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Original Research Paper

Integrating transportation systems management and operations into the project life cycle from planning to construction: A synthesis of best practices

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HIGHLIGHTS

- This paper provides detailed guidance on how to apply TSM&O strategies from the planning stages to the construction phase of any general transportation project.
- The developed TSM&O project cycle process provides a detailed structure for the potential interactions between phases of a project and department staff as a key to ensure that the program achieves the highest level of optimization.

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ABSTRACT

Guided by the federal highway administration (FHWA), many states are promoting the implementation of transportation systems management and operations (TSM&O) programs. TSM&O is traditionally managed by traffic engineers that focus on optimizing efficiency and operations within a particular corridor utilizing common techniques such as re-timings and access modifications. With the emphasis moving towards maximizing current infrastructure, the practice of managing TSM&O can be applied to all units and disciplines, within a transportation entity, for increased efficiency. One main reason of the stagnated integration is the lack of policies which could support the integration of TSM&O strategies within the planning or design stages. This paper provides detailed guidance on how to apply TSM&O strategies from the planning stages to the construction phase of any general transportation project. TSM&O programs established around the nation are discussed to understand the current initiatives underway and the best practices to create a robust and performance-based program. The developed TSM&O project cycle process provides a detailed structure for the potential interactions between phases of a project and department staff as a key to ensure that the program achieves the highest level of optimization. Continuous evaluation must be undertaken by the agencies to ensure that the

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performance of the system is at an optimal level. Developing performance measures, which accurately describe the objectives of the agency, is critical to ensure the plan to be brought to practice.

1. Introduction

The main purpose of a TSM&O program is to maximize the safety, reliability, and efficiency of all modes of the transportation system. Increasing the benefits of an existing infrastructure can improve operational performance, reduce long term costs, and save time. According to the Federal Highway Administration (FHWA), TSM&O is defined as "an integrated program to optimize the performance of the existing infrastructure through implementation of multimodal, cross-jurisdictional systems, services, and projects" (FHWA, 2013). Due to limited resources and fiscal constraints for new infrastructure to mitigate congestion, new strategies are needed to obtain the most capacity and efficiency of the existing or planned transportation system. Strategies such as traffic incident management, traveler information dissemination, traffic signal coordination, and work zone management are considered parts of TSM&O and have proven to be quite effective thus far in many categories compared to the traditional capacity improvement projects.

TSM&O is traditionally managed by traffic engineers that focus on optimizing efficiency and operations within a particular corridor utilizing common techniques such as retimings and access modifications. With the emphasis moving towards maximizing current infrastructure, the practice of managing TSM&O can be applied to all units and disciplines to increase efficiency. This should include planning, emergency services, public transportation, environmental management, design, and integration of intelligent transportation systems (ITS) on the roads and railways.

Many agencies at the state, regional, and local level have found great use of managing and operating the transportation system as well as implementing ITS strategic plans and architectures and have made progress in applying TSM&O strategies (Atkinson et al., 2013). It is still noticeable. However, even with this progress there is a disconnection between infrastructure design and the needed long term results. One main reason is the lack of policies which could support the integration of TSM&O strategies within the planning or design stages as a routine method of business practice.

This paper provides detailed guidance on how to apply TSM&O strategies from the planning stages to the construction phase of any general transportation project. There are also tools included, which will assist in developing a TSM&O program and best benefit the needs of the agency. Various examples are used to show the effectiveness of TSM&O strategies applying in infrastructure design at the early stages of a project. The application of these strategies allows improvement in regional transportation system efficiency, reliability, and option over a long term of a project's life span.

2. Challenges to an effective TSM&O program

Steps in implementing TSM&O into the planning phase and gaining a better understanding of how to effectively use these strategies have been taken in various state DOTs. Looking at some of the examples, it is possible to see major strides are being made to incorporate TSM&O strategies (CDOT, 2013; Chandra, 2014; FDOT, 2013; Hammond, 2012; KCSTMC, 2007; KCS, 2014; MDOT, 2013). Table 1 provides a summary comparison between the different TSM&O programs and practices which were mentioned previously and describes the program goals, strategies implemented and specific applied projects.

Success in implementing a good TSM&O program has varied among the state DOT's over the years. Regardless of the successes, however, many research efforts show that there are areas that can be improved to bring TSM&O application to its full potential (AASHTO, 2014a).

Overall, how effective the program will become over time is closely related to both the specific processes and institutional arrangements that are required to support TSM&O strategies. These changes of course would most certainly bring adjustments in the overall architecture of an agency, which would affect leadership and staff as well as the supporting institutional framework of programs and resources (AASHTO, 2014b). Breaking down key elements for an effective program resulted in six dimensions that require improvements or focus.

1. Business processes: TSM&O is rarely included in state or regional planning processes and is typically used for certain particular reasons only, without a means to sustain or improve a program.
2. Systems and technology: though current technical staff have an understanding of recent technology, there is a struggle in standardizing, upgrading, and integrating the latest technologies due to rapid improvements in technology development.
3. Performance measures: increasing the effectiveness of TSM&O strategies is heavily reliant upon performance measurement. Many DOTs have a very limited knowledge in how the TSM&O activities affect items such as delay, reliability, and crashes.
4. Culture: most DOT senior leadership have a limited vision of the potential in TSM&O and focus on maintaining a legacy culture where capital improvements are made. Some TSM&O programs were not implemented until a major crisis came along, while others may have had one-star middle-manager that put forth the effort to make their program a success.

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