



Methods and Tools To Estimate Staffing Needs for Traffic Management Systems (TMSs)

Transportation Management Center (TMC) Pooled Fund Study
Federal Highway Administration (FHWA)
December 2024





Presentation Outline

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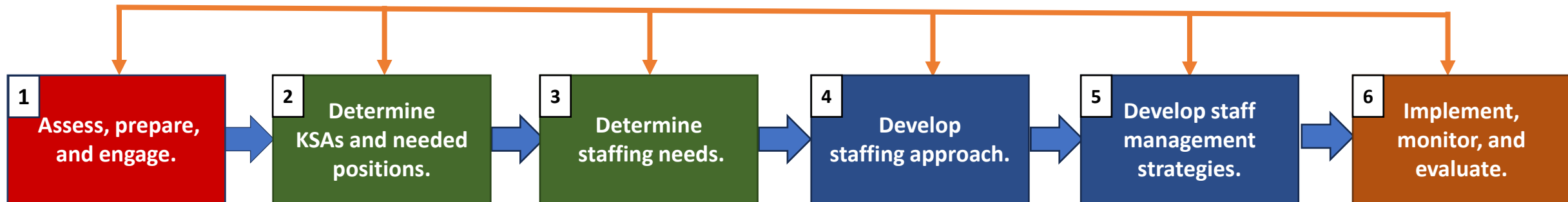
Challenges With Meeting TMS Staffing Needs

- Quantifying needed skills for TMSs.
- Understanding the metrics and data needed to estimate staffing.
- Hiring or developing staff with specific expertise.
- Training staff in specific technical areas.
- Modifying staff roles and job descriptions.
- Supporting TMSs with the range of needed skills and resources.
- Predicting or estimating future staffing needs.
- Expanding current capabilities and resources.
- Understanding changing demands that influence staffing needs.
- Understanding evolving TMS functions and services.



Process for Identifying and Estimating Staffing Needs

- Estimating staffing needs is part of an agency's process.
- Critical parts of the process for estimating staffing needs are as follows:
 - Identifying the TMS functions in step 1.
 - Determining the needed knowledge, skills, and abilities (KSAs) in step 2.
 - Forecasting the future demand and staffing needs and calculating the staffing levels in step 3.
 - Determining the preferred staffing approach in step 4.

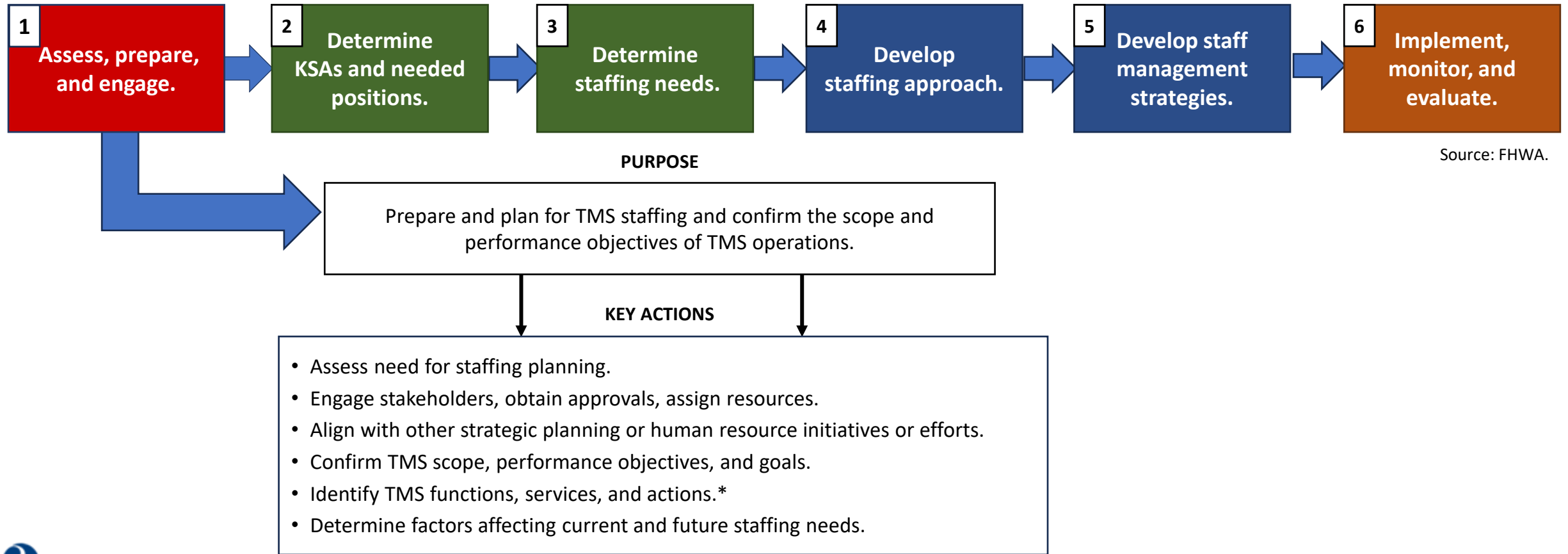


Source: FHWA.



Assessing, Preparing, and Engaging

Identifying TMS functions, services, and actions is critical to estimating staffing.



Source: FHWA.

*Critical action for estimating staffing needs.



What Are the Functions of a TMS?(1)

- A function is a capability or ongoing activity of a TMS that contributes to the accomplishment of the TMS's mission.
- Another TMS, the transportation system management and operations (TSMO) program, or another agency may sometimes perform and support functions.
- The functions performed or supported by a TMS and the demand for transportation management services by consumers determine the type and number of personnel needed.

Common TMS Staff Functions

- Monitor traffic.
- Control ITS devices.
- Maintain, repair, and troubleshoot ITS devices.
- Disseminate information.
- Manage personnel.
- Analyze data.
- Interface with media and public.
- Plan, recommend, and implement system and procedural upgrades.
- Coordinate with incident response agencies.
- Coordinate with other local and regional transportation agencies.





Potential Resources for Identifying TMS Functions

- TMS plans:
 - Need-based.
 - Link with broader plans that identify needed transportation actions.
- Concept of Operations (ConOps):
 - Describes the TMS and its functions.
 - Describes TMS staff roles, responsibilities, and interactions with various TMS subsystems, components, and functions.
 - Includes TMS use cases that provide:
 - Workflow context.
 - Details of systems or sources of information needed to accomplish tasks, make decisions, and anticipate results.
- TMS assessment:
 - Reviews and identifies needed improvements.
 - Provides insights into needs for workforce staffing, technical skills, and training.



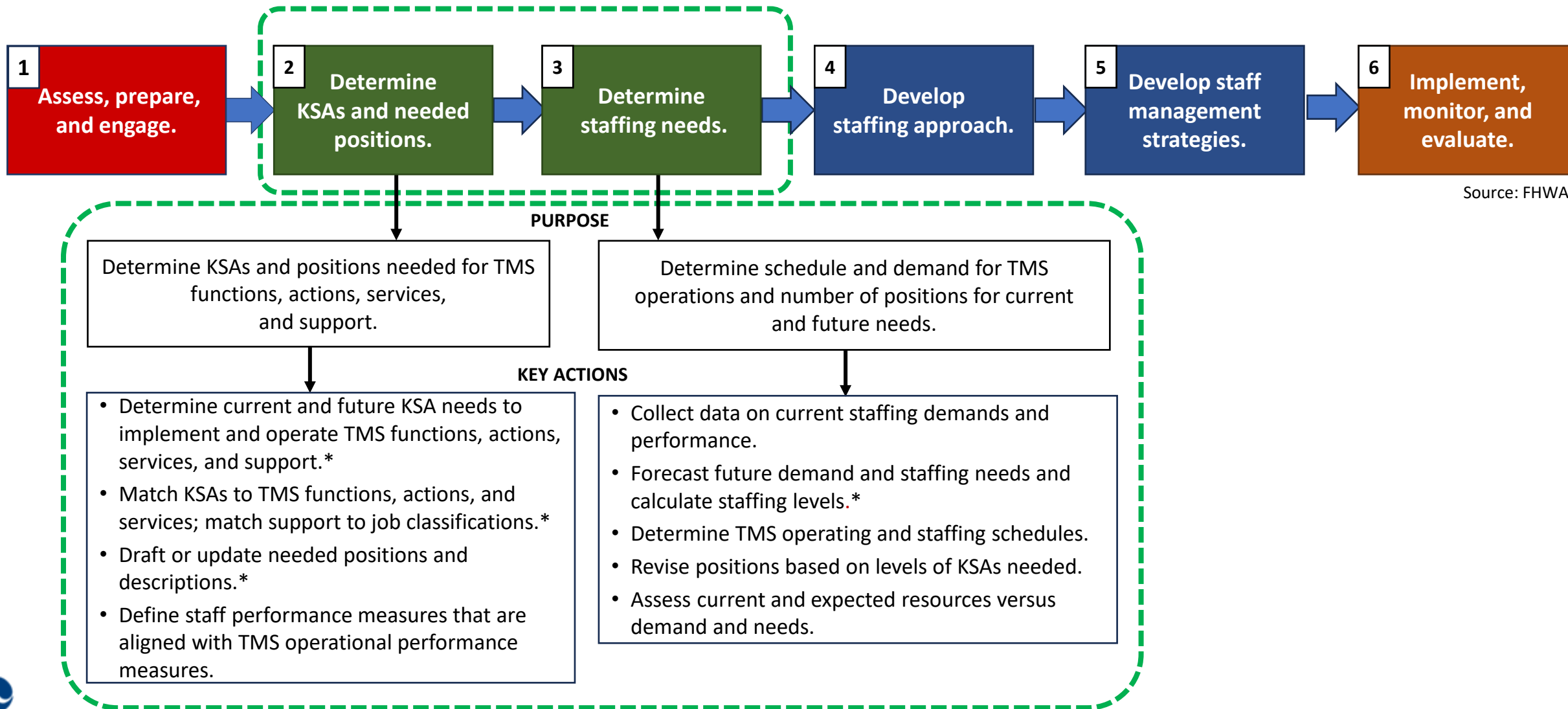


Challenges With Estimating Staffing Needs

- Identifying and collecting the right data.
- Determining the methodology to use to estimate needed staffing.
- Identifying and selecting appropriate performance measures.
- Understanding the metrics and data needed to estimate staffing.
- Predicting future staffing needs.
- Developing the capability to monitor and collect staff performance data and TMS demands.



Identifying TMS Staffing Needs



Source: FHWA.



*Critical actions for estimating staffing needs.



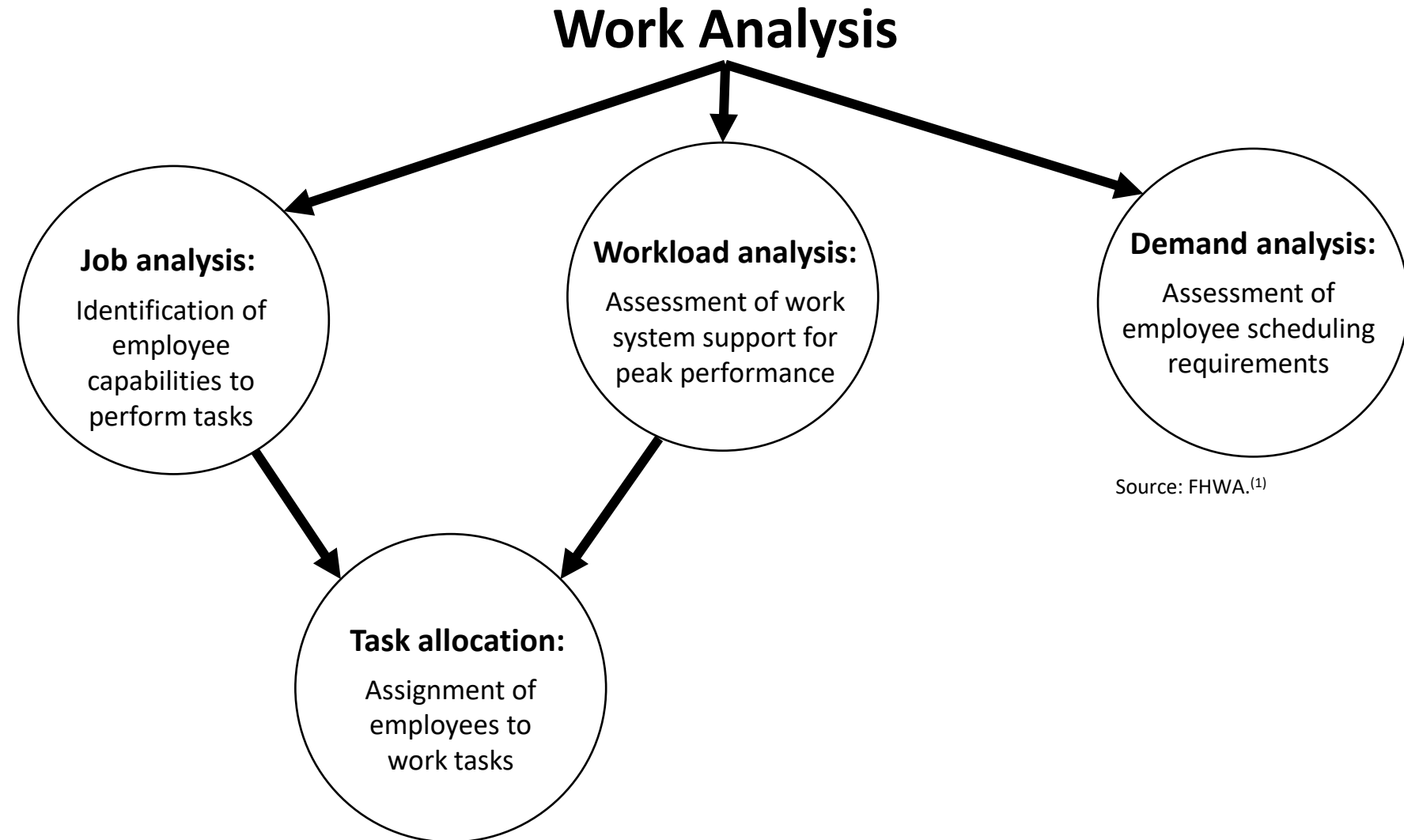
Identifying Current and Needed TMS Staff Positions

- Determine current and future KSA needs to implement and operate TMS functions, actions, services, and support.
- Match TMS functions, actions, services, and support to job classifications.
- Link job classifications to current and needed positions.
- Draft or update needed positions and descriptions.



Methods for Forecasting TMS Staffing Needs⁽¹⁾

Work analysis examines job-related activities and encompasses several methodologies that agencies can use to forecast TMS staffing needs.





TMS Job Analysis⁽¹⁾

- Determines basic elements of work.
- Assesses employee characteristics necessary to perform each element.
- Confirms employees possess the necessary attributes to perform each element.
- A job analysis may be:
 - Task-oriented—Determines specific elements of work:
 - Tasks.
 - Functions.
 - Positions.
 - Worker-oriented—Assesses employee characteristics:
 - Knowledge, skills, abilities, and other characteristics (KSAOs).
 - Training experience.
 - Performance level.





Example TMS Job Types For Consideration in Job Analysis

Functions	Typical Positions
Data Analysis	Traffic data scientist/statistician Data management specialist Visualization specialist
System Development	Traffic design engineer Systems engineer Computer engineer Telecommunications engineer
Real-Time Operations	TMS operator TMC shift supervisor TMC manager Cyber security engineer Traveler information specialist Public information officer Traffic incident management supervisor Transportation/electronics maintenance technician



TMS Workload Analysis (1)

- Assessment of work system support for peak performance.
- Considerations in three areas:
 - TMS workload:
 - Assessment of overall agency workload to enable prediction of staffing requirements.
 - Number of centerline or lane miles, number of intersections, number of TMS devices, number of incidents, and incident severity are commonly measured.
 - Employee workload:
 - Assess task resource requirements and whether employees can meet the resource demands.
 - Evaluate relative to resources available, based on the combination of tasks performed, the difficulty of the tasks, and the individual characteristics of the employee.
 - Attention:
 - Assessment of the attention required by staff for a particular task.
 - Generally categorized in three ways: (1) selective attention, (2) focused attention, and (3) divided attention.



Workload Analysis—Washington State Department of Transportation (WSDOT)¹

- Analysis is organized around agency function, with activity level estimates based on previous traffic operations experience.
- Functions within the TMS are rated based on how critical the functions are in terms of impacting:
 - Life safety (L).
 - Supporting regulatory control enforceable by law (R).
 - Advising travelers (A).
- Times associated with TMS operators and events are based on staff experience and “Guidelines for TMC Transportation Management Operations Technician Staff Development.”
- Full-time equivalent (FTE) staffing levels are based on a 40 h per week, 50 w per year resource allocation.
- WSDOT assumes total staff of 25 persons, operating the TMS 24 h per day, 7 d per week, 365 d per year.
- WSDOT used spreadsheet-based tools to estimate past staffing requirements.

¹WSDOT. 2012. *Evaluation of Operator Staffing Levels and Associated Space Requirements*. Unpublished internal document.



Workload Analysis—Washington State Department of Transportation (WSDOT)¹ (continued)

Function	Rating	Events	Metric	Operator Time/Event (minutes)	Mileage/Subsystem	Units	Annual Load (hours)	FTE Employees
Peak freeway operations	R/A	3.21	Per peak period	15	240	Miles	1,670	0.83
Incident management	A	2	Per peak period	15	180	Miles	1,040	0.52
Web page update (traveler information system)	A	2	Per peak period	5	1	Sites	347	0.17
Dynamic message sign	A	0.25	Per peak period	1	380	Signs	3,293	1.65
Interagency coordination	A	1	Per shift	30	10	Partners	300	0.15
Reversible roadway operations	R	2	Per shift	30	20	Miles	1,200	0.60
Logging	A	220,000	Per year	0.5	240	Actions	1,833	0.92
Maintenance dispatching	A	4,446	Per year	30	160	Trucks	2,223	1.11
Video and data sharing	R	5	Per week	90	10	Partners	3,900	1.95
Tunnel management	L	2	Per week	90	3	Sites	468	0.23

R = supports regulatory control; A = supports advising travelers; L = supports life safety.

© 2012 WSDOT.

¹WSDOT. 2012. *Evaluation of Operator Staffing Levels and Associated Space Requirements*. Unpublished internal document.



TxDOT Staffing Analysis¹

- Combines quantitative and qualitative analyses.
- Quantitative analysis includes:
 - Current staffing levels.
 - Annual turnover rate.
 - Number of ITS devices.
 - Centerline miles monitored.
 - Vehicle miles traveled.
- Qualitative factors include:
 - Job functions, including responsibilities outside the control room.
 - New technologies added to the TMS.
 - Upcoming major roadway projects.
 - Difficulty in filling positions.
 - Efficiency of current operation.

¹TxDOT. 2022. *Development, Integration, Implementation, and Maintenance Services for Traffic Management System (DIIMS) Transportation Management Center Staffing Analysis*. Internal document.





TMS Demand Analysis⁽¹⁾

- Identifies employee scheduling requirements.
- Predicts demand for TMS functions, actions, and services.
- Analyzes trends in demand (time-series analysis).
 - Trend component—upward or downward.
 - Seasonal component (weather, school, holidays).
 - Cyclical component—demand for TMS services tend to increase over time.
 - Random component.
- Estimates anticipated demand by regression analysis and similar means.



Demand Analysis—Florida DOT (FDOT)¹

- Uses historical values to develop factors in the subsequent calculation of FTE employee factors.
- Determines TMS staffing needs from historic values and user-input values.
- Calculates other elements of TMS staffing requirements, such as the number of events expected to occur within the fiscal year.
- Provides similar outputs for 19 other TMS staffing classifications, including information technology, public relations and marketing, and administration and reception.
- Embeds analysis in spreadsheet-based tools to estimate future demand for TMS services.

User-Defined Inputs	2024–2025
RTMC count	1
STMC count	3
Freeway center line miles	430.0
Freeway ramp meters	0
Arterial center line miles	465.0
Arterial signals	670
Express lane miles	22
Express lane ramp meters	12
Event growth rate (percent)	2.0
Example Spreadsheet Outputs	2024–2025
RTMC/STMC management	\$751,088
RTMC shift supervisor hours	8,760
STMC shift supervisor hours	12,480
Shift supervisor original loaded rate	\$54.00
Shift supervisor district rate	\$49.68

Source: FHWA.

RTMC = regional traffic management center;
STMC = statewide traffic management center.

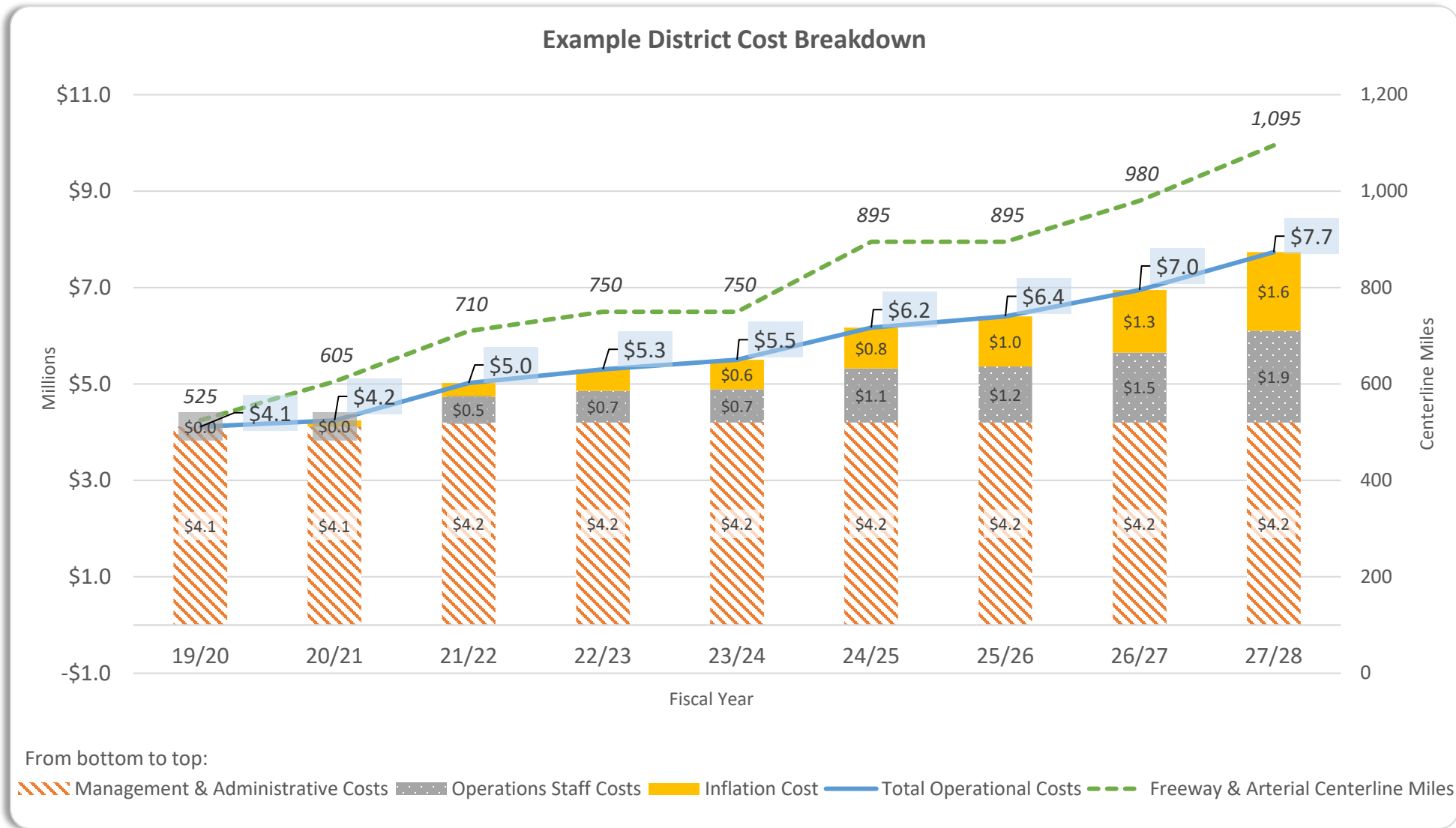
¹FDOT. 2022. *ITS Operations Budgeting Model v2.0*. Unpublished internal spreadsheet tool.



Demand Analysis—Florida DOT (FDOT)¹ (continued)

Florida DOT's spreadsheet tool provides a district-level cost breakdown summarizing annual costs, relative to user-defined changes in the roadway network.

¹FDOT. 2022. *ITS Operations Budgeting Model v2.0*. Unpublished internal spreadsheet tool.





Estimating TMS Staffing Without Formal Tools

- Minnesota DOT:¹
 - Adds new staff positions only when retirements are pending or existing personnel is transferred to a different position.
 - Hires staff as State employees for technical positions to improve staff retention, relative to private sector staffing.
 - Anticipates additional staffing needs to cover new shifts when the agency transitions to 24 h per day, 7 d per week operations.
- Utah DOT:²
 - Conducted benefit-cost analysis based on congestion and incident clearance, considering various factors, such as urban versus rural geography, number of incidents within a corridor, and traffic volume.
 - Transitioned to a matrix-style organizational structure so that Incident Management Team (IMT) support staff are managed regionally and statewide.
 - Approved additional IMT staff through executive decision and permanent TMC staff-to support TSMO initiatives.
- Pennsylvania DOT:³
 - Assesses staffing needs on an ad-hoc basis while working toward a formalized process.
 - Relies primarily on internal TSMO operations guidebook for staffing guidance.
 - Plans to develop a methodology to create a “snapshot” of staff requirements projected into the future.

¹Unpublished interview with Minnesota DOT. July 5, 2023.

²Unpublished interview with Utah DOT. June 29, 2023.

³Unpublished interview with Pennsylvania DOT. June 1, 2023.



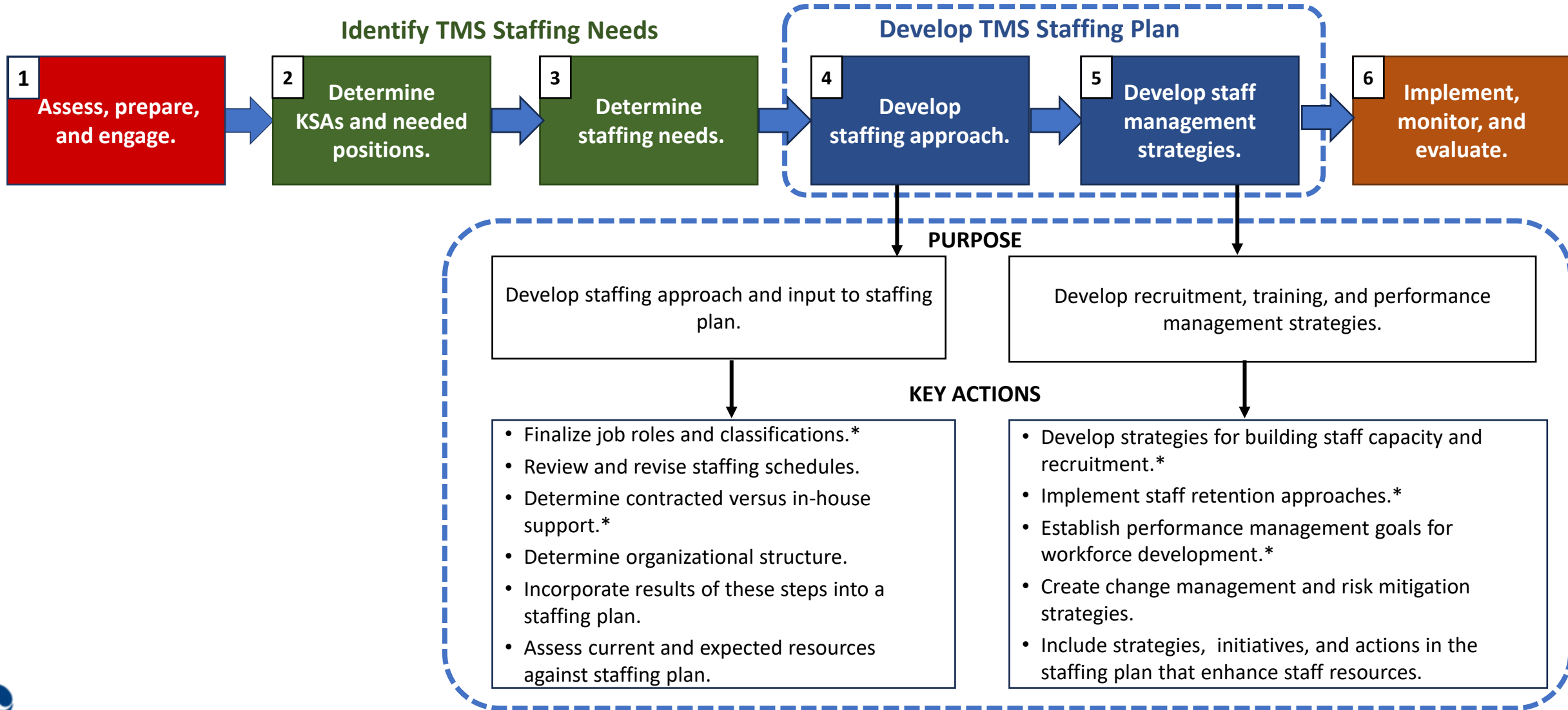


TMS Task Allocation⁽¹⁾

- Assigns discrete work activities to employees based on the results of job and workload analyses.
- Ensures the optimum allocation of work among employees or groups of employees.
- Supports the consideration of different staffing configurations.
- Supports estimating, identifying, and assigning staff for shifts or schedules.



Developing a Staffing Approach





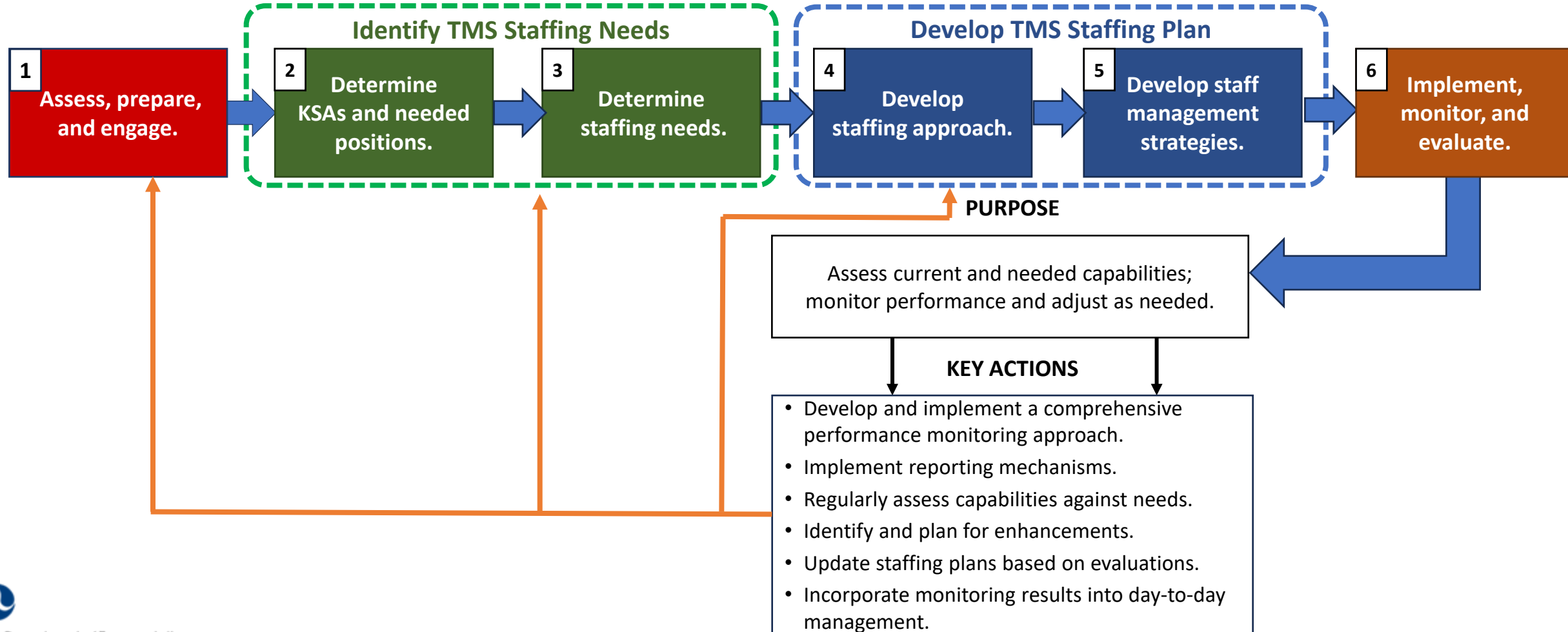
Key Actions in Estimating Staffing and Developing a Staffing Plan

- Finalize job roles and classifications.
- Determine contracted support versus agency staff.
- Develop strategies for building and maintaining staff capacity.
- Initiate and sustain efforts to recruit staff.
- Implement initiatives or activities to support staff development (e.g., retention programs or efforts, rotational assignments).
- Establish performance management goals, measures, reporting, and evaluation methods to support assessing current workforce and identify development needs.



Implement, Monitor, and Evaluate

Monitoring and reporting on staff performance is important for updating estimates for staffing and scheduling and managing staff resources, staffing plans, and feeds in day-to-day operations.



Lessons Learned

- Managers of TMSs may not use formal tools for estimating staffing needs.
- Agencies may rely on ad hoc processes to estimate staffing needs and resources.
- Agencies may not be able to fill the number of positions identified through the staff estimation process because of budget constraints, policies, or legislation.
- Cost-benefit analyses are commonly used to justify new staff positions when funding is requested.
- Staffing plans consider factors like organizational structure, agency staff versus contract staff, scalability (based on size, complexity, and capabilities), available agency resources and services provided (type and size of the area serviced, TMC operational hours), and gaps in current or future staffing needs.
- Changes in TMS demand, such as the number of incidents or number of ITS devices, can be considered in estimating staffing needs.





Available Resources

- *Organizing for TSMO—Case Study 5: Organization and Staffing.*⁽²⁾
- *TMC Operator Requirements and Position Descriptions.*⁽³⁾
- *TMC Staffing and Scheduling for Day-to-Day Operations,* including a TMC ops tool.⁽¹⁾
- *Transportation Systems Management and Operations (TSMO) Workforce Guidebook.*⁽⁴⁾
- *Day-to-Day Management and Operation of TMSs and TMCs.*⁽⁵⁾
- *Aligning Traffic Management Center Staffing Capabilities for the Future of Systems Operations.*⁽⁶⁾
- *TMC Operator Requirements and Position Descriptions.*⁽⁷⁾





Additional Information on TMS Practices

- National Operations Center of Excellence (NOCoE) Traffic Management Systems and Centers portal.⁽⁸⁾
- TMC Pooled-Fund Study website.⁽⁹⁾



References

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