEVEL

STRATEGY ADDRESSES NEED D – *Foster Knowledge and Provide Training*

DESCRIPTION

There is virtually no recognition of the importance of operations beyond PennDOT and the MPO. Outreach and awareness through LTAP and other associations should be targeted to local government. This should include the development of case studies that demonstrate the application and benefit of operations projects in local government. This will result in the evaluation of operations solutions early in the project development process and will serve to educate and engage local policy makers regarding the value of operations.

EXAMPLE TSMO PRACTICES

- None identified.

ACTIONS

CUL02.01	Develop case studies that demonstrate the effectiveness of operations solutions.
CUL02.02	Identify mechanisms for outreach.
CUL02.03	Develop TSMO outreach program potentially using LTAP funding.

STRATEGY CUL03 – IMPLEMENT TSMO WITH TOP-DOWN AND BOTTOM-UP APPROACH

STRATEGY ADDRESSES NEED D – Foster Knowledge and Provide Training

DESCRIPTION

TSMO concepts are being developed and recommended by mid-level management within transportation agencies. However, there is a lack of understanding at all levels needed for widespread agency adoption. There is a need to develop a culture of open communication among personnel at all levels that leads to more direct implementation of operations solutions. This will result in complete “buy in” from all levels of the organization and help develop the message to be delivered by executive leadership.

EXAMPLE TSMO PRACTICES

- The current PennDOT Connects effort has demonstrated the commitment from executive level management as well as buy-in at the District, MPO/RPO, and municipal level. The program continues to move forward with implementation strategies.
- The Florida Department of Transportation (FDOT) Executive Board endorsed the working definition of TSMO, a TSMO Business Plan, and the outline of a Strategic Plan in 2010. Since then, they have taken a more aggressive approach to operations strategies, including a Statewide Active Arterial Management Needs Plan that identifies the causes of congestion on arterials across the state and recommends management strategies.
- Washington State DOT has emphasized incorporating TSMO into its policy and planning based on three overall strategies, tiered in order of priority to ensure cost effectiveness: “Operate Efficiently,” “Manage Demand,” and “Add Capacity Strategically.” The “Operate Efficiently” strategy is designed to “...get the most out of existing highways by using traffic-management tools to optimize the flow of traffic and maximize available capacity. Strategies include utilizing traffic technologies such as ramp meters and other control strategies to improve traffic flow and reduce collisions, deploying incident response to quickly clear collisions, optimizing traffic signal timing to reduce delay, and implementing low-cost/high-value enhancements to address immediate needs.”

ACTIONS

CUL03.01	Conduct executive briefings.
CUL03.02	Develop TSMO marketing materials.

STRATEGY CUL04 – EDUCATE PUBLIC ON BENEFITS OF TSMO

STRATEGY ADDRESSES NEED D – Foster Knowledge and Provide Training

DESCRIPTION

The benefits of operations solutions are not generally well understood by local officials or the traveling public. A comprehensive outreach plan should be developed that communicates TSMO values across varying platforms and with various messages depending on the audience. These messages should also be augmented both through regular public relation activities as well as appropriately integrated into educational activities at the college and high school level. A full set of contemporary media approaches should be considered including a prominent presence on the PennDOT website, and through PennDOT messaging on Twitter, Facebook, etc. This will support education and buy-in from the general public regarding the comparative benefits of operations strategies. In addition, it will aid in the recruitment of workforce with the skill set necessary to fill TSMO positions within the various agencies.

EXAMPLE TSMO PRACTICES

- Colorado DOT has developed a TSMO brochure that includes information about the program’s mission and provides examples of what practices are important to supporting the program.
- Iowa DOT launched a TSMO website with links for their Strategic and Program plan as well as their TSMO Launch Presentation. The website also includes an informational video explaining what TSMO is and why there is a need for it.

ACTIONS

CUL04.01	Identify target audiences for outreach.
CUL04.02	Develop audience-specific outreach programs.
CUL04.03	Develop TSMO website.
CUL04.04	Develop TSMO brochure.

COLLABORATION

Level 1 PERFORMED	Level 2 MANAGED	Level 3 INTEGRATED	Level 4 OPTIMIZING	
	COL01 COL02 COL03	COL04 COL05		COL01 – Foster development of regional TIM teams COL02 – Identify opportunities for coordination within PennDOT COL03 – Identify opportunities for coordination with planning partners COL04 – Develop and implement annual TSMO Summit



STRATEGY COL01 – FOSTER DEVELOPMENT OF REGIONAL TIM TEAMS

STRATEGY ADDRESSES NEED F – *Improve Interagency Coordination*

DESCRIPTION

DVRPC and SPC hold regular meetings to discuss the status of the Traffic Incident Management (TIM) teams in their region. In the SPC region, there are a total of five regional TIM Teams that cover various areas in the region. DVRPC has a total of six regional TIM teams that cover their five-county area. DVRPC and SPC host regional TIM Team meetings quarterly and by corridor. These meetings cover responder training, After Action Reviews (AAR), and planning for construction staging and detouring. Other areas of the state practice similar strategies without formally acknowledging it as a TIM team. For example, in the eastern region, District 8 piggybacks off of Three Mile Island responder meetings. DVRPC and SPC identify clear objectives and strategies as well as include all of the necessary stakeholders needed to advance their TIM teams. However, the remaining parts of the state lack the formal relationships and collaborative capabilities to create and maintain TIM teams.

The need for TIM teams in other parts of the state was very apparent during the regional workshops. Representatives from PennDOT District 4 and District 5 expressed a lot of interest in setting up TIM teams in their regions. In the past, they’ve found it difficult to schedule a meeting with the appropriate parties and had limited planning partner resources and volunteer emergency responders. Creating TIM Teams in the central and eastern regions will help bring the same benefits that come from the teams in both the western and southeastern parts of the state. These benefits include cross-discipline incident management training, post incident after action reviews, and standardized incident response plans. In addition to these benefits, organizing regional TIM team meetings will help promote collaboration and help form relationships between stakeholders throughout the regions. These relationships are key to ensuring regions plan more proactively. Reactive planning has historically proven to be a poor strategy for Incident Management (Valentine’s Day 2007, Winter Storm Jonas 2016, etc.).

EXAMPLE TSMO PRACTICES

- DVRPC developed a five-corridor-based TIM task force that meets on a quarterly basis. This task force includes personnel from state/local law enforcement, fire and rescue, EMS, PennDOT, towing and recovery, communications, and environmental protection agencies. This program is recognized as a national best practice and was the model for the SPC program.
- SPC currently has five TIM Teams that cover specific corridors and the city of Pittsburgh. In 2016, the SPC TIM teams facilitated four AAR meetings, coordinated SHRP II TIM Responder Training for over 70 participants, and developed a TIM funding primer and newsletter for first responders.
- District 2 hosts a pre-winter meeting with regional emergency responders that closely resembles the TIM Team meetings that take place in other parts of the state.



ACTIONS

COL01.01	Work with the Central and Eastern regions to define and set up TIM Teams where needed.
COL01.02	Shape best practices across TIM Teams and operations regions.

STRATEGY COL02 – IDENTIFY OPPORTUNITIES FOR COORDINATION WITHIN PENNDOT

STRATEGY ADDRESSES NEED E – *Improve Intra-Agency Coordination*

DESCRIPTION

Currently, there are no formal coordination processes in place within PennDOT at the District or Central Office level to support the implementation of TSMO. Although the District to Central Office level coordination exists for other functions within the Department (design, maintenance, and construction) through a range of meetings, there is no mechanism in place to promote this level of collaboration relative to operations. If this coordination exists, it is mostly ad hoc and champion-driven which equates to a Level 1.

Coordination between those responsible for operations at the District and Central Office level, and the planning and programming engineer will help promote the success of the TSMO program. This coordination is meant to ensure that everyone involved is well informed on the planning process and available funding sources to implement potential operations solutions. Setting up regular (quarterly) meetings between PennDOT planning officials and other relevant stakeholders will give all the interested parties a chance to voice their concerns and provide applicable feedback in the planning process.

Additionally, coordination between regions for those involved in existing operations functions (freeway service patrols, TIM teams) can ensure that operations solutions and best practices are applied uniformly across the commonwealth.

EXAMPLE TSMO PRACTICES

This level of coordination exists for other functions within PennDOT, including:

- Statewide DE Meetings
- Statewide Traffic Signal Meetings

ACTIONS

COL02.01	Participate in existing meetings with the planning and programming engineers at the District level, and District and Central Office operations representatives.
COL02.02	Review and strengthen TIM policies and procedures to improve consistency across the state.
COL02.03	Create a consistent outreach and management program for all Freeway Service Patrols (FSPs) in PennDOT.

STRATEGY COLO3 – IDENTIFY OPPORTUNITIES FOR COORDINATION WITH PLANNING PARTNERS

STRATEGY ADDRESSES NEED F – *Improve Interagency Coordination*

DESCRIPTION

There is currently a combined total of 23 MPOs and RPOs throughout the state, but only a few of these organizations hold regular meetings with their respective counties and municipalities. Communication between PennDOT and the planning organizations is needed to relay and reinforce the need for TSMO in the planning process. The limited funding dedicated to operations solutions may be tied to the lack of background on the effectiveness of these applications and available metrics to promote their value. Although a few MPOs such as DVRPC, SPC, and the Williamsport MPO conduct frequent collaboration exercises with PennDOT staff, it is not a uniform practice throughout the state.

Incorporating input and recommendations from stakeholders early in the project development process will allow PennDOT to plan for more comprehensive projects that address the needs of the surrounding community. Collaboration between PennDOT and planning partners will also help prevent ad hoc addition of operations solutions to roadway projects that are past preliminary design.

It is also important to recognize other TSMO-related efforts in the state. The Pennsylvania Turnpike Commission has just completed their Transportation Operations Program Plan that identifies their vision for operations for the future. Given the interrelationship of PennDOT and Turnpike facilities, collaboration between the two agencies is important in providing a consistent experience for Pennsylvania’s transportation customers. In addition, legislative changes necessary to support operations strategies must be encouraged.

EXAMPLE TSMO PRACTICES

- Based on discussions from the Central Region TSMO Workshop, the Williamsport MPO has planning advisory teams that meet semi-annually and successfully keep agencies involved in planning and development. Elected officials, planning commissions, school boards, public safety, universities, and Amish communities are all involved in the meetings.
- DVRPC holds a monthly meeting comprised of 18 members that represent stakeholders throughout the DVRPC region as well as several representatives from PennDOT Central Office and Districts.
- Caltrans began shifting their project planning approach from a capacity-driven approach to more of a real-time operations approach. This change included the integration of TSMO planning and strategies with local agencies earlier in the planning process.⁷

CALTRANS PROJECT DEVELOPMENT APPROACH



⁷ http://www.dot.ca.gov/trafficops/rof/July2016_2_Caltrans_TSMO_Statewide_Perspective.pdf

STRATEGY COL03 – IDENTIFY OPPORTUNITIES FOR COORDINATION WITH PLANNING PARTNERS (CONTINUED)

STRATEGY ADDRESSES NEED F – *Improve Interagency Coordination*

ACTIONS

COL03.01	Identify what meetings the MPO/RPOs are currently having.
COL03.02	Incorporate TSMO into standing agenda at existing MPO/RPO meetings.
COL03.03	Create collaboration between the Turnpike and their Transportation Operations Program Plan and PennDOT’s TSMO Program Plan.
COL03.04	Establish relationships with Transportation Management Associations (TMAs).
COL03.05	Encourage legislative changes to support Quick Clearance Programs or other TIM programs.
COL03.06	Encourage legislative changes to support centralized control of traffic signals.

STRATEGY COL04 – DEVELOP AND IMPLEMENT ANNUAL TSMO SUMMIT

STRATEGY ADDRESSES NEED F – *Improve Interagency Coordination*

CURRENT SITUATION

A statewide Annual TSMO Summit would give more experienced regions the opportunity to share success stories and implementation strategies on a statewide stage. Setting up a TSMO Summit will help promote the success of the TSMO program in Pennsylvania. The summit will ensure continuity and promote future coordination between PennDOT Central Office and Districts along with other entities including planning partners, universities, PA Turnpike, and neighboring states DOTs. The TSMO Summit could discuss topics such as planning for operations, performance measurement, corridor-based planning approaches, and many other similar topics.

The PA Turnpike hosted a similar event for incident management, the first PA TIM Summit on November 14th, 2016. Attendees included officials from PennDOT, PA Turnpike, PA Towing Association, Pennsylvania State Police (PSP), neighboring state DOTs, MPOs/RPOs, and several emergency responders throughout the state. The presentations ranged from the current state of TIM in PA to TIM best practices from other states. Hosting or attending an annual TIM summit in Pennsylvania will support continuity and promote future coordination between PennDOT Central Office, Districts (Traffic, TMC, Maintenance, and Construction), and Emergency Responders. Future planning of the TIM summit should also include close coordination with the new Pennsylvania TSMO Summit to avoid scheduling conflicts and overlap of presentation material.

EXAMPLE TSMO PRACTICES

- Missouri DOT hosts an annual Operations Summit with topics ranging from freight management and performance measures to best practices in multi-agency collaboration. Chris King (DVRPC) was invited to speak in 2012 about the work DVRPC is doing with Advanced Planning for Operations.⁸
- Although the Caltrans Regional Operations Forum (ROF)⁹ is a regional format, a majority of the topics could be discussed on a statewide level.
- The PA Turnpike along with several other organizations helped assemble a TIM Summit last year. The TIM Summit brought together PennDOT officials, PA Turnpike officials, MPOs/RPOs, and emergency responders from across Pennsylvania.
- The Annual PA Safety Symposium currently has 4 tracks of sessions and is tailored to safety issues statewide and nationally.
- The Maryland State Highway Administration CHART (Coordinated Highways Action Response Team) program is governed by the CHART Board consisting of senior technical and operational personnel from SHA, the Maryland Transportation Authority, Maryland State Police, Federal Highway Administration, University of Maryland Center for Advanced Transportation Technology, and various local governments. The Board is chaired by the Deputy Administrator/Chief Engineer for Operations and meets regularly.
- Iowa is in their second year of organizing a Statewide Traffic Incident Management Conference. The conference is broken down into two days. The first day is an optional Pre-Conference training for emergency responders while the second day is structured like the PA TIM Summit.

⁸ http://contribute.modot.mo.gov/safety/documents/MODOT_DVRPCAdvancingOperations.pdf

⁹ <http://www.dot.ca.gov/trafficops/rof-archive.html>

STRATEGY COL04 – DEVELOP AND IMPLEMENT ANNUAL TSMO SUMMIT (CONTINUED)

STRATEGY ADDRESSES NEED F – *Improve Interagency Coordination*

ACTIONS

COL04.01

Form a committee to collaborate with other state agencies and organizations to develop an annual TSMO Summit in Pennsylvania.

APPENDIX

SUMMARY OF NEEDS, STRATEGIES, AND ACTION ITEMS

NEED A – CONSIDER OPERATIONS THROUGHOUT PROJECT LIFE CYCLE

BP01 – Update the Regional Operations Plans

BP01.01 Deploy plan to consolidate ROP regions to mimic RTMC operations regions.

BP01.02 Update the Regional Operation Plans every two years.

BP02 – Identify clearly defined ties between ROPs & other plans

BP02.01 Produce a financial analysis that outlines the installation operational, recurring maintenance, and lifecycle/ replacement costs, to be fed into the Long-Range Transportation Plan.

BP02.02 Clearly identify operations-related goals throughout the region so they can be incorporated into the LRTP or other region-specific documents and eventually can be accounted for during the TIP process and in the ROP update.

BP02.03 Include requirements to evaluate operational strategies in the following planning and programming documents: Financial Guidance, Procedural Guidance, UPWP, Investment Plan, and Interstate TIP.

BP02.04 Finalize and publish Planning for Operations document.

BP03 – Integrate TSMO into PennDOT Connects

BP03.01 Utilize PennDOT Connects to identify congestion-related needs and suggested operations solutions.

BP03.02 Provide educational outreach to stakeholders on the effectiveness of operations solutions using PennDOT Connects.

BP03.03 Create a TSMO checklist to follow during project development (similar to Ped/Bike and roundabout).

BP04 – Consider operations strategies in project development process

BP04.01 Include District-level TSMO representative in all facets of project development process to ensure that operations solutions are considered.

CUL01 – Make operations strategies competitive in program development process

CUL01.01 Work with MPOs/RPOs to develop project ranking systems that include an evaluation of operations solutions.

NEED B – PROVIDE ADEQUATE FUNDING AND GUIDANCE

BP05 – Identify steady source and appropriate level of funding

BP05.01 Develop a long-term funding program, with a steady stream of funding, for operations projects.

BP05.02 Coordinate PennDOT outreach to municipalities on a regular basis, or set up a mechanism where District or MPO/RPO staff can assist with outreach.

BP05.03 Develop a highly interactive web tool to allow for easy understanding of the program, the cost/benefit of operations solutions to encourage participation, and simplified application process.

BP05.04 Finalize the Appropriation 582 Program 143 Funding Guidance Document.

BP06 – Track ITS maintenance and operations costs

BP06.01 Create an ITS Device Statewide Asset Management Program or incorporate into TSAMS.

BP06.02 Begin tracking the following costs exclusive to ITS:

- Design/Construction Cost
- Operations/Maintenance Cost

BP06.03 Make historical design/construction and maintenance/operations cost information available to the regional planners and stakeholders so it can be used to leverage more funding for operations-related projects.

BP06.04 Develop plan to properly budget for maintenance and operations costs of ITS devices (life-cycle analysis).

NEED C – ESTABLISH PERFORMANCE MEASURES**PM01** – Continue to develop performance measurement program

PM01.01 Promote system-wide performance measures of which the calculation can be automated using available data sources.

PM01.02 Project-level performance measurement should compare the expected benefit with the actual benefit in addition to quantifying before and after results.

PM01.03 A centralized performance measurement platform should be developed that is easy to use and provides all performance measures in one location without requiring separate logons.

PM01.04 Provide training to users of performance measures to learn how to generate metrics and interpret results.

PM01.05 Develop traffic signal performance measures.

PM01.06 Develop incident clearance and secondary crash performance measures.

PM01.07 Develop tool to more accurately predict work zone congestion.

PM02 – Identify performance measures to meet Map-21 criteria

PM02.01 Establish achievable targets for MAP-21 performance measures by May 2018.

PM02.02 Monitor progress toward achieving MAP-21 targets and utilize mid-period performance reports to adjust targets as needed.

PM03 – Develop metrics for District Executive dashboard

PM03.01 Choose/define appropriate traffic operations metric(s) to be included on the District Executive dashboard.

PM03.02 Choose/define appropriate traffic operations metric(s) for Assistant Districts Executives (ADEs) as appropriate.

NEED D – FOSTER KNOWLEDGE AND PROVIDE TRAINING

ORG02 – Develop and implement TSMO training

ORG02.01 Identify training needs at the District and Central Office level.

ORG02.02 Identify existing TSMO training opportunities.

ORG02.03 Identify new TSMO training course needs.

ORG02.04 Develop new TSMO training courses as needed.

ORG02.05 Offer TSMO training to planning partners.

ORG02.06 Integrate TSMO into PennDOT Academies.

ORG02.07 Execute TMC Training and continuing education program.

ORG03 – Collaborate with colleges and universities to develop TSMO curriculum

ORG03.01 Reach out to select colleges (including community colleges) and universities to gauge interest.

ORG03.02 Work with colleges and universities to develop curriculum.

CUL02 – Integrate TSMO concepts at local level

CUL02.01 Develop case studies that demonstrate the effectiveness of operations solutions.

CUL02.02 Identify mechanisms for outreach.

CUL02.03 Develop TSMO outreach program potentially using LTAP funding.

CUL03 – Implement TSMO with top-down and bottom-up approach

CUL03.01 Conduct executive briefings.

CUL03.02 Develop TSMO marketing materials.

CUL04 – Educate public on benefits of TSMO

CUL04.01 Identify target audiences for outreach.

CUL04.02 Develop audience-specific outreach programs.

CUL04.03 Develop TSMO website.

CUL04.04 Develop TSMO brochure.

NEED E – IMPROVE INTRA-AGENCY COORDINATION

COL02 – Identify opportunities for coordination within PennDOT

COL02.01 Participate in existing meetings with the planning and programming engineers at the District level, and District and Central Office operations representatives.

COL02.02 Review and strengthen TIM policies and procedures to improve consistency across the state.

COL02.03 Create a consistent outreach and management program for all Freeway Service Patrols (FSPs) in PennDOT.

NEED F – IMPROVE INTERAGENCY COORDINATION

COL01 – Foster development of regional TIM teams

COL01.01 Work with the Central and Eastern regions to define and set up TIM Teams where needed.

COL01.02 Shape best practices across TIM Teams and operations regions.

COL03 – Identify opportunities for coordination with planning partners

COL03.01 Identify what meetings the MPO/RPOs are currently having.

COL03.02 Incorporate TSMO into standing agenda at existing MPO/RPO meetings.

COL03.03 Create collaboration between the Turnpike and their Transportation Operations Program Plan and PennDOT's TSMO Program Plan.

COL03.04 Establish relationships with Transportation Management Associations (TMAs).

COL03.05 Encourage legislative changes to support Quick Clearance Programs or other TIM programs.

COL03.06 Encourage legislative changes to support centralized control of traffic signals.

COL04 – Develop and implement annual TSMO Summit

COL04.01 Form a committee to collaborate with other state agencies and organizations to develop an annual TSMO Summit in Pennsylvania.

NEED G – PROVIDE APPROPRIATE STAFFING AND ORGANIZATIONAL STRUCTURE

ORG01 – Clarify operations functions within BOMO, IT and the Districts

ORG01.01 Establish a task force, including District Executive and Human Resources representatives, to evaluate organizational changes necessary within PennDOT to clarify TSMO functions and relationships.

ORG01.02 Monitor new operations organizational structure in District 6.

ORG04 – Establish statewide TIM Coordinator

ORG04.01 Identify statewide TIM coordinator in PennDOT BOMO, along with roles and responsibilities.

ORG04.02 Identify TIM liaison in each operations region to coordinate TIM Teams, build relationships with planning and design staff, and intake best practices from the regions.

ORG04.03 Develop formal TIM stakeholder training and develop content for future website.

ORG05 – Standardize job descriptions for operations positions

ORG05.01 Identify necessary operations positions.

ORG05.02 Develop TSMO-related job descriptions.

NEED H – PROVIDE PROPER DOCUMENTATION AND TOOLS

SYS01 – Develop tools to assist with operations

SYS01.01 Integrate congestion maps showing areas for potential operations projects into PennDOT's MPMS IQ Portal.

SYS01.02 Work with MPOs/RPOs to recommend projects that include operations solutions geared toward mitigating specific congestion issues.

SYS01.03 Evaluate the effectiveness of these recommendations by tracking the before and after performance of specific corridors.

SYS01.04 Establish statewide command and control for traffic signals.

SYS01.05 Continue Green Light-Go efforts of operations and maintenance of traffic signals along critical corridors.

SYS01.06 Support the development of standardized interoperable communications platform (radio, software, etc.) to be used by all responders on PennDOT roads (First Net).

SYS01.07 Develop lane reservation system for work zones.

SYS02 – Update regional ITS Architectures

SYS02.01 Deploy plan to consolidate ITS Architecture regions to mimic RTMC Operations regions.

SYS02.02 Update the ITS Architectures to ensure they stay current based on each region’s needs.

SYS02.03 Develop ITS Architecture change forms to be submitted when a project will change an aspect of the Architecture.

SYS03 – Develop Concept of Operations template

SYS03.01 Create a statewide ConOps template.

SYS03.02 Develop a statewide Concept of Operations.

SYS04 – Develop alternative procurement system(s)

SYS04.01 Explore new procurement strategies to support more effective operations project delivery.

SYS04.02 Evaluate the legislative and other changes necessary to implement the procurement strategy(ies).

SYS04.03 Utilize procurement strategy(ies) on new operations projects and evaluate effectiveness and lessons learned.

SYS05 – Develop new technologies test program

SYS05.01 Continue effort to establish Technology Testing Corridor along I-99.

SYS05.02 Develop a standardized testing procedure template that can be customized for new technologies.

SYS05.03 Explore use of city of Pittsburgh and Pennsylvania Transportation Institute testing facilities.

NEED I – DOCUMENT OPERATIONS POLICIES AND PROCEDURES

BP07 – Identify and develop comprehensive operations policies and procedures

BP07.01 Develop Fiber/Communication Deployment Policy and Procedures

- Consider deployment of fiber in various locations.
- Opportunities for deployment of fiber to state and partner facilities.
- Identify need to deploy fiber for CV/AV testing facilities.
- Fiber versus wireless communication considerations.
- Fiber connection standards/specifications.

BP07.02 Develop Connected/Autonomous Vehicle (CV/AV) Policies and Procedures

- Review and approval of all CV/AV deployments.
- CV/AV Strategic Plan.
- Requirements and guidelines for installation of CV/AV infrastructure.

BP07.03 Develop Comprehensive Work Zone Policies and Procedures

- Address requirements of the FHWA Independent Oversight Policy (IOP) regarding work zones.

- Revise Publication 46 (Traffic Engineering Manual) and Design Manual 2 to analyze work zone impacts earlier in the project development process.
- Work zone speed limit policies.
- Type of road and time of day lane closure restriction policies.

BP07.04 Develop Comprehensive Incident Management Policies and Procedures

- Establish After Action Review (AAR) Program based on incident duration.
- Consideration for incentive towing programs.
- County maintenance incident management policies.

BP07.05 Develop Comprehensive Traffic Management Center (TMC) Policies and Procedures

- Quality Assurance Program for RTMCs.
- TSMO Guidebook – Part V: Operations.
- Update regional Traffic Operations Plans (TOP) to reflect Part V: Operations.
- Update DMS guidelines to include work zones and better-defined travel times.
- Update the video sharing policy to include criteria for recording.
- Highway Advisory Radio (HAR) Repurposing Policy.
- Update 511PA Operations Policy.

BP07.06 Develop IT/ITS Policies and Procedures

- Develop policies for IT oversight and telecommunications associated with ITS and traffic signal equipment deployments.

BP07.07 Develop Traffic Signal Policies and Procedures

- Establish policy for minimum functionality of traffic signals on critical corridors, including detour timing plans.
- Establish criteria for connecting key signals to the Commonwealth network and the ATMS signal command and control module.

BP07.08 Develop TSMO Guidebook and its parts, each focused on the respective parts of TSMO project delivery, from planning through operations/maintenance.