Guidelines for Virtual Transportation Management Center Development

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Project Purpose

• To develop a guidebook that provides technical guidance on planning and development of a Virtual TMC
• Virtual TMC Guidebook will serve as a key resource for developing a virtual TMC, including:
  – Examples of various TMC models
  – Guidance for business planning
  – Procedures for addressing common technical, operational, and institutional issues (e.g., data needs, communications, collaboration agreements)
1. Guidebook Overview
   - Introduction & Background
   - Current TMC Operational Practices
   - Virtual TMC Implementation Guidelines
   - Benefits and Challenges

2. Questions
Definition of a “Virtual TMC”:

A Virtual TMC is the function of monitoring, controlling and managing the functional elements of a transportation management system through the use of computers and computer networks without being present at a physical nerve center or without the existence of such a physical nerve center. This includes the functions of monitoring, collecting, processing and fusing transportation system data; disseminating transportation information to outside entities; implementing control strategies that affect changes in the transportation system; and coordinating responses to traffic situations and incidents.
TMC General Definition

- Transportation Management Center (TMC)
  - The nucleus for collecting, monitoring, verifying, and responding to traffic conditions
  - Disseminating important information to other agencies and the public
  - Staffing: TMC operators and emergency responders (highway patrol, etc.)
  - Typically a single or multi-agency facility
- Physical/operational model:
  - Centralized
  - Distributed
  - Virtual
  - Hybrid of the above

Most prevalent current models
TMC Model Shift

- Less Emphasis on physical facilities (very expensive)
- More emphasis on data communications (decreasing in costs)
- More use of advanced web-based software solutions, cloud computing and Software as a Service (SaaS)
- Not constrained geographically
GUIDEBOOK OVERVIEW

CURRENT TMC OPERATIONAL PRACTICES
There are four (4) typical TMC models:

1. Centralized
2. Distributed
3. Virtual
4. Hybrid
Current TMC Deployments

Legend:
- Centralized
- Hybrid: Virtual-Centralized
- Virtual
- Distributed/Decentralized
Interviewed Agencies

- Alabama DOT
- Idaho Transportation Department
- LA County
- LA Metro
- Michigan DOT
- Kansas DOT
- Minnesota DOT
- New Hampshire DOT
- Oklahoma DOT
- Oregon DOT
- San Diego Association of Governments (SANDAG)
1) Existing Systems and Needs Assessment

- A high level needs assessment should be prepared to describe the following areas:
  - Physical Communications
  - Logical Communications
  - Data and Information Needs
  - Operational Needs
  - Software System Needs

- A high-level logical architecture should be prepared during this stage.
## 2) VTMC ConOps

<table>
<thead>
<tr>
<th>Section</th>
<th>Section Purpose</th>
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<tbody>
<tr>
<td>Scope</td>
<td>What is the scope of the VTMC project, What is to be developed and documented</td>
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<tr>
<td>CURRENT SYSTEM AND SITUATION</td>
<td>What is the current state of practice related to TMC applications or systems that may or may not be performing the functions expected from a virtual TMC.</td>
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<td>JUSTIFICATION FOR AND NATURE OF CHANGES</td>
<td>Why does a VTMC need to be developed and what will it do, at a high level.</td>
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<tr>
<td>CONCEPTS FOR PROPOSED OPERATION</td>
<td>Who are the users of the VTMC and where will it/can it be deployed, and under what constraints</td>
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<td>OPERATIONAL SCENARIOS</td>
<td>What are the operational scenarios of the VTMC system, What systems and/or subsystems are involved, How do they operate, When do the sequence of events occur within the VTMC system</td>
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<td>ANALYSIS OF PROPOSED OPERATION</td>
<td>What improvements will be realized through the VTMC development, What Trade-offs were considered</td>
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3) Virtual TMC Security Design

- Layered Security
- Secure Communications
- Log Management
- Audit Policies
- Alerts and Notifications
- Log Analysis and Reporting
- High Availability Systems
4) Design Virtual TMC Communication Architecture

Transportation Management Center Hosting Facility/Location
Communication Architecture

C2C Communications Hub or Gateway
5) Develop ATMS Implementation Plan

- ATMS Purpose
- Mission Statement
- ATMS Functionality Description
- Existing and Proposed ATMS Architectures
- Implementation Procedures/Steps
- Roles and responsibilities for executing the plan
- Implementation Schedule
- Costs
6) Standard Operating Procedures (SOPs)

- Virtual TMC Procedure Overview – Provides decryption of each individual procedure and its purpose.
- Area or Responsibility – Who is responsible for implementing this procedure given the new VTMC model; i.e., who is responsible for doing what.
- Procedure Steps – An actual description of the steps that will be followed in the new VTMC model.
- References – References to any other procedures that will be used in association with this specific Virtual TMC procedure.
• Currently, these are the most common staffing approaches for Virtual TMCs:
  – Staffed and operated by the managing entity—no dedicated TMC staff, rather the entity staff also perform TMC functions.
  – Staffed and operated by the managing entity—dedicated staff for TMC functions but not working in a typical physical TMC environment (i.e., staff working remotely).
  – Managed by a single entity with the operational support of partner agencies.

• The staffing plan should address each of these functions given the new Virtual TMC model.
8) VTMC Training Plan

- Operators, Administrators, Maintenance
- VTMC Operators can have “blurred” responsibilities
- One-on-one Training
- Scenario-Based
9) Risk Assessment

Mitigating Risk

Example of possible risks and risk level assignments.

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<tr>
<th>Description of Risk</th>
<th>Likelihood</th>
<th>Impact</th>
<th>Actions/Mitigation</th>
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<tbody>
<tr>
<td>Agency partners do not have common operational concept</td>
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<td>H</td>
<td>Establish common multi-agency Concept of Operations</td>
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<td>Center-to-Center Communication System is not conducive for Virtual TMC Operations</td>
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<td>M</td>
<td>Design common C2C communication gateway, portal or hub using agreed standard data exchange mechanism</td>
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<tr>
<td>Regional ITS Architecture does not support VTMC model</td>
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<td>L</td>
<td>Begin process to update Regional ITS Architecture accordingly.</td>
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1. **Remote system accessibility** – provides operators and other users with the ability to operate the system(s) by establishing a remote access connection from any location
2. **Shared control of the agency’s existing (and future) ITS devices and data**
3. **Data sharing/exchange among partner agencies**
4. **Improved information collection and dissemination**
5. **Software alignment across partner agencies** – use of same software applications across partner agencies facilitates information sharing
6. **Ability for agencies to combine facility infrastructure and staffing resources to operate in a multi-agency coordinated manner**
7. **Operations alignment across partner agencies** - use of Standard Operating Procedures (SOPs) during multi-agency events facilitates integrated response
8. **Backup capabilities including systems and operations** – anyone with appropriate privileges can access the system from anywhere
9. Regional Stakeholder buy-in – improved cooperation and collaboration among partner agencies
10. Improved communication among partner agencies. Coordinated response to multi-agency events
11. Improved relationships with partner agencies
12. Cost savings – capital and staffing cost savings may significantly lower in the Virtual TMC model vs. a traditional TMC
13. Innovative approach that requires coordination and cooperation between agencies
14. A Virtual TMC can be at the service of many agencies
Virtual TMC Challenges

- Regional Stakeholder Buy-In
- Legacy Systems
- Servicing Agreements
- Lines of Communication
- Risk Avoidance
- Security
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