Introduction

This factsheet is based on past evaluation data contained in the ITS Knowledge Resources database at: www.itskrs.its.dot.gov. The database is maintained by the U.S. DOT's ITS JPO Evaluation Program to support informed decision making regarding ITS investments by tracking the effectiveness of deployed ITS. The factsheet presents benefits, costs and lessons learned from past evaluations of ITS projects.

Transportation or traffic management centers (TMCs) or transportation operations centers (TOCs) are an integral part of a transportation system. TMCs are responsible for operating the latest Intelligent Transportation System (ITS) technology including data collection, command and control of ITS devices, incident response, and communication for transportation networks. As deployments of ITS have increased over the last decade, state DOTs are continuing to implement TMCs to focus on the operations of their systems. TMCs are the focal point for agencies as they look to operate their transportation systems as efficiently as possible with the existing ITS infrastructure. New concepts are leading to the more effective use of the conventional ITS devices in the field.

Recent initiatives and concepts such as Integrated Corridor Management (ICM) and Active Traffic and Demand Management (ATDM) integrate more functionality into a single center for more responsive or even predictive traffic operation strategies. TMCs will be at the center of operating and maintaining these new systems. At the heart of ICM is a decision support system which consists of the set of procedures, processes, data, information systems, and people that support transportation system managers in making coordinated decisions to improve the collective performance of all transportation networks within a corridor. ICM seeks to integrate freeway, arterial, and transit systems together to make the entire transportation network more efficient.

ATDM is the dynamic management, control, and influence of travel demand, traffic demand, and traffic flow of transportation facilities. Through the use of available tools and assets, traffic flow is managed and traveler behavior is influenced in real-time to achieve operational objectives, such as preventing or delaying breakdown conditions, improving safety, promoting sustainable travel modes, reducing emissions, or maximizing system efficiency.
Under an ATDM approach, the transportation system is continuously monitored. Using archived data and/or predictive methods, actions are performed in real-time to achieve or maintain system performance. Both ATDM and ICM are being deployed across the country. Two U.S. DOT ICM Pioneer Demonstration sites (Dallas and San Diego) went live with systems in early 2013.

Other technology trends that are impacting TMCs are big data, social media and crowdsourcing, and the continual growth of mobile and wireless communications. TMCs are collecting more and more data every day with the potential for data directly from vehicles in the near future. Social media is being used more and more for traveler information, while crowdsourced data is being used to gather data from drivers to obtain travel times, incidents, and other roadway information from driver reports [1].

Smartphone applications are beginning to provide real-time individualized traveler information to users through crowdsourced data. These applications could be greatly enhanced with involvement from TMCs by simply collecting and providing data to the applications and eventually the individual users. For example, data that in real-time can track the status of incidents on the roadway would be of great value to application developers and their end users [2].

**Benefits**

Benefits enabled by TMCs vary depending on the purpose and functionality of the TMC. Many TMCs are currently focused on freeway, arterial, or transit operations. Figure 1 shows ranges of benefits for select entries in the ITS Knowledge Resource database at: [http://www.itsknowledgeresources.its.dot.gov/](http://www.itsknowledgeresources.its.dot.gov/). Benefits can be seen with many different measures across multiple goal areas including mobility, safety, and the environment. In this case, TMC benefits include incident clearance time, delay reduction, queue reduction, crash reduction, and travel time.

![Figure 1: Range of Benefits for Transportation Management Centers (Source: ITS Knowledge Resources).](image)

The online versions of the factsheets feature interactive graphs that contain all the data points included in the ranges. Here, each metric has a number after the text, representing the number of data points used to create the range; no number means only there was only one data point.

The travel time reduction benefits in Figure 1 are based on an advanced traffic signal system in New York City. The key to this project was the adaptive decision support system that resided at a TMC facility for NYC. The system uses historic data as well as real-time conditions to determine the optimal operation of the signals. If a new plan is needed, it is
presented to an operator for visual verification of conditions using the CCTV cameras before it is initiated. With this real-time congestion management system in place, NYC DOT was able to achieve 10 percent reductions in travel times through the initial corridor (2012-00810).

Costs

TMCs are a critical component of the shift in emphasis of state DOTs from building infrastructure to managing and operating the existing systems. Operations and Maintenance (O&M) is one of the largest portions of a TMC cost, as shown in Figure 2. This column represents annual O&M costs as reported by seven agencies. The large range can be explained by size of the agency (statewide or local) as well as the TMC housing a single agency or integrating multiple agencies into a single TMC. Personnel costs are generally the greatest percentage of O&M costs. The construction costs in Figure 2 cover planning and building a TMC, and the equipment costs include general hardware such as computers, servers, and video walls.

Costs for TMCs vary dramatically depending on the functionality of the TMC, if it is a multi-agency or multi-jurisdictional TMC, level of ITS deployment required, and the communication costs. Regardless of the specific functionality, the highest portion of the cost of a TMC over its useful life will likely be in the Operations and Maintenance of the centers and its systems.

Lessons Learned

The report titled Impacts of Technology Advancements on Transportation Management Center Operations identifies many of the trends discussed in this fact sheet in TMC operations. The report lists several lessons to help TMCs move forward with new technologies and tools (2013-00642):

- **Develop a data fusion engine to merge data from multiple sources, such as travel time information coming from toll tag readers, Bluetooth sensors, and/or third party providers.** An automated data fusion engine is designed to integrate multiple forms of raw data from different types of sensors, process and arrange the data into subsets, and present them in a way that provides a clear, more accurate picture for the operator to draw conclusions from, creating situational awareness.

- **Develop procedures and protocols for use of social media.** Develop a uniform policy for DOT use of social media, such as Facebook, Twitter, and video distribution platforms such as YouTube, among others. Social media can provide an important connection to users to disseminate travel warnings and alerts, as well as promote projects or public interest campaigns.

- **Support two-way information exchange via social media.** Social media can provide a valuable tool to reach out to travelers and residents, but also can provide an important source of data for the TMC.
• Utilize crowdsourcing for traffic information, incident information, and feedback on department performance, pavement roughness, etc. Crowdsourcing would enable real-time feedback from users on a variety of transportation issues and impacts, with an emphasis on crowdsourced information.

Case Study – Idaho Statewide Communications Center

While TMCs can be a critical part of a region's transportation network, they are also costly to the transportation departments that must build, operate, and maintain them. Across the country, more and more TMCs are being used to co-locate transportation operations staff and other agencies, such as public safety and emergency departments. This allows for resource sharing and more efficient transportation networks.

The Idaho Statewide Communications Center is under the Idaho Department of Health and Welfare with a customer base in emergency medical services and hospitals [3]. The Statewide Communications Center serves the entire state of Idaho. It is a 24 hour, seven days-a-week dispatch for the Idaho Transportation Department (ITD) that includes dispatching maintenance vehicles and snow plows. It also dispatches 15 rural Emergency Medical Service (EMS) units (county and community based) and provides communications to public health departments for the state and the seven districts. In addition, the communications center provides public health emergency notification, and is the point of contact for the Idaho Bureau of Homeland Security for Weapons of Mass Destruction and Hazardous Materials. The Statewide Communications Center also works with the Department of Environmental Quality, FBI, EPA and other local state agencies.

This unique partnership has allowed for the development of applications that other standalone TMCs may not be able to handle. For example, the Condition Acquisition Reporting System (CARS) MAYDAY project brings OnStar data from a crash vehicle and uses an urgency algorithm to provide a real-world real-time data feed that predicts injury. The urgency algorithm (developed by the University of Florida) gathers the change in velocity, air bag deployment information, and other on-board data to estimate the probability of injury to occupants. The information comes into the Statewide Communications Center screens and places an icon on the screen representing the vehicle with direction of travel before the crash, and automatically displays the appropriate dispatching organization to contact. It also triggers dispatcher reminder boxes (early notification to hospital, need for helicopter on standby etc.). They are presently in the evaluation stage and validating the probability of injury scores.

The information provided by the system is not currently being acted upon until the system is validated; a larger number of incidents are needed to validate the system. Because Idaho is rural, it may take 1 to 2 years to validate. Once validated, the Statewide Communications Center supervisor plans to approach other systems similar to OnStar to expand the system. This unique center that operates 24/7 with operators that are all EMS trained can handle this type of information easily. And with the same operators responsible for handling the Idaho DOT message signs and other ITS, the transportation system will be able to respond quickly and appropriately to the situation.

References


All other data referenced is available through the ITS Knowledge Resources Database, which can be found at http://www.itsknowledgeresources.its.dot.gov/.