Aligning Transportation Management Center Staffing Capabilities for the Future of Systems Operations

**Transportation Management Center (TMC)
Pooled-Fund Study**

**Federal Highway Administration (FHWA)
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Presentation Outline

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Overview

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Aligning TMC Staff with Current and Future Agency Needs and Capabilities

Potential Future TMS Enhancements:

- New or enhanced system operations strategies.

- New, improved, or expanded functions, services, or areas of coverage (e.g., integrated corridor management, active traffic management, adaptive system operations, active work zone operations, etc.).

- New technologies and improved system capabilities and changing needs for maintenance and repairs.

- Increased expectations for analysis, performance reporting, and data management.

Agency Considerations:

- Assessing staff numbers, skill sets, and technical capabilities.

- Quantifying and determining skills and requirements.

- Acquiring the right staff.

- Recruiting, retaining, and developing staff.

- Aligning compensation and roles with technical needs.

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Examples of New or Specialized Roles in TMCs

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- Information or data analyst, business analyst.

- Data scientist and data management specialists.

- Traffic analyst.

- Meteorologist.

- Traffic incident management coordinator, Safety Service Patrol—Dispatcher and coordinator.

- Work zone monitor and coordinator.

- Telecommunications and information technology specialist.

- TMC instructor.

- Engineer or engineering technician.

- Corridor manager.

- Computer and systems engineer.

- Cybersecurity specialist.

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Potential Staffing Needs To Improve TMC Performance

Technical Needs

- Software.
- System networking and sharing data.
- Hardware.
- Telecommunications.
- Emerging technologies.
- Data management.
- Electrical engineering.
- Traffic engineering.

Business and Operations Needs

- Follow standard operating procedures (SOPs).
- Collaborate with multiple agencies.
- Use multiple operating systems.
- Implement and monitor traffic operations strategies.
- Analyze data and performance.
- Troubleshoot equipment and systems.
- Train and develop staff.

Acquiring Staff for the TMC

Staffing Approach	Characteristics
Public Sector Staff	Agency employees fill roles for operations, management, staff supervision, and project and program management.
Contractor Staffing	• Agencies establish contracts with private sector firms to support operations, staff management, or maintenance. Additionally, contractors may fulfill roles for traveler information, incident response, data analysis, and other functions. • Agencies may include multiple contractors for various roles.
Hybrid Approach	• Agencies utilize contractors for specific functions or services (such as device maintenance, system design, day-to-day operations, and express lanes operations). • Contracts may include oversight of contractor staff by agency staff.

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TMS Influences on Staffing

Motivations for Needing Additional Staff at TMCs

- Changes in agency business rules and operating environment:
  - Limitations on full-time equivalent (FTE) staff numbers.
  - Funding considerations.

- Challenges with staff recruitment and retention:
  - Difficult for public sector to attract and retain staff with the right technical skills.
  - Limited opportunities for career advancement.
  - Higher salaries in competing industries for people with skills TMCs need.

- Desire to improve TMS capabilities and performance.

- New, improved, or expanded functions, services, or areas of coverage.

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Agency or Contracting Staff for TMCs

- Potential benefits of utilizing contracted staff:
  - Provides needed staff without counting toward agency FTEs.
  - Provides ability to expand or scale staff to meet needs.
  - Provides potential staff retention benefits (e.g., compensation, career paths, and staff development).
  - Offers supplemental staff for specific functions, such as maintenance, design, integration, and other services.

- Potential benefits of utilizing agency staff:
  - Allows agency to retain knowledge and operational responsibilities.
  - Keeps decisionmaking for operations in-house.
  - Provides integration with other agency functions and access to internal agency resources.
  - Enables cross-training and utilization across other group or agency functions.

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Challenges With Assessing TMC Staffing Needs

- Quantifying needed knowledge, skills, and abilities (KSA).

- Developing, operating, and maintaining TMSs with staff members who have specific technical expertise, knowledge, and skills.

- Having limited training resources available to staff in TMCs beyond on-the-job training.

- Modifying staff roles, responsibilities, job descriptions, staffing levels, or support resources.

- Aligning the different types of knowledge, skills, and resources that may be needed to support TMSs compared to typical agency positions.

- Expanding staff members' capabilities to proactively manage and operate a TMS.

- Adding staff with the capabilities needed to support the next generation of the agencies' TMS.

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Evaluating Impacts of TMSs on TMC Staffing

- What are the staffing and resource needs of the TMS?

- Are adequate numbers of staff members available to manage and operate the TMS?

- Do current staff members have the needed technical KSA? Are there specialized skills needed that do not exist with current staff?

- Is training available? If not, how can staff members acquire the needed knowledge, skills, and technical capabilities?

- Will the addition of new operations strategies, functions, or services require staff members to perform differently? Are the needed staff and resources available?

- Are new technologies, capabilities, or systems that may require new processes or skills to manage, operate, or maintain the TMS being implemented ?

- How might agencies support staff with preparing for new TMS capabilities?

- Can specific reasons for staff turnover be identified? Can the number of potential turnovers be mitigated?

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Staffing Issues To Consider for TMSs

- Being aware of the roles and responsibilities for monitoring, managing, or verifying the status of subsystems, components, or devices.

- Having the ability to troubleshoot malfunctions to prevent unnecessary maintenance, equipment downtime, or repairs.

- Being aware of distinctions between automated and manual operations or actions to assist staff with understanding when a manual intervention may be needed.

- Documenting SOPs for functions, actions, or services to promote consistency and understanding among staff.

- Understanding how different subsystems, components, or devices may support operational strategies and improve staff decisionmaking.

- Establishing authority levels to implement or adjust different operational strategies or response actions to align staff with appropriate experience and expertise.

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TMS Staffing Plans

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Opportunities for Identifying TMC Staffing Needs as Part of Planning for Future TMS Improvements

- System Planning and Concept of Operations:
  - TMC use cases—User needs, TMC workflows.
  - TMS components that TMC staff must interact with or operate.
  - TMS perspectives—Traveler information, incident monitoring and response, traffic management.

- System Requirements:
  - Understand TMC roles and needs to address requirements.
  - Identify areas for training, new knowledge requirements, or processes.

- Capability Maturity Model Assessments:[1]
  - Organization and Staffing dimension provides the most direct input to needs for workforce, staffing, technical skills, and training.
  - Other dimensions (Business Processes, Systems and Technology, Performance Measurement, and Culture and Collaboration) provide additional staffing needs.
  - Capability Maturity Framework dimension serves as an additional tool.

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KSA for TMC Staff

- **Knowledge** is defined as the intellectual possession and command of information necessary to qualify for the position (entry level) and the information to be acquired after assuming a position to perform the required tasks. The knowledge of a TMC staff member or candidate may be assessed by measuring the accuracy of responses to a set of TMC operations-related questions.[2]

- **Skill** is defined by an assessment of the level of proficiency in exercising knowledge and performing TMC tasks. Skills are typically assessed by task performance time and accuracy assessments.[2]

- **Ability** is defined as the basic intellectual and physical capacities necessary to successfully perform in a TMC operations position, acquire the necessary skills, and apply the necessary knowledge. The ability of a TMC staff member or position candidate may be assessed by aptitude tests or may be assumed based on level of education and job history.[2]

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Developing KSAs for TMS Staff

Sample Function	Sample Corresponding Action[3]	Sample Requirement[3]
Detect traffic incidents on the freeway	• Receive system alerts of abnormal conditions. • Confirm incident location with closed-circuit television cameras. • Monitor updates from public safety agencies.	• Use TMS tools to detect incidents (alerts, visual monitoring systems). • Use TMS tools to verify incidents (alerts, visual monitoring systems).
Coordinate response to incidents	• Enter confirmed incident into lane closure database. • Determine response needs from agency. • Dispatch safety service patrol. • Receive updates from safety service patrol and responders. • Respond to questions and requests.	• Use lane closure system. • Coordinate with internal resources for response. • Coordinate with external resources for updates and support needs. • Actively monitor incident scene with TMS tools.
Share incident information with agencies and travelers	• Update details of incident response in lane closure database. • Activate dynamic message sign appropriate message from library. • Notify affected agencies (local agencies, other responders). • Monitor social media alerts. • Confirm 511 and other agency traveler information systems have issued alerts.	• Use TMS to provide en route traveler information. • Use and monitor public-facing tools. • Update systems that support external information sharing.

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Using Contracted Staff for TMCs

- Benefits:
  - Allocate FTE staff across agency operations.
  - Define job roles and classifications as well as pay scales.
  - Enhance contractor responsibility for hiring process, scaling up resources in emergencies or to cover during vacations and absences, and implementing strategies for staff retention.
  - Increase opportunity for employee advancement.
  - Extend incentives and recognition provided (something not allowed in public agencies).
  - Extend and expand training opportunities.

- Challenges:
  - Experience tradeoffs with contract duration.
  - Add to contract scope and fee with changes.
  - Have gap or void of knowledge for agency.
  - Involve transition periods between contractors.
  - Align contract type and payment method needed to consistently achieve operating expectations.
  - Require agency staff with required skill set and authority to manage and evaluate contractor performance.
  - Define contractor performance expectations and thresholds.

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Using Agency Staff for TMCs

- Benefits:
  - Understanding broader agency missions and functions.
  - Understanding agency organization.
  - Having access to internal agency resources, publications, processes.
  - Being eligible for retirement and benefits offered to State or public sector employees.
  - Retaining institutional knowledge, expertise, and lessons learned.
  - Facilitating integration among agency TMC staff.
  - Acquiring incentivized tenure and long-term employment from civil service benefits.

- Challenges:
  - Administrative rules may apply that can slow advancement within organization.
  - Operational budgets and hiring processes may make quickly expanding staff challenging.
  - Agency compensation limitations can make attracting qualified candidates challenging.
  - Career growth can be limited within public agencies or within TMCs.

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Benefits of Staffing Plans for TMCs

- Aligns with current and future needs of the TMS.

- Identifies where future operational strategies will influence staffing.

- Supports agency resource planning, considering the timeline for system and operating enhancements.

- Provides a business case for additional resources or realignment of current resources.

- Identifies gaps in current staffing numbers or skill sets, and identifies new roles or functions needed.

- Captures methods to acquire staff, adjust TMC staffing approach, and provide additional training.

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Components of a TMC Staffing Plan

- Current TMC functions, operations, hours, shifts, and organization.

- Current TMC staff roles or responsibilities and gaps.

- Operational influences (e.g., new systems, new operating strategies, and expanded TMC roles or functions).

- Future organization and staffing needs.

- Process to acquire needed TMC staff resources.

- Training needs—Internal (agency), technical, and cross-training opportunities.

- Implementation timeline. (When is new staff or training needed?)

- Process for reviewing or updating the plan.

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TMS Staff Development

Challenges With Defining New TMC Roles

- Creating job descriptions and roles.

- Quantifying specific staff technical needs for future systems.

- Knowing what general and specific knowledge areas are needed:
  o Understanding how actions to be performed translate to specific requirements.
  o Determining how TMC staff will interact with and use TMS components and systems.
  o Identifying decisionmaking needs and requirements to support those decisions (i.e., engineering judgment).

- Aligning with human resource (HR) requirements:
  o Differentiating between "required" versus "desired" experience, qualifications, and education.
  o Establishing compensation and classification scales.
  o Creating recruiting strategies and maintaining a pool of potential candidates.
  o Obtaining a broader perspective on comparable roles within an agency.

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Acquiring Staff To Support TMS Operations at the TMC

- In-house agency staff:
  - Work with HR to develop job descriptions and roles.
  - Leverage TMC staffing plan for KSAs and specific staff needs.
  - Recruit through agency HR processes.
  - Implement onboarding, training, and integratione of staff members into TMC operations.
  - Establish processes for staff development, ongoing training, and career progression.

- Contracted staff:
  - Identify TMC functions (partial or full operations) where supplemental staff are needed.
  - Develop procurement, advertisements, and contractor selection.
  - Outline requirements for selected contractor:
    » Performance expectations.
    » Staff expectations.
    » Roles, responsibilities, and lines of communications.
    » Compensation.
  - Monitor contractor performance.
  - Update or modify contract, if needed over time.

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Types of Contracts

Contract Type	Advantages[3]	Challenges[3]
Time and Materials	• Lower risk for contractors. • Ability to be reimbursed for authorized changes and adjustments.	• Requires contractor effort to track and report. • Consists of variable costs. • Requires balance of escalating labor costs versus negotiated billing rates.
Performance Based	• Incentives for achieving performance thresholds. • Flexibility for contractors in how they achieve performance expectations.	• Requires clearly defined expectations and criteria. • Can be challenging to define how contractors will be evaluated and measured.
Fixed Price	Risk is on the contractor to deliver within the established budget.	• Requires well-defined scope. • Requires contractor to build risk into costs or rates. • Offers limited flexibility in expanding scope or resources.
Cost-Plus Fixed Fee	• Ability for cost reimbursement with negotiated fee. • Less risk to agency for unaccounted costs. • Relatively low risk to contractor and limited need to build in risk. • Incentivizes the use of high-quality staff.	• Requires clear identification of what costs are reimbursable. • Requires periodic monitoring for adjustments.

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TMC Staffing Contractor Expectations

- Recruit and hire qualified staff.

- Supervise staff and operations.

- Identify additional skills or expertise needed to support TMS operations.

- Provide training to staff; verify staff proficiency with TMS operations and systems.

- Implement processes to retain and develop staff.

- Address staff performance and conduct issues.

- Track, monitor, and report on TMC staff and operations to agency per contract terms.

- Provide benefits and equipment (phones, vehicles), and implement processes for tracking and reporting time.

- Communicate and coordinate with contracting agency.

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TMC Staff Recruiting and Development

- Candidate pools (TMC operations):
  - Military experience.
  - Engineering program credentials.
  - State and local law enforcement dispatch and public safety.
  - Considerations: Comfortable with maps, radio communications, operating systems, dispatch functions, and multitasking.
- Candidate pools (technology focused):
  - Agency may be competing with other industries for technical skills (electrical engineering, software, and telecommunications).
  - Agency pay scales and career path options may be limited.
- Creative approaches:
  - Advertise through social media.
  - Recruit through career fairs.
  - Reach out to universities, community colleges, and technical programs.

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Staff Recruitment and Retention Considerations

- ## Recruitment:
  - o Partner with technical and community colleges to develop a course that can help train potential candidates. The Delaware DOT (DelDOT) and the Washington State DOT (WSDOT) have such partnerships.[1,2]
  - o Utilize staffing contractors who may have more flexibility in recruiting and targeting specific candidates for TMC roles.
  - o Invest in training less skilled operators who are hired at entry-level positions.

- ## Retention:
  - o Provide incentives for staff, such as performance bonuses, recognition, and performance-based pay increases.
  - o Redefine TMC operator positions into different classifications. Utah DOT (UDOT) and Caltrans (California DOT) District 11 both reclassified TMC operations staff into a dispatch classification, which provided an increase in pay ranges and helped staff qualify for additional career levels within the dispatcher classification.[3,4]
  - o Link advancement opportunities to performance-based milestones and have skill-based milestones to incentivize employees into wanting to achieve those incentives.

[1] Interview with DelDOT, February 2020.

[2] Interview with WSDOT, March 2020.

[3] Interview with UDOT, February 2020.

[4] Interview with Caltrans District 11, February 2020.

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Staff Recruitment and Retention Challenges

- Lack of competitive salaries (agency and contractors).

- Competition with strong economy and job market (may require training the right candidate for entry-level roles).

- Undefined career paths:

  o Certification and license requirements may limit advancement to management roles.

  o Small teams may limit other advancement opportunities.

- Increased flexibility for contractors:

  o Recruiting practices.

  o Candidate screening and interviewing.

  o Training programs and resources beyond operating procedures.

  o Incentives—Performance bonuses, performance-based pay increases, additional career paths.

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Resources

TMS Resources

- TMC PFS website.[4]

- National Operations Center of Excellence (NOCoE) TMS portal.[5]

- TMS staffing and operators resources.[6]

- Next generation of TMSs resources.[7]

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TMS Staffing Resources

- TMC operator requirements and position descriptions.[2]

- Aligning Traffic Management Center Staffing Capabilities for the Future of Systems Operations.[3]

- Human factors design guidelines.[8]

- TMC staffing and scheduling for day-to-day operations.[9]

- HR resources.[10]

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