ITS DEPLOYMENT EVALUATION

Executive Briefing


Source: FDOT

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Highlights

- New data sources are enabling greater situational awareness for roadway networks not previously possible under prior generations of traditional infrastructure-based data collection.
- Virginia Department of Transportation study finds that non-traditional messages on highway message boards are more memorable and effective at changing driver behavior.
- The City of Austin, Texas underwent a recent TMC expansion project that resulted in a benefit-cost ratio of 2.4 in 2019.

This brief is based on past evaluation data contained in the ITS Databases at: www.itskrs.its.dot.gov. The databases are maintained by the U.S. DOT's ITS JPO Evaluation Program to support informed decision making regarding ITS investments. The brief presents benefits, costs and best practices from past evaluations of ITS projects.

U.S. Department of Transportation
Intelligent Transportation Systems
Joint Program Office

Next Generation Transportation Management Centers (TMC)

Introduction

Transportation management centers (TMCs) operate as the hub of the surface transportation system and 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.

TMCs are the focal point for agencies to operate their transportation systems as efficiently as possible with surrounding ITS infrastructure. Multimodal in nature, TMCs involve the coordination of state and local transportation agencies, transit agencies, tolling agencies, and public safety agencies. New technologies, advances in telecommunications, and emerging sources of data have enabled the emergence of new capabilities and possibilities with "Next-Generation" traffic management systems (TMSs). These systems offer the potential to transform how agencies actively manage and operate the surface transportation system while improving the safety and mobility of all travelers. These advances, along with the availability of emerging sources of data (including Bluetooth, probe and connected vehicle data), high speed telecommunication networks, advanced computing, and the integration and sharing of information represent a generational shift from previous methodologies developed and deployed for TMSs and TMCs. The "Next-Gen" systems are ultimately expected to enable operators to:

- Make more decisions in real-time
- Operate in a highly automated fashion
- Proactively manage and control traffic
- Coordinate and share information with other systems and service providers
- Provide modular and expandable platforms, making it easier for agencies to manage, maintain, and modify to meet their evolving needs

TMCs are at the center of recent initiatives and concepts such as Integrated Corridor Management (ICM) and Active Traffic and Demand Management (ATDM) that work to integrate more functionality into a single center for more responsive and predictive traffic operation strategies.

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 [1].

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.

Benefits

- **Provide faster, automated searching of Closed-Circuit Television (CCTV) cameras to identify traffic incidents.** A prototype of an interactive web-based platform (TITAN) to collect, process, store, analyze, and display transportation-related mobility and safety data was developed for the Missouri Department of Transportation (MoDOT). [2] One application of the platform is an automated CCTV surveillance system that uses a computer vision system that is trained to identify and trace multiple types of traffic incidents. This system facilitates TMC personnel in surveying multiple camera feeds simultaneously and quickly, which can increase incident detection rates, decrease response time, and reduce TMC personnel fatigue.
- **Provide methods to better pinpoint the locations of motorists stranded outside of CCTV coverage** (2022-01616)**.** To help stranded motorists in rural parts of Georgia where TMCs have no surveillance or monitoring capabilities, Georgia DOT (GDOT) piloted an incident connectivity platform that helped TMCs get in touch with motorists. Under the system, if a stranded motorist contacts 511, the operator sends a text to the motorist's phone, and with a one touch return text, the TMC's Active Traffic Management System (ATMS) software is provided with the exact GPS coordinates of the vehicle. From there, GDOT can dispatch the proper Coordinated Highway Assistance & Maintenance Program (CHAMP) or Highway Emergency Response Operators (HERO) unit. This

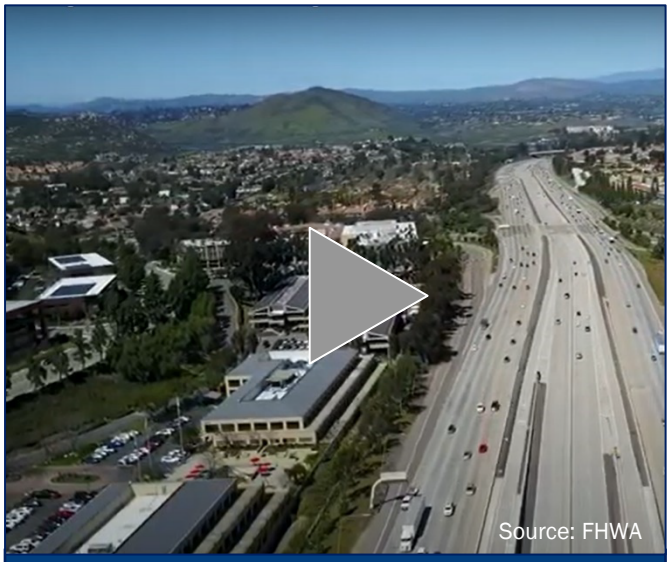

Figure 1: An FHWA video highlights the benefits of Integrated Corridor Management, a surface transportation strategy implemented at the TMC-level.

technology has proven the ability to reduce the time to locate stranded motorists from upwards of 23 minutes to just 3 minutes.

- **Improve Traveler Information Messaging by Utilizing Established Geofenced Locations**. Pennsylvania DOT's state-of-the-art interactive voice response (IVR) 511 system translates requests for information to geofenced locations on cameras to collect needed data, allowing users who enter the geofenced area (essentially a virtual perimeter for a real-world geographic area) to receive a push notification alert related to critical situations. [3] Benefits of this technology include:
    - access to more customized information that travelers may need based on changing weather, roadway conditions, and incidents
    - increased coverage (as cellular reach is greater than the reach of Highway Advisory Radio in some states)
    - decreased cost to collect and generate information
    - improved safety and mobility from drivers having access to updated information and increased automation decreases distraction to drivers.

Costs

The costs to provide a specialized facility to house a TMC can vary considerably according to the (1) size and scope of the operations that will be managed by the TMC; (2) whether the building is newly constructed for this purpose or converted from an existing building; and (3) other factors such as regional labor and material costs. Capital expenses should be expected to range from several hundred thousand dollars for a small TMC facility to several million dollars for a large, metropolitan area TMC that houses multiple agencies and services.

For example, Puerto Rico opened a small operations TMC in San Juan in 2012 for an initial equipment cost of $123,000 [4]. However, for a large state like California, costs for a satellite TMC facility average $1.2 million and capital costs for communication upgrades such as fiber optic cable and wireless modems are estimated to cost $200,000 per mile and $5,000 per location, respectively (2019-00432).

Best Practices

In recent years, TMCs across the country have become more creative with the development and use of non-traditional safety messages on variable message signs, with messages such as "Camp in the Mountains, Not in the Left Lane" and "New Year, New You. Use Your Blinker". These messages attempt to provoke an emotional response and often reference themes like popular culture, sports, or use rhymes to

Figure 2: The above message displayed over Route 460 in Virginia received media attention from The Washington Post, The Wall Street Journal, NPR, and several other news outlets and online media. [5]

increase their effectiveness. In a recent study, Virginia DOT (VDOT) surveyed drivers to quantify the effectiveness of non-traditional dynamic message sign (DMS) messages concerning general safe driving topics, such as driving without a seat belt, impaired and drowsy driving, aggressive driving, and distracted driving. Based on the study's findings, the following suggestions are recommended for developing new messages (2021-01021):

- Distracted driving messages should represent a high proportion of non-traditional safety messages as messages about distracted driving, drinking and driving, and messages that include statistics are more memorable compared to other message intents and themes.
- Messages should address a specific behavior change (e.g., wearing a seat belt, not driving impaired). The more specific the intended behavior change, the more likely drivers comprehend the intent of the message.
- Inappropriateness of messages is not a concern for most participants. If inappropriateness is a concern for message creators, it is suggested to not develop messages that single out groups of people.
- Messages should use word play, rhyming, statistics and/or attempt to evoke an emotional response whenever possible. Such messages command the most cognitive attention or engagement compared to other types of messages. Messages that mentioned sports should be avoided since they are generally less understood compared to other message themes.
- Factors such as age, race and area type should be considered when designing non-traditional safety messages as specific groups of people perceive the messages as more effective and command a high level of cognitive attention.

Case Study

The City of Austin, Texas' TMC, known as the Mobility Management Center (MMC), works to monitor traffic patterns, deploy resources to address equipment issues, implement signal timing adjustments, and aid in special event management with the ultimate goal of improving traffic operations in the city. In 2016, the MMC oversaw 998 signals, 53 pedestrian beacons, 125 Bluetooth and WiFi sensors, 244 CCTV cameras, and 13 DMS. That same year, the City decided to expand operations of the MMC to address Austin's increasing congestion challenges resulting from a fast-growing population. The goals of this operation and capability expansion were to increase staff coverage and flexibility, increase the hours of center operation, improve operational efficiency, help manage incidents and events, and ultimately improve transportation system performance (2021-01521). The addition of consultant staff enabled the City to expand the hours of TMC operation during weekdays, as well as providing coverage on weekends, helping expand the number of person-hours spent monitoring traffic increased by nearly 100 percent each week.

The Mobility Management Center (MMC) is the City of Austin's headquarters for monitoring and managing traffic throughout the Austin area.

Since the initial 2016 expansion, a benefit-cost analysis has been performed annually to assess the services provided by the MMC. Sources of quantitative benefits provided by MMC staff include timing adjustments for lane closures related to incidents & special events, signal outage responses, and remote responses to

citizen requests. These benefits are quantified using data reported in the City of Austin's data tracker and through the use of traffic simulation software.

The data tracker was developed in-house and is fully integrated with the City of Austin's 3-1-1 service [6]. This service is the primary process by which citizens can submit requests, known as Citizen Service Requests (CSRs), directly to the MMC. It is also the tool MMC operators use to manage and record day-to-day operations. Examples of recorded information within the data tracker include: signal outages and signals in flash mode, signals with malfunctioning equipment or detectors, lane blockages near signal locations, signal retiming information and needs, dynamic message sign updates, social media messages, dispatched technicians and special event operations [6].

Table 1: Findings from the Benefit-Cost Analysis of the MMC for 2019 [6]

Activity	Benefit to Public
Signal Timing – Arterial Lane Closure	$ 838,236
Signal Timing – Highway Lane Closure	$ 338,141
Signal Outage Response	$ 667,038
Remote Response	$ 930,437
Remote Investigation	$ 307,100
Special Event Management	$ 1,718,921
Total Benefit	**$ 4,799,875**
Total Cost	**$ 1,979,814**
Benefit-Cost Ratio	**2.4**

MMC staff have already identified ways to further improve procedures and operations, including additional operator training, more cross-agency coordination during special events, and further use of data reporting tools to investigate CSRs. Plans to further integrate the MMC into the City of Austin's operations and continued partnership with neighboring agencies such as the City of Austin Police Department is expected to yield even more positive impact in the future.

References

[1] FHWA, "Mainstreaming Integrated Corridor Management: An Executive Level Primer," 2019. [Online]. Available: https://ops.fhwa.dot.gov/publications/fhwahop19040/fhwahop19040.pdf.

[2] Missouri DOT, "TITAN - An Interactive Web-based Platform for Transportation Data Integration and Analytics," 2019. [Online]. Available: https://www.modot.org/sites/default/files/documents/cmr19-6.pdf.

[3] E. T. P. F. Study, "Evolving and Phasing Out Legacy ITS Devices and Systems," 2019. [Online]. Available: https://enterprise.prog.org/wp-content/uploads/ENT_PhasingOutLegacyITS_Report_FINAL_Oct2019.pdf.

[4] Puerto Rico Highway and Transportation Authority, "Transportation Systems Management and Operations (TSM&O) Program," 2019. [Online]. Available: http://prltap.org/eng/wp-content/uploads/2019/08/TSMO-LTAP-April2019.V.1.0.pdf.

[5] Virginia DOT, "VDOT'S CHANGEABLE MESSAGE SIGNS: CREATING DIALOGUE + DRIVING BEHAVIORAL CHANGE.," 2021. [Online]. Available: http://www.ctb.virginia.gov/resources/2021/july/pres/4_july_ctb_meeting_cms_signs_v3.pdf.

[6] City of Austin, "Mobility Management Center Annual Performance Report 2019," 2020. [Online]. Available: http://www.austintexas.gov/sites/default/files/files/MMC%20Annual%20Report%202019-Final.pdf