

# The Next Generation of Traffic Management Systems and Centers

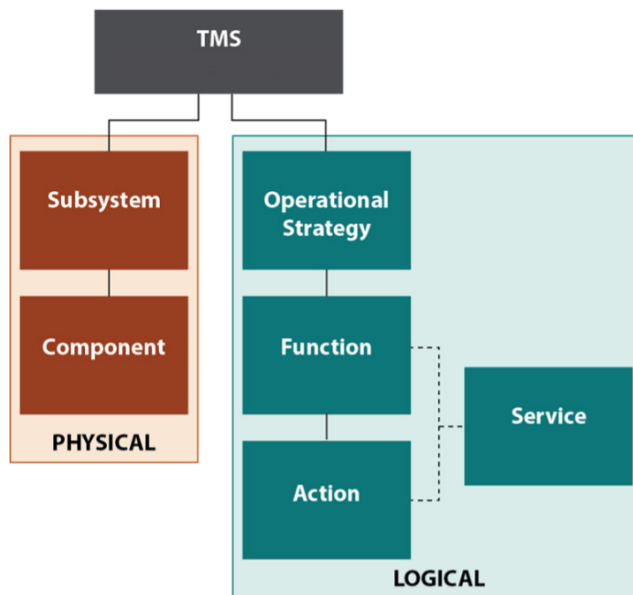
Traffic management systems (TMSs) and their centers are critical resources that offer agencies the potential to improve the safety and mobility of travel on the surface transportation system. TMSs also assist agencies in fulfilling the ever-increasing transportation needs of travelers (e.g., travel times), service providers (e.g., transit and emergency services), other agencies, and the public (e.g., incidents). TMSs provide agencies with various functions (e.g., monitoring traffic conditions, analyzing collected data, and disseminating traveler information) and operational strategies.

Agencies continue to be challenged with improving performance; expanding the geographical area served; expanding or enhancing services; and providing the funding and staffing to actively manage, operate, and maintain their TMSs. Agencies may consider a range of issues, opportunities, and possible improvements when planning to enhance an existing TMS or prepare for the next generation of their TMS. Agencies preparing for the next generation of their TMS may also need to consider assessing feasibility; initiating and conducting planning; or pursuing development, implementation, and transition efforts.

## NEXT GENERATION (NEXTGEN) TMS

The design or structure of a TMS can be broken into the physical (e.g., subsystems, components, devices, and software) and logical elements shown in figure 1. The physical elements include the subsystem and the components. A subsystem is a group of self-contained and interactive components that support one or more operational strategies as a part of a TMS. The logical elements provide the capabilities for TMSs to actively manage the use of operational strategies, functions, actions, and services. The term NextGen TMS refers to the needs, capabilities, and potential performance of the next generation of an agency’s TMS, and how that potential TMS may differ from the current or legacy TMS. The following examples are emerging issues that agencies may want to consider when planning or pursuing the next generation of their TMS:

- Implementing active transportation and demand management strategies.
- Including emerging data sources.
- Integrating connected and automated vehicles.
- Sharing and using third-party and service-provider data.
- Implementing methods and using technologies that expand surveillance and coverage.
- Automating operations and management of operational strategies, control plans, services, or actions.



Source: Federal Highway Administration (FHWA).  
 Note: The solid lines show the internal system hierarchy and the dashed lines show the need for connection to external systems.

Figure 1. Diagram. General TMS structure.<sup>(1)</sup>

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## MOTIVATIONS FOR AGENCIES IMPROVING A CURRENT TMS OR PLANNING FOR THE NEXT GENERATION OF THEIR TMS

Potential drivers of change for improving a current TMS or planning for the transition to the next generation of TMS may include the following objectives:<sup>(1)</sup>

- Providing new capabilities that were not possible due to limitations with existing or legacy systems.
- Replacing existing or legacy capabilities to meet performance objectives (do more, cost less, and be more efficient and effective).<sup>(1)</sup>
- Providing new capabilities while offering cost-effective and flexible options for future changes to subsystems and software.
- Replacing legacy systems at the end of those systems' lifecycle.

### PLANNING FOR A NEXTGEN TMS

Contemplating, planning, and pursuing improvements to or replacement of a TMS provide opportunities to innovate and make changes, but also introduce many challenges, which may include the following situations:

- Limited staff and resources available to actively manage and operate the existing TMS.
- Need to improve or add operational strategies.
- Desire to expand service area.
- Limited ability to make modifications due to proprietary products.
- Limited options to share data internally within an agency.
- Limited services and physical capability available to share data externally with other systems or stakeholders.
- Funding and staff resources needed to implement improvements.

Agencies typically implement a planning process before designing, procuring, developing, pursuing improvements to, or replacing

a TMS. This planning assists in the following areas:

- Identifying the range of possible improvements to consider.
- Assessing those possible improvements' feasibility and costs.
- Aligning potential improvements with agency goals and priorities.
- Prioritizing proposed improvements with expected funding and staff resources.
- Engaging and obtaining the support of stakeholders and agencies.
- Including improvements and funding in the appropriate planning, program, or budget processes and documents.

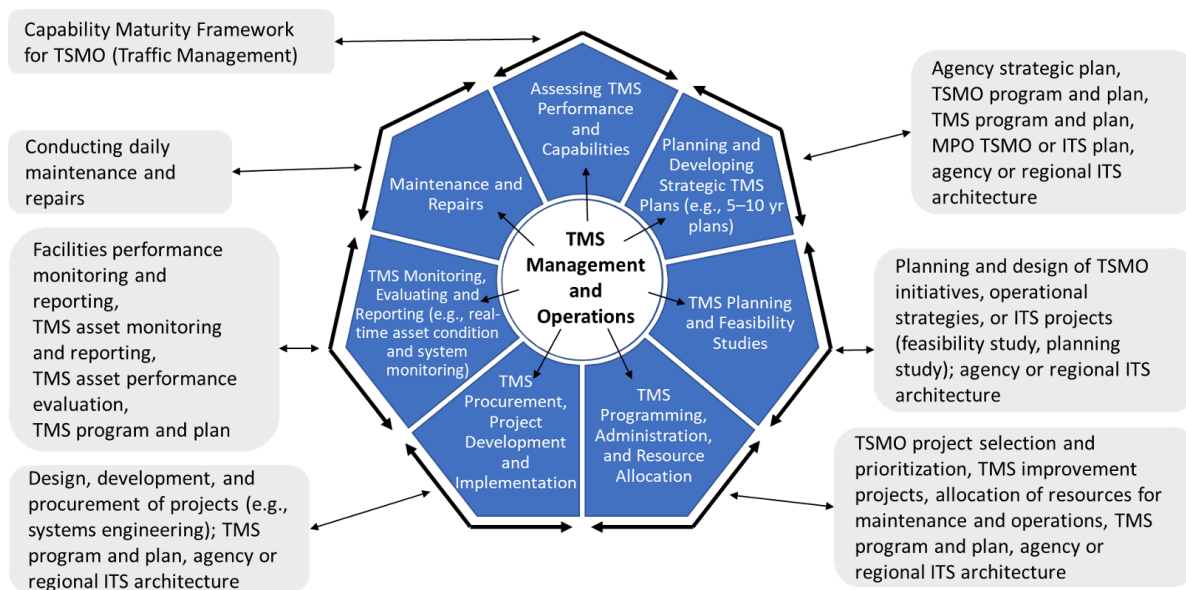
Planning activities that can benefit an agency may include assessing the capabilities and performance of a TMS; performing studies to assess the feasibility and priorities for possible improvements to a TMS; and framing the strategic direction, future evolution, and improvements to a TMS (for example, through a strategic plan or a multiyear plan of proposed future projects). These planning activities can help an agency build the support to address

identified needs, resources, and priorities associated with pursuing improvements to the TMS or improving how that TMS is managed and operated. These planning activities are all a part of the lifecycle of a TMS. Figure 2 shows this lifecycle, where TMS monitoring and evaluating, maintaining and repairing, planning specific improvements, and multiyear planning for the NextGen TMS are all coordinated and interrelated to support continuously improving the active management, operation, and ongoing improvement of the TMS.

### INTERDEPENDENCIES BETWEEN THE MANAGEMENT AND OPERATION OF TMS AND PLANNING FOR TMS IMPROVEMENTS

To address potential challenges, agencies should incorporate information from other agency or regional planning processes into their assessment of their TMS's capabilities and performance and their planning for improvements to their current TMS or implementing the next generation of their TMS. Agencies should integrate the results of these TMS planning efforts, identified improvements, and needed resources for either their

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Source: FHWA.  
 TSMO = transportation systems management and operations; MPO = metropolitan planning organization;  
 ITS = intelligent transportation systems.

**Figure 2. Diagram. Processes and activities supporting TMS management and operations.<sup>(2)</sup>**

existing system or the next generation of their system into the strategic and planning processes of their agency or region. Agencies and regional entities can consider and incorporate the capabilities, performance, and future improvements of TMSs into their planning processes and plans, which are typically conducted in the five following time horizons:

- Day-to-day operations (realtime to 1 yr): Allocating resources in current processes, staff efforts, and available funding that support day-to-day operations.
- Planning and preparing for day-to-day operations (1–3 yr): Planning for improvements that may require a ramp-up or startup time, but that the agency wants to pursue as soon as possible.
- Program planning (3–5 yr): Planning for activities that will likely be dependent on other actions or that are included in other regional plans.

- System planning (5–10 yr): Generally State or regional technology- or initiative-specific system planning activities.
- State or regional long-range planning (20 yr): Building the vision for a transportation system of the future.

### THE VALUE PROPOSITION FOR IMPROVING TMS CAPABILITIES AND PERFORMANCE

By continuously looking for potential opportunities to enhance TMS capabilities, functions, and services, agencies can improve their overall TMS performance, save or reallocate resources, and help meet their agency or regional goals. TMSs are focused on improving the efficiency, safety, and predictability of travel on the surface transportation network. A TMS is a system that comprises a complex, integrated blend of hardware, software, processes, and people performing a range of functions and actions.<sup>(1)</sup>

Agencies should consider and manage the evolution of their systems so agencies can meet these short- and long-range goals. Agencies should also continually look for ways to improve system performance regardless of the current lifecycle stage of their TMSs. Not all planning activities or opportunities suggested in this factsheet will be appropriate for every agency, at least not immediately. Agencies can consider the current state of their TMSs, where their TMSs are headed, and the current state of their TSMO planning, support, and available resources.

A key aspect of effective traffic management is active management. Active management of a TMS provides dynamic and adaptive adjustments to changing current and future conditions. Active management offers agencies a way to incrementally improve their TMS implementations by monitoring the performance of the TMS, assessing its effectiveness, developing and selecting actions

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to improve its performance, and implementing the selected action(s). An effective TMS is one that has the active management concept embedded in it. This active management cycle is illustrated in figure 3.<sup>(1)</sup>

## REFERENCES

1. Kuciamba, S., L. Jacobson, A. Mizuta, and D. Nguyen. 2023. *Review of Traffic Management Systems—Current Practice*. Report No. FHWA-HRT-23-051. Washington, DC: FHWA.
2. Weatherford, M., J. Schroeder, P. Okunieff, and J. Wu. 2024. *Managing Traffic Management Systems Assets*. Report No. FHWA-HRT-24-088. Washington, DC: FHWA.



Source: FHWA.

Figure 3. Diagram. The active management cycle.<sup>(1)</sup>

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