

## Resources to Support Traffic Signal System Capability Maturity Framework Users

The Traffic Signal System (TSS) Capability Maturity Framework (CMF) tool, assesses an agency's capability to plan, design, integrate, maintain, and proactively operate traffic signal systems in order to improve the efficiency, safety, and reliability of signalized intersections. Traffic signal programs should strive to achieve delivery of Good Basic Service (GBS)—i.e., doing what is most important in the context of limited resources.

**These resources provide users of Traffic Signal System CMF with relevant information as they consider their identified actions for improvement. When multiple examples are available, they are included as “additional examples” in the table.**

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For more general resources and publications pertaining to arterial management: [FHWA Arterial Management Program Publications](#).

## Business Process

Business processes, in the context of traffic signal systems, refers to activities such as planning, programming, agency project development processes, and those organizational aspects that govern various technical or administrative functions such as training, human resource management, contracting and procurement, information technology, or coordination. In many cases, the business process elements go beyond the day-to-day operational activities and require broader institutional support and involvement to address. All of these processes are fundamental to the success of operations and management activities. Without the right procurement processes, partnering commitments, sustainable funding, internal awareness, and support, there could be a limited capacity to be able to implement more complex operations programs and activities. Table 1 provides a list of resources in this area.

Table 1. Business Process Resources for Traffic Signal Systems

Sub-Dimensions	Primary Example
<p><b>Strategic Planning</b></p> <p>Actions associated with this sub-dimension focus on the ability of an agency to engage in strategic planning activities to support the operations and maintenance of its traffic signal systems. Actions emphasize the ability of the agency to articulate operational and regional goals and objectives.</p>	<p>The report <a href="#">Improving Traffic Signal Management and Operations: A Basic Service Model</a> provides a guide for achieving a basic service model for traffic signal management and operations. The basic service model is based on simply stated and defensible operational objectives that consider the staffing level, expertise and priorities of the responsible agency.</p> <p><b>Additional Example</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Utah Department of Transportation (DOT) Traffic Signal Management Plan</a></li> <li>• <a href="#">Operation Green Light 2017-2020 Strategic Plan</a></li> </ul>
<p><b>Operations and Maintenance</b></p> <p>Actions associated with this sub-dimension focus on the business processes that agencies use to manage the operations and maintenance of their traffic signal systems, communications systems, and traffic signal infrastructure.</p>	<p>The <a href="#">Traffic Signal Operations Handbook</a> provides guidelines for timing traffic control signals at intersections that operate in isolation or as part of a coordinated signal system. The guidelines are intended to describe best practices, as identified through interviews with Texas DOT engineers and technicians, and to identify conditions where alternative practices are equally workable.</p> <p><b>Additional Examples</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Traffic Signal Timing Manual Second Edition, NCHRP Report 812</a></li> <li>• <a href="#">Traffic Signal Operations and Maintenance Staffing Guidelines (FHWA-HOP-09-006)</a></li> </ul>

Sub-Dimensions	Primary Example
<p><b>Programming and Budgeting</b></p> <p>Actions associated with this sub-dimension focus on improving the ability of an agency to develop programs and provide budgeting for operating and maintaining traffic signals.</p>	<p>The <a href="#">Traffic Signal Management Plans</a> is intended to provide planning guidance for professionals involved in the management, maintenance, design, and operations of traffic signal systems. Chapters 3 and 6 of the document describes how to create a management plan, and what to take into account, including programming and budgeting.</p>
<p><b>Resource Allocation</b></p> <p>Actions associated with this sub-dimension focus on enhancing the business processes that agencies use to allocate resources, both personnel and financial, for operating and maintaining traffic signals.</p>	<p>The <a href="#">Traffic Signal Management Plans</a> is intended to provide planning guidance for professionals involved in the management, maintenance, design, and operations of traffic signal systems. Chapters 3 and 6 of the document describes how to create a management plan and what to take into account.</p>

## Systems and Technology

Use of the appropriate processes for design and implementation of systems will ensure that the needs of the region are appropriately addressed, that systems are implemented in an efficient manner, and that interoperability with other systems is achieved. Table 2 provides in a list of resources in this area.

Table 2. Systems and Technology Resources for Traffic Signal Systems

Sub-Dimensions	Primary Example
<p><b>Continuity of Service</b></p> <p>Actions associated with this sub-dimension are intended to help agencies provide continuity of service over a wide range of operational scenarios and situations.</p>	<p>In addition to covering basic and advanced signal timing concepts, the <a href="#">Traffic Signal Timing Manual - Second Edition</a> addresses establishment of a signal timing program including setting multimodal operational performance measures and outcomes, determining staffing needs, and monitoring and maintaining the system.</p>
<p><b>Procurement</b></p> <p>Actions associated with this sub-dimension are intended help agencies procure traffic signal systems and technologies appropriate for achieving defined operational goals and objectives.</p>	<p>The <a href="#">Model Systems Engineering Documents for Adaptive Signal Control Technology (ASCT) Systems</a> (see Section C - Procurement Plan) provides guidance for professionals involved in selection and implementation of adaptive signal control technology systems, including key aspects of a procurement plan.</p> <p><b>Additional Example</b></p> <ul style="list-style-type: none"> <li>• <a href="#">NCHRP 560 Guide to Contracting ITS Projects</a></li> </ul>
<p><b>Systems Engineering and Interoperability</b></p> <p>Actions associated with this sub-dimension are intended to help agencies utilize the systems engineering approach to identify, procure, and deploy appropriate systems and technologies to achieve defined operational objectives.</p>	<p>The <a href="#">Model Systems Engineering Documents for Adaptive Signal Control Technology (ASCT) Systems</a> (see Section C) provides guidance for professionals involved in developing systems engineering documents covering the evaluation, selection and implementation of adaptive signal control technology systems.</p>

Sub-Dimensions	Primary Example
<p><b>Operational Flexibility</b></p> <p>Actions associated with this sub-dimension are intended to help agencies deploy systems and technologies that provide flexible responses for a wide range of operational scenarios and situations.</p>	<p>In addition to covering basic and advanced signal timing concepts, the <a href="#">Traffic Signal Timing Manual - Second Edition</a> addresses establishment of a signal timing program including setting multimodal operational performance measures and outcomes, determining staffing needs, and monitoring and maintaining the system.</p>
<p><b>State of Good Repair</b></p> <p>Actions associated with this sub-dimension are intended to help agencies identify strategies for maintaining their traffic signal systems and technologies in a state of good repair.</p>	<p>The <a href="#">ITE Traffic Signal Audit Guide</a> provides a general audit process that can be used to evaluate the effectiveness of TSS program management and maintenance.</p> <p><b>Additional Example</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Traffic Signal Operations and Maintenance Staffing Guidelines (FHWA-HOP-09-006)</a></li> <li>• <a href="#">Improved Traffic Signal Maintenance and Management Study SD2003-01 Final Report and Executive Summary</a></li> </ul>

## Performance Measurement

Performance measurement is essential as the means of determining program effectiveness, determining how changes are affecting performance, and guiding decision-making. In addition, operations performance measures demonstrate the extent of transportation problems and can be used to make the case for operations within an agency and for decision-makers and the traveling public, as well as to demonstrate to them what is being accomplished with public funds on the transportation system. Table 3 provides a list of resources in this area.

Table 3. Performance Measurement Resources for Traffic Signal Systems

Sub-Dimensions	Primary Example
<p><b>Performance Measures Definition</b></p> <p>Actions associated with this sub-dimension are intended to help agencies identify and define appropriate and meaningful performance measures that can be used to evaluate the effectiveness of their traffic signal systems and technologies.</p>	<p><a href="#">Performance Measures for Traffic Signal Systems: An Outcome-Oriented Approach</a> is an academic paper providing a synthesis of research carried out on traffic signal performance measures based on high-resolution controller event data, assembled into a methodology for performance evaluation of traffic signal systems.</p> <p><b>Additional Examples</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Indiana Traffic Signal Hi Resolution Data Logger Enumerations</a></li> <li>• <a href="#">FHWA Arterial Management Website - Performance Measures</a></li> </ul>
<p><b>Performance Measures Utilization</b></p> <p>Actions associated with this sub-dimension are intended to help agencies develop processes and procedures for using collected performance measures in strategic decision making to improve operations and safety.</p>	<p><a href="#">Integrating Traffic Signal Performance Measures into Agency Business Processes</a> is an academic paper discussing uses of and requirements for performance measures in traffic signal systems facilitated by high-resolution controller event data.</p> <p><b>Additional Example</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Automated Traffic Signal Performance Measures - Open Source Software</a></li> </ul>

## Organization and Workforce

Efficient execution of processes supporting effective programs requires appropriate combination of coordinated organizational functions and technical qualified staff with clear management authority and accountability. Table 4 provides a list of resources in this area.

Table 4. Organization and Workforce Resources for Traffic Signal Systems

Sub-Dimensions	Primary Example
<p><b>Staff Development</b></p> <p>Actions associated with this sub-dimension focus on how agencies can build and develop the knowledge, skills, and abilities of their traffic signal operations and maintenance personnel.</p>	<p>The <a href="#">Traffic Signal Operations and Maintenance Staffing Guidelines</a> summarizes the findings from a scan workshop of domestic regional traffic signal operations programs in the United States. The scan's purpose was to examine the different types of organizational structures, institutional agreements and arrangements, and operational policies that organizations throughout the United States use to manage and operate traffic signal systems from a regional perspective.</p>
<p><b>Program Structure</b></p> <p>Actions associated with this sub-dimension focus on structural changes that agencies might consider to improve the performance and effectiveness of their traffic signal system operations and maintenance programs.</p>	<p>From the <a href="#">Operational and Institutional Agreements That Facilitate Regional Traffic Signal Operations</a>, Chapter 4 focuses on operational and institutional arrangements, and Chapter 5 focuses on sustaining regional traffic signal operations programs.</p>

## Culture

Culture is the combination of values, assumptions, knowledge, and expectations of the agency in the context of its institutional and operating context, and as expressed in its accepted mission and related activities. Table 5 provides a list of resources in this area.

Table 5. Culture Resources for Traffic Signal Systems

Sub-Dimensions	Primary Example
<p><b>Outreach</b></p> <p>Actions associated with this sub-dimension focus on enhancing the ability of the agency to communicate benefits, outcomes, and needs to various external stakeholder groups, including policy makers, the media, and others.</p>	<p><a href="#">Georgia DOT's Traffic Signals Website</a> clearly explains their regional traffic operations program (RTOP), and provides reports, benefit summaries, and videos.</p> <p><b>Additional Examples</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Denver Regional Council of Governments' Traffic Operations Program website and detailed program materials</a></li> <li>• <a href="#">FHWA Website on Arterial Management Program: Awareness and Outreach</a></li> </ul>
<p><b>Leadership</b></p> <p>Actions associated with this sub-dimension focus on improving the leadership of the agency to influence and affect changes in traffic signal operations within an area, region, or state.</p>	<p>The <a href="#">Best Practices In Regional, Multiagency Traffic Signal Operations Management</a> report summarizes the findings from a scan workshop of domestic regional traffic signal operations programs in the United States. Several organizational structures are discussed in Chapter 5.</p>



## Collaboration

The development and implementation of traffic signal systems requires a collaborative approach. The effectiveness of most strategies is dependent on improving the coordinated performance of each partner. Table 6 provides a list of resources in the area.

Table 6. Collaboration Resources for Traffic Signal Systems

Sub-Dimensions	Primary Example
<p><b>Data Sharing</b></p> <p>Actions associated with this sub-dimension are intended to help agencies improve their data sharing collaborations.</p>	<p>Montachusett Regional Planning Commission (MRPC)'s <a href="#">Regional Traffic Counts</a> program provides information on traffic counts and offers an agency contact for other counts not presented in the data. The program now synchronizes its data with the broader Massachusetts DOT program.</p> <p><b>Additional Examples</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Massachusetts DOT Transportation Data Management System web browser tool</a></li> <li>• <a href="#">Portland, Oregon's interactive map of traffic counts</a></li> </ul>
<p><b>External Stakeholders</b></p> <p>Actions associated with this sub-dimension are intended to foster collaborations with external local, regional, and state stakeholders.</p>	<p>Virginia DOT's <a href="#">Weekly Lane Closures and Travel Advisories webpage</a> is a public-facing lane closures map and information tool that allows for easy access to full information on road closures.</p> <p><b>Additional Example</b></p> <ul style="list-style-type: none"> <li>• <a href="#">FHWA Arterial Management Program Website - Regional Traffic Signal Operations Programs</a></li> </ul>