SHRP 2 Reliability Project L17

Gap Filling Project 3: Best Practices for TSM&O Program and Budget Development

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Gap Filling Project 3: Best Practices for TSM&O Program and Budget Development

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SHRP 2 L17 Gap Filling Project #3

Best Practices for TSM&O Program and Budget Development

Overview

The L17 project is A Framework for Improving Travel Time Reliability, and the project objectives are to move the research findings into mainstream practice among transportation professionals and develop a simple, easily understood way to articulate travel time reliability. During the L17 project, the research team identified several gaps to address, including this work on programming and budgeting of Transportation Systems Management and Operations (TSM&O) at the state department of transportation (DOT) level. TSM&O strategies are designed to anticipate and manage traffic congestion and minimize the other unpredictable causes of service disruption and delay, thereby maintaining roadway capacity while improving reliability and safety. There is a need for guidance on how annual TSM&O programs should be developed, particularly in light of the trend toward performance-based management of the transportation system.

This project will develop *Best Practices for TSM&O Program and Budget Development* by presenting case studies of successful operations and management programs at state DOTs. This work focuses on summarizing TSM&O programs that have effectively mainstreamed TSM&O practices and presents state TSM&O programs that have been successful in conveying the value of operational strategies in terms of reliability improvement to DOT management, partner agencies, and the public. The products from this research are intended to complement and fit within the framework of the Knowledge Transfer System (KTS) produced as part of the L17 project.

Other DOT functional areas (e.g., pavements, safety, bridges) have longstanding procedures for developing annual programs and budgets and for identifying their long-term needs. No comparable processes exist for TSM&O. Where TSM&O planning documents exist, they usually are disconnected from annual program and budget development activities and not well integrated into the same needs identification process as other functional areas. TSM&O programs are commonly funded with both capital budgets and operations budgets. Capital budgets generally have a defined funding cycle based in the Statewide Transportation Improvement Program (STIP), and operations budgets are unique to the variety of situations within the state or district. Because TSM&O strategies address both congestion and safety concerns, it is imperative that cross-cutting approaches be developed so that a TSM&O program is integrated with those of planning, construction, and safety. The analytic process that develops future transportation needs must also account for TSM&O, regardless of which department contributes funds.

The research presents case studies as a way to provide examples and lessons learned from successful TSM&O programs. Specifically, the research team focused on TSM&O business processes. These business processes are those actions an agency needs to undertake in order to maximize the benefits of incorporating a formal reliability and TSM&O program into their core structure. Business processes include planning, programming/budget, performance measurement, procurement, and project development. Through detailed case studies, information is presented

for determining how short-term programs and budgets are developed, as well as procedures for identifying long-term needs for TSM&O within an agency. This approach developed case studies of existing programs as a way to frame the guidebook's best practices and document the current state of the practice to assist other agencies with their program development. The project case studies are organized into three primary parts that document

1. The specific structure and unique characteristics of the agency's and region's TSM&O program.
2. Information about current business processes in terms of TSM&O programming and financing practices: how they were achieved, where they are headed, and technical processes that are used in developing TSM&O programs and budgets.
3. Lessons learned, takeaways, and recommendations that could be useful to other agencies working on mainstreaming their TSM&O programs.

Four sites were selected for evaluation in this study due to their strong TSM&O programs:

- **Maryland Coordinated Highways Action Response Team (CHART):** This case study focuses on the historical growth and development of the statewide traffic management center located just outside of Baltimore, Maryland.
- **Florida Department of Transportation (DOT):** This case study focuses on documenting the programming of intelligent transportation system (ITS) and TSM&O activities in Florida.
- **Minneapolis Regional Transportation Management Center (RTMC)/Minnesota Department of Transportation (MnDOT):** This case study focuses on Minnesota DOT's ITS program, how it developed over time, and how it is currently maintained.
- **Washington State Department of Transportation (WSDOT):** This case study focuses on the historical growth and development of WSDOT's policies, goals, and strategies for programming TSM&O.

Best Practices

This research documents lessons learned and recommendations that could be useful to other agencies working on mainstreaming their TSM&O activities by providing information on how short-term programs and budgets were crafted, as well as procedures for identifying long-term needs for TSM&O. Each of the four case study locations had unique paths in identifying and securing funding to align with the various programs for each state. The best practices are many, as described in each individual write-up. In reviewing the four case studies as a whole, four common themes emerged: there are many potential sources of funding; upper management support is critical; interdepartmental collaboration is necessary; and performance management programs are invaluable.

Funding Sources

Each of the four TSM&O programs participated in the State Transportation Improvement Plan/Transportation Improvement Plan (STIP/TIP) planning process for capital improvements

within their DOT cycles. Since many of the TSM&O programs were more mature systems and mostly built out, the focus has moved away from securing funding for major expansions and more toward spot improvements and lower-cost strategies. There was a marked shift from deployment activities to operations activities, preserving the system that was on the ground. As TSM&O funding can come from different departments (pieces from operations, maintenance, engineering, safety, etc.), planners need to identify all available appropriate resources and work collaboratively across departments to be efficient.

Management Support

All four case study locations attribute success to the visionary leadership and support of upper management in the DOT. There were several examples of top-down introduction of program focus areas as well as bottom-up identification of projects. Either way, progress was made when all parties acted according to shared TSM&O goals. It was noted that advertising successes of the TSM&O programs further reinforces progress in the program. All four locations noted the benefit to having forward-thinking managers as an element in successful TSM&O programs.

Build Relationships

Emphasis was placed on the need to build and maintain relationships within the agency and with partner agencies. As described under Funding Sources, the resources for TSM&O can come from multiple departments with separate budgets. At a minimum, there is a natural link between the planning departments and operations groups, and in each case study, planners were well informed about TSM&O programs. Strong collaboration results in a more balanced program.

Performance Measures

The findings from each case study showed some aspect of performance-based management defined in their TSM&O programs. Strong data-driven investment strategies were well defined, and the resource of operations data benefited many groups within the DOT. Well-supported programs are able to develop enhanced analysis tools, methodologies, and information sources to support benefit-cost analysis for the TSM&O programs. Outside the DOT, performance reporting was cited as an excellent way to prove value and promote realized benefits to the public and policymakers, thereby drumming up support for future implementations of TSM&O.

Deployment Summary

The Coordinated Highways Action Response Team (CHART) is a joint effort of the Maryland Department of Transportation (MDOT), Maryland Transportation Authority, and the Maryland State Police, in cooperation with other federal, state, and local agencies. CHART's mission is to "*Improve mobility and safety for the users of Maryland's highways through the application of ITS technology and interagency teamwork."* This comprehensive and advanced traffic management system employs a state-of-the-art command and control center called the Statewide Operations Center (SOC). The SOC is the hub of the CHART system, functioning 24 hours a day, 7 days a week, with satellite Traffic Operations Centers (TOCs) spread across the state to handle peak-period traffic (*1*).

"This program started in the mid-1980s as the 'Reach the Beach' initiative, focused on improving travel to and from Maryland's eastern shore" (*1*). It has become so "successful that it is now a multijurisdictional and multidisciplinary program. Its activities have extended not just to the busy Baltimore–Washington Corridor, but into a statewide program" (*1*).

"The program is directed by the CHART Board, consisting of senior technical and operational personnel from the Maryland State Highway Administration, 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 Chief Engineer of the State Highway Administration (SHA)."" (*1*).

"The CHART program is comprised of a number of sub-systems, including traffic monitoring, traveler information, incident management, and traffic management. To support the monitoring and control activities of the SOC and the TOCs, a large number of field components and devices are being deployed, including a communications infrastructure, closed-circuit television (CCTV) system for traffic monitoring and complex interfaces to existing and new detection systems. To support the motorist's information needs, SHA is currently expanding its already extensive arsenal" (*2*) of dynamic message signs (DMS), highway advisory radio (HAR) transmitters, and MD 511 Interactive Traveler Information Service and the new MD 511 website. CHART DMSs are also used to display travel times to and from specific points of interest. "A media interface will also be added to the SOC system which will allow the media to access higher quality real-time traffic video to supplement" the web page's information. The "incident management capability will also be enhanced through the integration of all radio communications, local government communications, and [the] traffic signal systems activities" (*2*).

Initial System

The CHART program started in the mid-1980s to improve travel to and from Maryland's eastern shore. Over the years, CHART has invested a great deal of its operational effort in the reduction of delay due to non-recurring congestion. Based on statistics from the annual CHART Performance Evaluation (an independent study conducted by the University of Maryland), the average incident duration between 1997 and 2007 went from 45 minutes to 25 minutes as a result

of the program. In addition to focusing on measures of delay, safety was another key element of the system. Early and strong champions were noted as major success factors at the program's inception that have carried through to this day. Hal Kassoff worked at SHA for 25 years where, as the SHA administrator, he secured 100% federal funding in 1991 for the creation of the SOC and its subsequent opening in 1995; it was the nation's first statewide incident management and traffic management program. The SOC was later renamed the Hal Kassoff Statewide Operations Center in honor of his contributions. Thomas Hicks also promoted early advancement of the center. Mr. Hicks was the director of the Office of Traffic and Safety at SHA and mainstreamed the activities of CHART with SHA operations. As CHART matured, a third and a fourth champion (Parker Williams and Neil Pederson respectively, past SHA administrators) were credited with bringing business planning acumen to advance CHART.

After the official opening of the SOC in 1995, a 1995/1996 business plan was developed for the CHART program. From there, the program has continued to grow and mature, not only by adding more ITS infrastructure, but also by mainstreaming TSM&O within the agency. In 1997, CHART was made an official SHA office under the MDOT umbrella and now has its own operating budget with transparency and funding line items containing TSM&O in the Statewide Transportation Improvement Program (STIP) and the MDOT Consolidated Transportation Program (CTP), which is fed by projects included in the CHART Long-Range Strategic Deployment Plan (LRSDP) and the CHART Deployment Plan. In 1999, CHART began tracking performance measures and routinely works with the University of Maryland to report on the performance of the program.

CHART Business Processes

The CHART project planning and programming process usually begins with the project exploration and identification phase, where information is gathered from planning and design documentation, input from CHART operational staff, and operations and maintenance data related to infrastructure life expectancy. This information comes from the following sources:

- Baltimore and Washington, D.C., regional operations coordination committees' planning initiatives. Some CHART projects related to regional incident management have originated from these committees.

- Planned deployments from Maryland Statewide ITS Architecture. The CHART program bases capital improvement projects on planned system functionality and information exchange defined in the architecture.

- Other Maryland State Highway Administration (MDSHA) office projects with ITS. The office of CHART will often provide preliminary planning and integration support for projects that contain ITS from other MDSHA offices.

- MDSHA and CHART business plans. These business plans outline a process for tracking progress toward accomplishing the mission, vision, and values of the agency.

- CHART Nonconstrained Deployment Plan (NCDP). This plan depicts an ideal vision of how CHART should be operating several years in the future by tracking the latest technologies and operational applications available to the CHART program.

- CHART System Business Area Architecture. This document defines the current and future CHART system operational vision including business processes for relationships to organizations, technology, and facilities.

- CHART Management and Operations (M&O) Rural Strategic Deployment Plan. This plan defines strategies to support weather, evacuation, seasonal/everyday traffic, special events, and safety issues within the rural parts of Maryland.

Once capital projects are identified, high-level project summaries are created containing rough scope definitions, preliminary cost estimates, implementation schedules, needs addressed, and anticipated benefits. Together these summaries comprise an arsenal of projects that are put forth into the MDOT CTP when the time is right. The CTP includes project titles and costs (projected in yearly increments) to be programmed over a six-year period. It covers all modes of transportation and is updated annually. The office of CHART is responsible for contributing its portion of the six-year capital investment program within the CTP. The CHART Deployment Plan coincides with the six-year CTP and is updated annually. The Deployment Plan provides more detailed information on CHART projects that have started deployment, are close to project initiation, or are close to being programmed.

TSM&O cost estimates are explicitly included in the NCDP as an estimated percentage of capital costs. For field and infrastructure deployments, TSM&O estimates are based on 15% of total capital cost projections. Integration and communications deployments also are based on a 15% estimate. Software deployments are estimated at 4.6%. This percentage is significantly lower as it covers break-fixes in the originally developed software and not enhancements or new software. The NCDP defines operations and maintenance costs associated with the upkeep of future deployments, not current expenditures. The following TSM&O items are included in the NCDP: management staff hours, operational staff hours, maintenance staff hours, operational expenses, and maintenance expenses/equipment. Operations and maintenance cost estimates are derived using an incremental calculation that assumes CHART will build deployments in each year, amounting to one-twentieth of the total capital costs estimated for projects over 20 years.

Maryland's STIP is a four-year, fiscally constrained, and prioritized set of transportation projects for Maryland, compiled from statewide, local, and regional plans. The STIP is guided by the Maryland Transportation Plan (MTP), which establishes a long-term vision for Maryland's transportation network. The current STIP references the CTP, the six-year capital program for transportation projects for the years 2013 to 2017. Within the STIP, the CHART program has line-item funding streams for operations support, technical support, research support from the University of Maryland, and leased circuit systems. The STIP also incorporates funding streams for expansion of the systems through line items for installation of fiber and copper communication systems and variable message systems (VMS).

CHART operations generally focus on short-term, high-priority operational needs, such as the immediately necessary repairs and restoration needed after winter weather. At the other

extreme is the NCDP, which goes beyond defined projects to include functional visions without associated costs for situations where the technology is not there yet. CHART also is working on the development of a new plan with a time horizon of 20 to 25 years to more directly compete with the 20-year program for capital projects (e.g., infrastructure, preservation).

When an operational priority surfaces or when an unexpected state or federal funding source becomes available, a project may be initiated outside the realm of the formal planning process. Therefore, CHART has taken the approach to have a backlog of projects that are immediately ready for deployment. In order for these "on the ready" projects to take full advantage of such funding sources, the CHART program must also have on-call engineering contract vehicles so that the projects can quickly be contracted.

A performance evaluation and benefits analysis is conducted to aid in securing financing and setting priorities, which, as previously mentioned, has been independently prepared by the University of Maryland for more than 15 years (1996 to present).

In the year 2011 CHART has:

- Provided over 41,000 responses (assists and incidents);
- Produced a reduction in delay of 33.6 million vehicle hours;
- Maintained an average incident duration of approximately 22 minutes; and
- Produced annual user cost savings of $1.1 billion.

Funding

The CHART office of ITS development submits a budget request on an annual basis to fund TSM&O and planning and development projects, which are included in the program's strategic planning documentation. This request is then included in the legislative budget as a line item for CHART in the STIP and is based on statewide priorities.

The level of funding that is allocated to the program under the STIP is based on statewide transportation priorities. All CHART planning, development, and operations and maintenance (O&M) projects and funding needs, as presented in the program's strategic planning documentation, are submitted to the OPPE (Office of Planning and Preliminary Engineering) and OOF (Office of Finance) as part of this budgeting request. Considering this, 100% of CHART's budget requests are not always approved. What gets included and the associated level of funding is determined by state planners in the OPPE and the OOF.

The funding allocated to the program is never a fixed amount. The level of funding made available to the program is generated as part of a global analysis of needs and statewide priorities, which is why CHART is included as a line item in the STIP. Other areas are supported by the STIP and include projects such as highway development, bridge repair, and so on.

The Long-Range Strategic Deployment Plan (LRSDP) is a 20-year plan that presents planning, development, software, and operations and maintenance (O&M) projects for future deployment. Projects from the LRSDP are carefully selected for inclusion in the six-year CHART Deployment Plan, which presents and describes improvement projects that CHART will be responsible for within the MDOT CTP. The budget associated with these projects, as well as

funding needs for the CHART operations budget, are submitted to state planners for approval and inclusion in the legislative budget and, as a result, in the STIP.

Other CHART resources include funding through the Maryland Department of Transportation (MDOT) Consolidated Transportation Program (CTP), which is supported by sources such as the Congestion Mitigation and Air Quality (CMAQ) Improvement program, Surface Transportation Program (STP), and the National Highway System (NHS). Available grants, such as Urban Area Security Initiative (UASI) grants, are also a source of funding for the CHART program.

Good Practice

Establish and Maintain Strong Visionary Leadership

The statewide CHART concept matured quickly and benefitted greatly from the strong, visionary leadership of Hal Kassoff, Thomas Hicks, and Neil Pederson. In addition to their collective foresight and leadership skills, each brought a strategic area of expertise beyond transportation management, including financial planning and business planning. To maintain its cutting edge vision, the NCDP is updated annually to reflect a model CHART system without institutional and resource constraints. The NCDP addresses the challenge of long-term planning for ever-changing technology by including functional visions for situations where the technology is not there yet. This process also enables CHART to stay abreast of the latest advancements in ITS and be more prepared to deploy the latest transportation operations and technology applications.

Build Relationships and Meet Regularly

CHART member agencies include state, federal, metropolitan planning organizations, police, trucking associations, etc., and great emphasis has been placed on developing close partnerships among these stakeholders. This can only be accomplished by funding the effort to build relationships, define clear roles and standard operating procedures, establish communication protocols, and conduct training exercises.

Colocation is another major asset. CHART maintains the central software and architecture for the TMC and has many regional partners residing in the center. This arrangement leads to great flexibility for CHART to expand the system; for instance, if a regional partner, such as Baltimore City, would like to add a VMS and does not have the means to do so, CHART can fund the sign and add it to the CHART system software and operations.

An example of the importance of relationship building was cited: during a major incident, the success of the response increases when all responding parties know the rules of who is responsible for what; who is who at the scene; and who and how to contact those parties needed for addressing all elements of the response.

Use Operations Data to Set Targets and Promote Benefits

CHART was a pioneer in performance-measures–based planning and has incident data starting in 1999. Year after year, the incident statistics continue to prove the value of the CHART system. The overwhelming availability of new data has brought fresh energy to the CHART center. SHA

currently has access to INRIX data for travel times throughout the state via its participation in the I-95 Corridor Coalition. Having the INRIX data in the Regional Integrated Transportation Information System (RITIS) provides the information needed to quantify delays and estimate benefits. The data enable an understanding of the full distribution of recurring and nonrecurring congestion. The challenge the program now faces is that given the quantity and granularity of data available on the system, it must be determined how best to use the data to advance the program.

The CHART program also employs a benefit-cost analysis to track performance. Figure 1 (below) shows the 10-year historical trend (from 2002 to 2011).

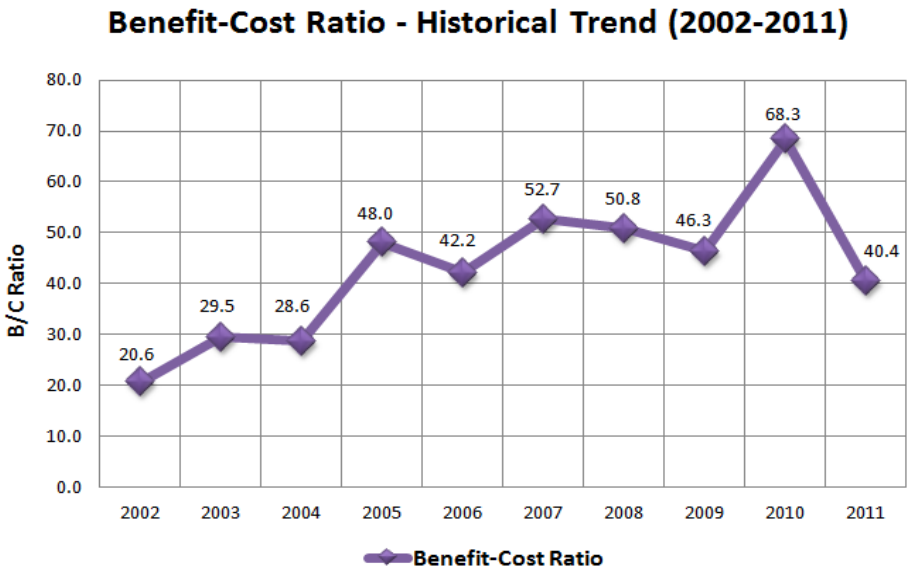

Figure 1. 2002–2011 benefit-cost ratio for the CHART program.

CHART routinely tracks and documents transportation performance in an annual report. The current report, the *2012 Maryland State Highway Mobility Report*, highlights the performance of the state highway systems and details the mobility-related efforts in terms of successes, challenges, and strategies for improving the transportation services delivered by SHA. Key CHART-related highlights and accomplishments as presented in the *2012 Mobility Report* (2011 data) are provided below:

- SHA's traffic monitoring, traveler information, incident management and traffic management program: CHART responded to and cleared more than 17,000 incidents and assisted more than 24,000 stranded motorists from Maryland roadways, saving approximately $1.1 billion in annual user costs for 2011.
- In August 2011, SHA launched the Maryland 511 traveler information service. This service, with its "Know Before You Go" theme, provides reliable travel information via the web or phone for state-maintained roadways. Available information includes travel times, incident and work zone lane closures, weather reports, connections to transit, the airport, and tourism information. This information helps Marylanders plan their travel for major events, long distance trips, and daily commutes.

- SHA partnered with State Farm Insurance to expand emergency traffic patrol coverage hours by 8,000 hours a year to optimize incident response along high-volume/high-incident routes.
- SHA collaborated with other regional agencies to increase camera video-feed interoperability, adding access to camera sites throughout Maryland and improving traffic monitoring and emergency response.

The safety benefits of the CHART program are tangible, as evident in their longstanding track record of improving incident management and reducing nonrecurring congestion (e.g., average incident durations were reduced by 41% between 2000 and 2007). Customers perceive mobility benefits through the convenient traveler information provided by CHART. Public stakeholders also receive great benefits from the system. CHART monitors and shares traffic information with other transportation agencies across the state through its network of operations and management centers. For example, CHART integrates cameras installed for the purpose of security and traffic monitoring into one place and shares those images with emergency responders and the U.S. Department of Homeland Security.

Outreach and spreading the word of what CHART can do in managing the statewide transportation system is another success factor for the center. CHART's reputation within the community is evident in a recent article in TheBayNet.com: *"The CHART website offers a treasure trove of travel information, snow emergency plans, real-time traffic camera views, weather information, average travel speed maps and incident-related road closure reports"(3).*

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Resources

The CHART website hosts a wealth of information on the CHART program and can be found at http://www.chart.state.md.us/ChartSystem/overview.asp

2012 Maryland State Highway Mobility Report can be found at http://roads.maryland.gov/OOTS/2012_Maryland_State_HIghway_Mobility_Report.pdf

More information on the INRIX data mentioned in the report can be found at http://www.inrix.com/

Performance evaluations of the CHART system are available at http://chartinput.umd.edu/

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2. Maryland Department of Transportation, Coordinated Highways Action Response Team. CHART Subsystems. http://www.chart.state.md.us/about/subsystems.asp

Florida Department of Transportation Case Study

Deployment Summary

Florida has a longstanding success in the deployment of ITS. In 2001, Florida completed the nation's first implementation plan for statewide 511 telephone-based traveler information services. Numerous ITS deployments have been deployed and updated over the years. The most recent ITS Annual Report for Fiscal Year 2010–2011 describes numerous accomplishments in the areas of traffic management center (TMC) software, standards, performance measures, communications, 511, commercial vehicles, traffic incident management (TIM), rural ITS, road weather management, and more. Today, Florida has a bright future as its program currently supports research and testing of the most advanced technologies and concepts, such as connected vehicles.

The Intelligent Transportation Systems (ITS) Office of the Florida Department of Transportation (FDOT) was established in 2000. In December 2003, the ITS Office was combined with the Traffic Operations Office and was renamed the Traffic Engineering and Operations Office. The ITS Office is now known as the ITS Program. ITS is widely adopted, accepted, and prioritized within the FDOT. State funding for ITS projects is set aside along with other designated programs, such as capacity and preservation. The funds are distributed according to a 10-year ITS Cost Feasible Plan, which is guided by the 20-year ITS Strategic Plan. The ITS program works collaboratively with the FDOT districts and Florida's Turnpike Enterprise (FTE), which works with the metropolitan planning organizations (MPOs), and local governments.

In 2010, the FDOT Executive Board endorsed the development of a separate program for Transportation Systems Management and Operations (TSM&O), prompting the development of its own strategic plan. TSM&O involves real-time active management and operation of the transportation system, which is dependent upon ITS technologies. The definition of TSM&O goes beyond ITS to encompass other operational strategies (e.g., work zone management, arterial street access management, and so forth) and therefore spans multiple offices and functions within the FDOT. Although there is no dedicated funding source at this time, a task team is currently evaluating the option for dedicated funding, especially on arterials.

FDOT Business Processes

The overall **2060 Florida Transportation Plan (FTP)** establishes long-range goals to provide a policy framework for expenditure of federal and state transportation funds through FDOT's Work Program. The FTP also provides policy guidance to metropolitan planning organizations (MPOs), local governments, and other transportation partners in Florida in making their funding decisions. The FDOT works with statewide, regional, and local partners to update the plan every five years. The most recent update in 2010 extended the horizon to 2060 and, for the first time, clearly included operations as one of the six primary goals: "Maintain and operate Florida's transportation system proactively."

In 1999, the FDOT adopted its first *ITS Strategic Plan*, which presented a 20-year vision for ITS in Florida and recommended strategies and guiding principles to achieve this vision.

Specific ITS deployment corridors and projects were identified. The *2005 Update of Florida's ITS Strategic Plan* evaluated the progress made to date, updated the vision to reflect current goals, and recommended core strategies based on new initiatives and advances in the state of the practice. The ITS Strategic Plan is consistent with the goals and objectives of the FTP. The ITS Strategic Plan covers the interstate and freeway system and provides direction at the local level to allow for the planning and deployment of ITS services that are consistent with the statewide mission. The update calls out operations and management (O&M) as one of the five guiding principles and includes nine specific strategies to address the preservation and management of the system.

The 2005 Update recommends that the FDOT work with each district to develop regional operating organizations (ROOs) to focus on the O&M aspects of ITS. The 2005 Update emphasizes the importance of developing a statewide O&M manual and district ITS O&M plans. A statewide study initiated in 2004 included a survey of national ITS O&M costs for the purpose of funding the TMC operations costs and equipment replacement costs associated with current and future ITS deployments. The results of this study secured an additional 8% of funding each year for O&M, over and above the funding already set aside for ITS capital deployment. The 2005 Strategic Plan Update also included an evaluation of district O&M functions to determine the most feasible activities for outsourcing. The 2005 update outlines the content of the statewide O&M Manual as follows:

- Provide a framework for the districts to use in developing O&M plans;
- Detail statewide O&M policies and procedures;
- Project O&M costs and resources over a two- to three-year period;
- Identify and project potential O&M funding sources;
- Recommend strategies for streamlining O&M activities; and
- Identify appropriate O&M activities for privatization.

Note: Individual districts produced their own versions of O&M manuals so the Central Office ITS Program decided not to produce one.

The 2005 Update includes the Tier 2 Business Plan, which functions as the short-term component of the ITS Strategic Plan by further detailing objectives and day-to-day activities. It maps the implementation of key ITS projects and initiatives to budget considerations and program priorities.

While the ITS Strategic Plan and Business Plan contain goals and projects, the 10-year ITS Cost Feasible Plan (CFP) ties these projects to a dedicated funding source for ITS capital deployments totaling $500 million for a 10-year period. The FDOT annually updates the ITS CFP, first created in 2002, to maintain a five-year planning horizon. In 2004–2005, this funding was increased by 8% annually to cover O&M costs (e.g., equipment replacement, contractor staff). Once the funding source was secured, the biggest challenge was how to fairly distribute

the funds among the seven districts, while addressing the different needs for urban versus rural deployments. At first the districts with little or no deployments received a larger monetary share to get started with ITS implementation, which reduced the funding available for other congested urban areas that wanted to expand their systems. Some districts have been able to secure additional funds for TSM&O outside of statewide managed funds. These are referred to as district managed funds, which, for example, may come from the county portion of the Statewide Comprehensive Enhanced Transportation System (SCETS) gas tax. District managed funds are distributed based on individual district priorities and require approval from local MPOs.

The 50-year FTP, 20-year ITS Strategic Plan, and 10-year ITS CFP all feed into the Statewide Transportation Improvement Plan (STIP), which in Florida is known as the Work Program. Although an STIP is required by the federal government to be updated every four years, Florida updates the Work Program on an annual basis rather than every four years. Annual updates are necessary to align with the legislative budget approval process and to enable the Work Program to be more dynamic and flexible. Also uncommon, the Work Program has a five-year horizon. It contains allocations for many funding codes, each with specific requirements and limitations. There are dedicated funding codes specifically set aside for ITS projects and other funding codes under which ITS and/or TSM&O activities are eligible (e.g., statewide managed Strategic Intermodal System funds for capacity enhancements). For compatibility, each of the 26 MPOs produces a Transportation Improvement Plan (TIP) following the same planning horizon and update schedule, since the TIPs are incorporated into the STIP. In addition to the funds in the Work Program, there is some opportunity to fund TSM&O under Florida's operating budget (e.g., utilities for traffic management centers and ITS field devices, non-contracted operating personnel, and so forth).

The ITS CFP currently covers the Interstate and freeway system and a limited number of arterials that access those highways. The FDOT is now facing the challenge of determining how best to program ITS for arterials, recognizing the importance of system integration and interoperability. Staff are conducting a major outreach effort to understand the operations and maintenance of the signal systems within each district. Funding for TSM&O related to arterials is currently allocated at the district level through MPOs.

The initial draft of the TSM&O Strategic Plan was developed in 2010. It has a three-year horizon and contains its own TSM&O Tier 2 Business Plan. The FDOT's TSM&O program is based upon performance measurement, active management of the multimodal transportation network, and positive safety and mobility outcome delivery to Florida's traveling public. The plans describe activities needed to deploy TSM&O in terms of people, processes, tools, and changes to policies. The TSM&O Program encompasses a wide variety of functions and operations solutions available within the FDOT, spanning planning and development, construction, system operations, and maintenance. Figure 2 graphically depicts this relationship. Any TSM&O occurring at a district level is currently funded by the district. A statewide funding source for the program will be sought in the near future.

Source: **http://www.dot.state.fl.us/trafficoperations/TSMO/documents/2011-Feb-16-TSMO_Strategic_Plan-DRAFT-v0-9-1.pdf**

Figure 2. TSM&O program components.

Good Practice

The following summarizes the key best practices and lessons learned toward mainstreaming TSM&O into the transportation planning and programming process in Florida.

Research Supporting Facts

The FDOT conducted research from across the nation to prove the need to allocate appropriate funds for O&M. They identified what O&M activities were needed and studied the related costs. Districts were surveyed to determine reasonable costs, as they differ depending on deployment types and location within the state. The research also looked into the spectrum of available ITS systems, from the least expensive to the most well-appointed. This included evaluating the optimum number of staff required in a traffic management center (TMC). They presented this comprehensive study based on defensible facts to the executive board at the July 2004 Executive Board Workshop and successfully obtained an 8% increase in ITS funding specifically for the O&M of ITS.

The FDOT's executive board is composed of the department's secretary, eight district secretaries (including the executive director of the Turnpike Enterprise) and several other important decision makers who make the department's major decisions that impact Florida's

transportation systems. They meet once a month for the executive workshop to discuss and decide the FDOT's business.

Set Criteria for Distribution of Funds

The FDOT has found it challenging to determine the fair distribution of funds among the districts. At first, the new O&M money was distributed evenly among the districts based on the average. This was not well received, as urban districts argued that they needed more funds than rural areas where there is less deployment to operate and maintain. The FDOT is considering factoring in urban versus rural considerations when allocating future funds.

Forward Thinking Managers

They have been fortunate to have a lot of support from managers that are receptive to new technologies and methods for improving transportation. The funding source has been continuous and the ITS program is considered mainstreamed. The support for TSM&O is further evidence of the commitment from decision makers.

Partnerships at District Level Are Critical

The FDOT recognizes that there are different needs for different districts around the state. System deployments and TSM&O needs vary, sometimes widely, around the unique characteristics of each subarea. As there is no one-size-fits-all approach, successful statewide planning and programming requires strong communication and partnership with district leaders so their unique needs can be met.

Within each district, it also is important to invite emergency responders and other key stakeholders. Even though they may choose not to participate on a consistent basis, their input is valuable and always welcome. This inclusive spirit during the planning process fosters collaboration in the field.

Evaluate Past Performance and Build on Success

The 2005 update of the ITS Strategic Plan included an assessment of the projects that were completed and under way during the first three years in which the original plan had been established. The tangible benefits achieved from these first projects helped prove their worth by documenting successes and providing a baseline on how best to focus future resources.

Acknowledgments

The authors appreciate the valuable time and information provided by Elizabeth Birriel, Daniel Cashin, and Yvonne Arens of FDOT whose thoughtful insights made this case study possible.

Resources

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Minnesota Department of Transportation (MnDOT) Case Study

Deployment Summary

The ITS Program in Minnesota began with a small traffic management center (TMC) in 1972 in downtown Minneapolis that was gradually expanded in response to increased traffic demands. In 1991, Minnesota Guidestar was formed, where Guidestar represents the overall statewide ITS program initiatives. The Regional Transportation Management Center (RTMC) in Roseville, Minnesota, at the Metro District's offices was opened in 2003 and contains three areas of transportation monitoring and incident response: freeway and arterial traffic and incident management; Metro District Maintenance dispatch; and State Patrol dispatch. One of the workstations in the RTMC is shown in Figure 3.

Through the years, the ITS program has continually expanded to its current state of a fully deployed, robust, metropolitan ITS system on freeways and is being deployed on arterial highways in the Twin Cities. There are also significant ITS deployments in the regional metropolitan centers throughout the state and in each of the DOT's districts. MnDOT's ITS program on freeways in the Twin Cities is viewed as a mostly built-out mature program in terms of traditional ITS techniques. There is a dedicated emphasis on continued research; targeted enhancements and expansion; and operations and preservation of the existing system. MnDOT consistently performs a broad range of ITS activities, including operations of the existing system; needs assessments; research and development; full-scale operational testing; and deployment of ITS strategies and technologies.

Minnesota Guidestar is managed by the MnDOT Office of Traffic, Safety and Technology (OTST). Guidestar has been key in advancing ITS technologies and programs to help achieve statewide and local transportation objectives. Most of Minnesota Guidestar's early work focused on the Twin Cities metropolitan area. Numerous operational tests evaluated a variety of ITS concepts and technologies. Guidestar partners with numerous public, private, and academic partners to conduct ITS research, operational tests, and deployments.

Figure 3. MnDOT's RTMC (2013).

More recent operational tests conducted through the Guidestar program include the Integrated Corridor Program along the western suburbs of Minneapolis and the Urban

Partnership Agreement (UPA). The UPA is a set of initiatives for commuters to experience more transportation choices and less traffic congestion on some of the busiest roadways in Minneapolis. The initiative accomplishes this through a combination of technology, transit, road pricing, and telecommuting strategies and deployments. Other programs include MnPASS Express Lanes, which are designed for solo drivers to use the high-occupancy vehicle lanes by paying a fee via electronic tolling, and deployments of rural intersection conflict warning systems (an operational test of the connected vehicle program) and managed lanes.

The metro area has a strong incident response program, the Freeway Incident Response Safety Team (FIRST) program that quickly clears stalled vehicles, crashes, and debris. The primary purpose of the FIRST program is to minimize congestion and prevent secondary crashes through quick response and removal of incidents. A secondary benefit to the program is aiding stranded motorists. This program has been very popular with the public.

MnDOT's ITS Program Business Processes

The TMC and its replacement, the RTMC, were funded primarily by state highway construction funding and CMAQ (Congestion Mitigation Air Quality) funding. The funding for the expansion throughout the Twin Cities freeway system has been largely independent of the dedicated ITS funding except for a few expansion projects in recent years. This is because the RTMC purpose is primarily focused on its operation and management function in contrast to the ITS program being more focused on research and operational tests. However, the coordination between the RTMC and the ITS program continues to strengthen as the two program purposes and geographical areas continue to overlap.

Early MnDOT ITS development occurred prior to 2004 using earmark-designated funding along with state monies to meet the required matching funds. These early successful operational tests allowed upper management in the agency to understand the benefits of a strong ITS program. Once the dedicated earmark funding no longer flowed to the state, the matching level of funds remained available to further grow the program. In 2006, the division directors reaffirmed the agency's commitment to funding the program using the level of matching funds of previous years. Current ITS funding includes $2.5 million per year in ITS state matching funds, $1.5 million per year in STP Federal District C funds, and other sources such as the U.S. Department of Transportation (U.S. DOT) project initiatives that are competed for and require a state match.

MnDOT initially focused on the mobility aspects of ITS development to address congestion issues in the state. In recent years safety has become a top priority. The ITS development projects are typically funded with ITS funding and led by the OTST ITS Section. These projects are generally experimental or seed projects that determine the best techniques for applying an innovative device or process to the transportation system.

ITS deployment projects are typically permanent projects that deploy proven ITS systems for ongoing operations on the transportation system and are typically led by MnDOT districts and funded with regular construction funds. For example, the RTMC along with its extensive freeway management system was constructed using mostly regular construction funds. ITS

deployment projects originate from the normal district planning process, U.S. DOT project initiatives, or governor and/or department initiatives.

The RTMC is no longer significantly expanding the miles of freeway covered, but rather focusing on an "operate and maintain" mode. At this point, additional deployments of ITS elements in the metro area would be supplemental, with an isolated addition as a need is identified, but no large geographical expansions are anticipated in the near future. The exceptions to this are the potential for Advanced Traffic Management techniques involving high-occupancy toll (HOT) lanes, dynamic lanes and shoulders, lane control signs and dynamic speed signs to be employed in areas currently covered by the traditional freeway management system techniques.

The MnDOT Planning Group is currently updating its STIP. The 20-Year Minnesota State Highway Investment Plan 2014–2033 (MnSHIP) will support the state's guiding principles and link the policies and strategies laid out in the Statewide Multimodal Transportation Plan to capital improvements on the state highway system. A new component to the process has been introduced to include a four-year STIP project cycle plus an additional six-year look (or 10 total years) at a higher level, more broadly based highway investment plan. This plan has gone through the development stages and will be outlined to state legislators this summer. This higher-level 10-year view is very exciting for the agency.

The MnSHIP process defines and categorizes investments into 10 categories that make up five key groups of highway projects. ITS projects that would be classified as capital preservation projects (not operations) are included in the group "asset management" and category "roadside infrastructure condition." ITS capital improvement projects fall under various other categories such as Twin Cities Mobility, Inter-regional Corridor Mobility, and Traveler Safety. Previous long-range plans (LRPs) have included the Active Traffic Management project as a priority along with the UPA project and MnPASS project; all of these are examples of ITS projects competing for funding and being included alongside traditional bridge and pavement projects in the planning process. The MnSHIP plan development process is shown in Figure 4.

Figure 4. Screen capture of the 10 investment categories by key groups of highway projects.

Another important planning document is the Highway System Operations Plan that describes the operations and maintenance (as opposed to capital) funding needs for operating and maintaining the highway system, including ITS components. This plan is based on risk analysis of the gaps between targeted operations and maintenance activities and the available resources.

The planning group is also responsible for the Congestion Mobility Safety Plan. This plan focuses on mobility issues addressed with low-cost solutions. Performance data analysis out of the RTMC supports this effort.

Another big change is the influence of the Moving Ahead for Progress in the 21st Century Act (MAP-21) in funding programs. Before MAP-21, districts had a lot of latitude and received formula funding. The updated distribution under MAP-21 is centrally funded, based on performance reporting. For example, there are performance management criteria where funding levels are set with pavement and bridge performance data. A number of ITS performance measures have been identified and are being tracked and monitored as part of MnDOT's overall performance reporting system and as detailed in the statewide Highway Systems Operations Plan (HSOP). Data on performance and investment levels for incident clearance time on metro freeways and FIRST coverage have been tracked and reported since the mid-1990s. The percentage of the Twin Cities freeway system that is congested has been reported since the early 1990s. Other categories under traffic management include metro signal timing and ITS maintenance. The plan makes a commitment to further expand and enhance the use of performance measures in tracking ITS elements.

Metro RTMC has learned that a greater emphasis on quality design and installation can greatly reduce operational expenses. For instance, Metro has a high quality standard for loop detectors, noting that a bit more effort in the design and installation stages has resulted in loop detection that is more accurate and reliable.

Good Practice

Establish and Maintain Strong Leadership

MnDOT upper management has always provided strong support and leadership for the ITS program as it has developed and matured. Ideas flow down to the operational level from management and vice versa, rather than only a bottom-up process. This is a strong testimony of upper-management support. The ITS program has representation in many cross-cutting areas in the agency including the Metro District, other MnDOT districts, OTST, Office of Planning, and Office of Maintenance. Each office within MnDOT plays a critical role and distinct stewardship for monitoring and advancing the ITS program.

Recognize Where You Are

MnDOT is focused on the operations and preservation of the Metro ITS program. Understanding the system has reached a point where expansion is no longer the focus and monies must be committed for maintenance and preservation.

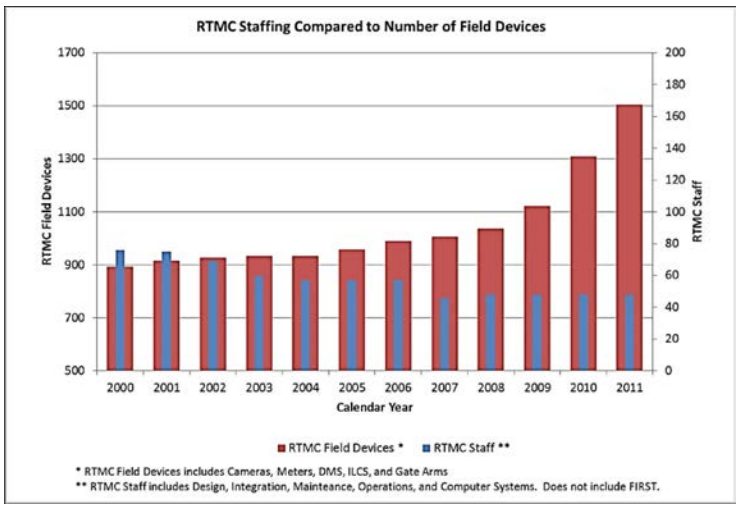
At the same time, the agency is committed to a continued funding stream to research new and emerging technologies and provide seed money for statewide deployments.

Build Relationships

Minnesota Guidestar is managed by the MnDOT Office of Traffic, Safety and Technology in conjunction with numerous public, private, and academic partners to conduct ITS research, operational tests, and deployment projects. The Minnesota Guidestar board is unique in its support and promotion of ITS in the state. The unique makeup of the Guidestar board allows a natural springboard for information transfer and sharing of information regarding the ITS program.

Keeping a Constant Eye—Doing More with Less

Public agencies across the country are being asked to do more with less: less funding to expand and maintain systems and less staff to conduct business. MnDOT has had to face these same challenges. In the years between 2000 and 2011, the ITS program expanded with additional field devices and whole staffing for the RTMC was reduced. The number of ITS field devices managed by the RTMC in that timeframe increased 68%, while staffing for the RTMC decreased 38%, as shown in Figure 5. This is a constant balancing act for the department and is tracked and reported on in the HSOP.



Source: Figure 3.23 HOP 2012–2015, pg. 92.

Figure 5. RTMC staffing compared to number of field devices.

Acknowledgments

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Resources

The Guidestar website hosts a wealth of information on Minnesota's ITS program and can be found at: http://www.dot.state.mn.us/guidestar/

20-Year Minnesota State Highway Investment Plan 2014–2033 (MnSHIP) can be found at http://www.dot.state.mn.us/planning/statehighwayinvestmentplan/index.html

Statewide Highway Systems Operations Plan (HSOP) can be found at http://www.dot.state.mn.us/maintenance/hsop/

More information about the Minnesota Urban Partnership Agreement can be found at http://www.dot.state.mn.us/upa/

More information about the MnPASS program can be found at http://www.mnpass.org/

Washington State Department of Transportation Case Study

Deployment Summary

The Traffic Operations Division at the Washington State Department of Transportation (WSDOT) is a distinct group with distinct funding. Activities under Traffic Operations include incident response, system operations, traditional traffic engineering, ITS research, ITS planning, and more. Traffic operations and tolling overlap from a traffic management perspective, with high-occupancy toll (HOT) lanes in place. Although the Toll Division is a separate group with a separate budget, the Traffic Operations Division and the Toll Division work together inside the integrated approach that is part of WSDOT's culture.

WSDOT has benefitted from the continual deployment of innovative ITS deployments and operational traffic management strategies over the course of many years. WSDOT operates seven regional Traffic Management Centers (TMCs), where real-time information is gathered 24 hours a day, 7 days a week from sources including traffic detectors, CCTV cameras, ramp meters, the Washington State Patrol (WSP), road crews, WSDOT's incident response teams, and media traffic reporters. Perhaps they are best known for their longstanding real-time traffic monitoring and management program, which provides valuable data to support real-time operations, performance-based planning, and informed decision making. Since May 2001, WSDOT has used this data for developing performance reports that are published in the Gray Notebook, a quarterly accountability report with the latest information on system performance and project delivery.

Beyond the traffic data detectors being used for traffic monitoring purposes, WSDOT operates closed circuit television (CCTV), variable message signs (VMS), road weather information systems (RWIS), highway advisory radio (HAR), and ramp meters. Beyond these longstanding, more traditional deployments, WSDOT operates high-occupancy vehicle (HOV) lanes that also function as HOT lanes on SR-167. This strategy has proven to be a successful example of TSM&O, where HOV lanes are open to solo drivers who choose to pay a dynamically priced toll to ensure traffic in the HOT lane is free flowing even when the regular lanes are congested.

The recent implementation of active traffic management (ATM) technology on four corridors is a testament to Washington's commitment to innovation. WSDOT is the first state transportation agency to use the system in the United States. The ATM system uses overhead speed limit signs to provide advance notice of traffic conditions such as slowdowns, backups, and collisions ahead. The warnings provided by the system are designed to decrease the likelihood of collisions by reducing last-second avoidance maneuvers and panic braking.

WSDOT Business Processes

The transparency provided by the Gray Notebook instills a sense of confidence to the public that WSDOT knows exactly what is happening on the roadways and how traffic operations and management strategies have impacted travel conditions. Since it was first published in 2001, these hard facts have demonstrated that ITS and TSM&O strategies provide important benefits in

safety, mobility, and efficiency. As the public and decision makers continue to experience the benefits, they are more favorable toward investing in such strategies.

Gas tax increases were put into effect in 2003 and 2005 by the Nickel and Transportation Partnership Act. These funding packages were tied to a specific project list, and therefore those funds are unavailable for any other uses for the next 25 to 30 years. Capital ITS investments were made as a direct result of those funds, but not for TSM&O activities. In 2008, the region was expected to pass a supplemental gas tax to complete some of those projects, but it failed. In the absence of these regional funds, the Moving Washington approach was born to bridge the gap until more funding became available. Moving Washington concepts, policies, and strategies are centered on maximizing efficiency and shifting the way of thinking toward a more integrated approach for project development and operations.

Moving Washington is a framework that drives the planning process and lays out the transportation program's guiding investment principles. The highest priority in the Moving Washington approach is to "Maintain and Keep Safe." Three overarching strategies are combined to address this priority in an effort to integrate investments for cost-effective solutions. The program's primary strategies are depicted in the Moving Washington logo, as shown in Figure 6.

Source: www.wsdot.wa.gov/Movingwashington

Figure 6. Moving Washington logo.

1) Operate efficiently: This approach gets 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.

2) Manage demand: Whether shifting travel times, using public transportation, or reducing the need to travel altogether, managing demand on overburdened routes allows the entire system to function better. Strategies include using variable-rate tolling in ways that reduce traffic during the most congested times and that balance capacity between express

and regular lanes; improving the viability of alternate modes; and providing traveler information to allow users to move efficiently through the system.

3) Add capacity strategically: Targeting the worst traffic hotspots or filling critical system gaps to best serve an entire corridor, community, or region means fixing bottlenecks that constrain the flow. Upgrading a failing on-ramp merge or hard-shoulder running during peak periods can free up the flow of traffic through a busy corridor. From improving rail crossings and ferry service to working with transit agencies to connect communities, from building direct-access ramps for carpools and transit to including paths for pedestrians and bicyclists, capacity improvements require strong partnerships with a shared vision for the corridor (1).

The state of Washington has benefitted from a strong history of applying cutting-edge operations strategies through the federal grant process. Moving Washington strives to mainstream operations by integrating the approach for making capital and operations investments. Rather than operations strategies competing with capital projects for funding, Moving Washington encourages implementing a combination of strategies to maximize efficiency and throughput. For example, the state might address a deficiency with a cost-effective operational strategy to delay and complement a larger infrastructure investment in the future. WSDOT's focus on integrating ITS into traditional projects is closely linked to the maintenance program, as the state's TMCs are all partially financed by maintenance funds. The Moving Washington framework encourages broad oversight to highways so that the various groups work together before the budget process.

The strategies in Moving Washington are being reflected in each of the state's transportation planning documents as they get updated over time. The declaration of the three operationally focused strategies affirms the state's commitment to mainstream the consideration of TSM&O strategies into all planning and programming activities.

The 20-year Washington Transportation Plan (WTP) is a visionary document that offers policy guidance for all jurisdictions statewide on matters related to the transportation system. The WTP serves as the federally compliant statewide Long-Range Transportation Plan (LRTP) (2) It promotes data-driven decision making and identifies the top transportation investment priorities in the state. The WTP is based on a continual systemwide performance measuring and monitoring program. Assets that don't meet established performance threshold criteria are identified as needs. WSDOT develops cost-effective strategies, based on analysis of performance outcomes and best management practices, to provide high-benefit solutions for identified needs. WSDOT aims first to maintain, preserve, and improve the operating efficiency of the existing highway system before adding to the system (3). The most recent update to the WTP covers the period of 2010 to 2030 and identifies six policy goals: economic vitality, preservation, safety, mobility, environment, and stewardship. Strategies for ITS or TSM&O can directly support nearly all of these goals, which are specifically addressed under mobility.

The Washington State Multimodal Transportation Plan (SMTP) is the state's overall 20-year transportation plan, which covers facilities that the state owns and those in which the state has an interest. The Washington State Highway System Plan (HSP) is the state highway component of the SMTP. The HSP addresses current and forecasted state highway needs based

on the investment options identified in the WTP. The HSP is updated every two years and includes constrained lists of identified congested segment needs, specific prioritized strategies for addressing them, and performance measurements to determine the effectiveness of these strategies.

The HSP informs the 10-Year Capital Improvement and Preservation Program (CIPP), with a biennial budget discussion. The CIPP outlines categorical investments and is not project specific. Relevant to TSM&O, the first priority listed in the capital program is to "Operate and maintain the existing system to maximize efficiency and effectiveness. Improve performance of the system through variable pricing and other traffic management tools"(4). TSM&O investments can be funded under multiple categories, including traffic operations and highway construction.

Before the 10-year CIPP was introduced, Washington had a two-year financial planning cycle. During that time there was more competition for funds between capital and operations projects. Each capital program (highway, rail, bridge, etc.) independently brought its individual programs forward. Once Moving Washington was introduced, the new 10-year planning process facilitated discussions of trade-offs, timing, and strategic investments. As a result, all the capital programs became more consistent and complementary. The focus was shifted to the entirety of the transportation system.

Stemming from the CIPP are the six-year Business Directions: WSDOT's 2011–2017 Strategic Plan and the four-year State Transportation Improvement Program (STIP). The Strategic Plan sets out the objectives and strategies that the agency will focus on over the next six years. It guides budget investment decisions and provides direction for WSDOT division- and program-level business plans. A key focus area in the Strategic Plan is to "enhance transportation system and agency efficiency through performance-based investment decisions (5)"

As required by the Federal Transportation Act, the 2013–2016 STIP is a four-year, fiscally constrained prioritized program of transportation projects, compiled from local and regional plans, along with the WTP. Since WSDOT is limited by statute to a two-year capital construction program and local agency capital programs are adopted annually through their commissions and councils, it is difficult to cover a four-year horizon. The projects to be implemented are tied to current and/or reasonably available funds (6).

Good Practice

The following summarizes the key best practices and lessons learned toward mainstreaming TSM&O into the transportation planning and programming process in Washington State.

Advertise Your Success and Be Transparent

One of the five strategic drivers in the WTP states that it is critical to educate, inform, and reach out to the public. Broad community outreach and efforts are needed to raise awareness about the critical role that transportation plays and the need to ensure continued investment in the system. An important aspect of this is figuring out what's important to the public in terms of performance measures. Travel time and delay are meaningful and easy to understand, as opposed to level of service. By reporting to the public, policy makers get the message, too.

The Gray Notebook reports the facts, both good and bad. Performance reporting means being transparent to the public about exactly what is happening on the roadways. Use dashboards and graphics to help communicate impacts rather than tables filled with numbers.

Clearly Define "Deficiency"

Beyond advertising successes, the traffic monitoring and management program helps identify needs and deficiencies. WSDOT is working on redefining a deficiency in terms of the end goal. For example, aim to achieve maximum throughput rather than a percentage of the posted speed limit.

Focus on Maximizing Revenues

Remove the competition between operations and capital projects by tying them together. Operational strategies are low cost, high return, and quicker to implement. Investments in operational strategies bring in value in the near term, can postpone the need for a major capital project, and will eventually serve to complement the inevitable big investment later.

Stay the Course

It takes time to visibly prove and experience the value of TSM&O investments. Variable tolling was recently implemented. Some say the public perceived it as a government intrusion rather than an optional toll as a demand management strategy. More time is needed so the public can see and understand the benefits. In turn, it is WSDOT's responsibility to demonstrate to the public that these strategies will be implemented only where it makes sense.

Further Interact Planning and Operations

With planning and operations working together, the planning process will result in more balanced programs.

Necessity Is the Mother of Invention

During financially challenging times, consider an overarching framework like Moving Washington that can help shift the way of thinking toward a more collaborative effort to improve efficiency using lower-cost solutions.

Encourage a Data-Driven Investment Strategy

Encourage decision makers to make investments based on anticipated benefits and proven performance rather than specific projects. Provide an analysis of alternatives and help them understand how their decision will impact other investments within the overall constraints of the statewide plan.

Keep Working At It

The process for mainstreaming TSM&O is still developing at WSDOT. The planning, operations, maintenance, and tolling groups check in with one another and coordinate. For example, multiple sign-offs are needed on corridor plans to ensure that there is an integrated approach. Although they are coordinating on an ad hoc basis, no official forum exists for routine collaboration.

In addition, WSDOT is open to using new analysis tools and strives to enhance its processes for benefits analysis. Quantifying the specific benefits of operational strategies is a challenge in the overall national discussion on performance analysis and performance management. As such, WSDOT is still learning and refining the analysis tools it uses to make decisions. There is always room to improve.

Acknowledgments

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