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Traffic Signal Tech Brief 2016-1

Traffic Signal Management Plan: What is it? and Why do I want one?

Purpose of a Plan

The purpose of a Traffic Signal Management Plan (TSMP) is to provide a framework for delivery of high quality service to the public through an efficient and well-maintained traffic signal system. The plan describes the objectives of traffic signal management within the context of an organizations goals and sets out strategies to guide the maintenance, design and operation of the traffic signal system. It also defines appropriate measures of performance to determine the extent to which the objectives are being met.

There are two primary audiences for the TSMP. For an agency's management and the public, the TSMP shows how all the system management activities support the agency's goals, and defines specific objectives for traffic signal management. For agency staff, the TSMP describes in detail the strategies they will employ while maintaining, designing and operating the system. In addition, the approach to customer service is defined, plus additional enabling strategies that must be implemented by other groups within the agency or its partners to support the traffic signal management.

Why are some agencies successful?

An FHWA study found that organizations that were most successful, regardless of their level or resources, all had a number of common characteristics, shown here. The development of a TSMP promotes understanding and use of these characteristics.

- ✓ **Strong concept of basic service;**
- ✓ **Clear evaluation of objectives;**
- ✓ **Close coordination of design, operations, and maintenance resources and limitations;**
- ✓ **Good understanding of measuring results; and**
- ✓ **Commitment to staff development.**

What is good basic service?

The short answer is that ***given a set of resources, do what is most important***. The definition of "important" is up to the agency to determine but it should be close to the user expectations. The most effective agencies place a high priority on providing good basic service first, before attempting advanced service techniques. Defining what basic service means and then committing to it helps optimize the use of available resources to where they will have the most impact to the user. All too often agencies expend considerable resources without achieving good basic service as their efforts misdirected or unfocused.

"I want to drive to my destination at my desired speed."

Clarity of Objectives

From their definition of basic service, successful agencies craft clear objectives that describe what needs to occur to accomplish those goals.

Objectives for traffic management typically relate to:

- Preserving a state of good repair, i.e. maintained to a minimum threshold;
- Moving traffic in accordance with motorist expectations; and
- Designing infrastructure to achieve operations and maintenance objectives.

Good Objectives have SMARTS!

Specific: Provides sufficient detail to formulate viable alternatives without dictating the approach;
Measurable: The objective facilitates quantitative evaluation;
Agreed: There is stakeholder consensus on a common objective.
Realistic: The objective can reasonably be accomplished within the limitations of resources and other demands;
Time-related: The objective identifies a timeframe within which it will be achieved;
Sustainable: The objective can continue to be achieved and is not a one-off improvement.

Design, Operations, and Maintenance Coordination

Each agency must develop strategies that put the capabilities in place to implement their objectives. These strategies should be mutually supportive. Successful agencies avoid constructing infrastructure elements that cannot be maintained, and they avoid operations that demands such infrastructure and maintenance.

Maintenance Strategies

The driving force behind maintenance strategies is field infrastructure reliability. As it is most often funded through a jurisdiction's general fund, which are often constrained and subject to competitive demands, maintenance is typically extremely resource-limited. A realistic assessment of maintenance capability is required in order to achieve reliability objectives. The two main constraints of maintenance resources are technological and quantitative.

These limitations stem from the difficulty in attracting and retaining the staff with the expertise and in sufficient numbers to maintain complex and sizable traffic signal infrastructure.

Approaches to deal with these limitations include:

- Reduce the complexity of infrastructure both in technical depth and number of elements built;
- Invest capital resources to build more durable components;
- Operational methods matched with the technological expertise of the agency;
- Use specialized contract forces to maintain elements where expertise is not found in-house.

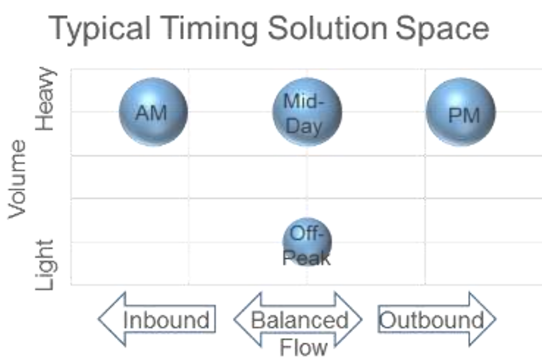
A critical step in designing within an agency's capabilities is understanding maintenance limitations by coordinating with those responsible for it.

Operations Strategies

The goal for operations is to provide good basic service under all traffic conditions. Objectives to achieve this depend on the context of traffic conditions. During uncongested time the objective is smooth traffic flow, while during congested periods the objective is to maximize throughput and manage queues.

Looking at smooth flow practitioners should consider a mix of objectives that will be seen by the motorist to be fair and predictable. From their point of view time delayed is worse than time traveled and time delayed by traffic signals is worse than time delayed by congestion. It may, therefore, be better to achieve multiple wide progression bands rather than a single narrow one that is impossible to achieve for most motorists. Designing for smooth flow can often forgo complex and labor intensive optimization and simulation software and instead use a simple and direct approach using time-space diagrams and on-street evaluation.

These timings should also consider versatility. While this can be achieved using local traffic actuated or central traffic adaptive features, these are detection intensive methods that



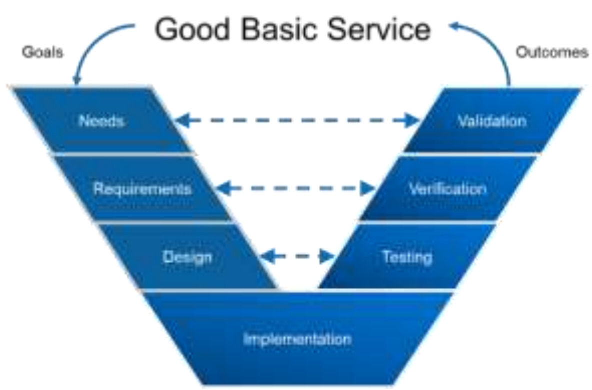
increase the maintenance and operations work load. Designing for versatility looks implement fewer plans that are effective over a broad range of conditions instead of many plans that are optimal under narrow ones. In this way good basic service can be maintained with predictable operation to which a motorist may adjust their behavior.

Under congested conditions, following the fundamental principle of basic service to do what is most important, the best resources should be devoted to the worst congestion. These locations would be where to use every available feature to improve green time efficiency for congested movements and to manage queues in the network.

Design Strategies

Design strategies expand upon traditional infrastructure design requirements and should set quality standards as they affect operations and maintenance. The application of consistent standards for traffic signal design, including street furniture, pedestrian accommodation, numbers and placement of signal heads, etc. should be included along with an analysis of how the standard does or does not impose limitations on operations and maintenance. This provides the operations practitioner with an understanding of how design affects operations.

An objectives based approach is also reflected in meaningful systems engineering. In this process real needs are addressed first, describing what the agency does or wants to do. These user needs describe a *Concept of Operations*. From these needs a *Requirements Document* explicitly defines the required functionality of the system. The system is designed so as to meet the requirements. A *Requirements Traceability Matrix* documents how each design feature fulfills at least one requirement and every requirement is fulfilled. After implementation *Verification* tests system components against the design requirements. *Validation* confirms the finished product supports the needs in the *Concept of Operations.*

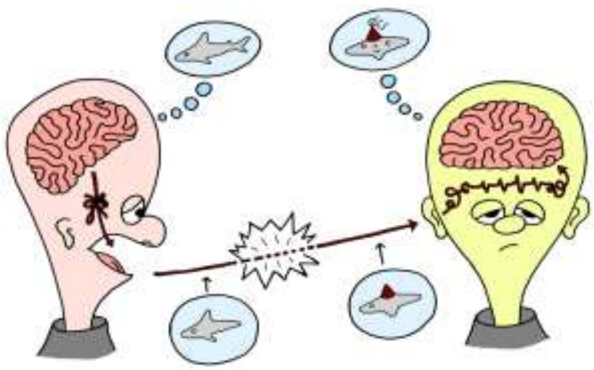


Measuring Results

There needs to be a clear evaluation of how the operation meets objectives. The evaluation may be quantitative or qualitative, but they must be directly linked to the objective and how the system is operating according to design. The best agency models evaluate their effectiveness in terms of basic service objectives first. The methods used should be matched to resource limitations. A rough measure is collected often is better than a precise measure that is rarely accomplished. Consider building in remote or automated methods consistent with the sophistication of staff ability to monitor and analyze.

Clear Communications to all Stakeholders

The success of an agency is incomplete unless it is communicated. In order to be credible and garner support for the traffic management program, agencies must communicate performance information to all stakeholders effectively so they can understand and evaluate the data. This requires a communication style that captures and retains interest and provides the necessary tools to understand the data that are presented.



A communications plan should have elements that target the correct audience as they each have different needs. The objective is that the right story is being told to the right person at the right time. Report the progress of programs to policy makers and the public based on the operational objectives. This is an opportunity to emphasize your successes but it must be done in terms that are relevant to your audience.

References and Resources

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