Systems and Technology Guidance

LEVEL 3 TO LEVEL 4

Why Systems and Technology are Important

Use of the appropriate processes for design and implementation of TSM&O systems will ensure that the needs of the region are appropriately addressed, that systems are implemented in an efficient manner, and interoperability with other systems is achieved.

Improvement Target

<table>
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<tr>
<th>From</th>
<th>Systems and technology standardized, documented and trained statewide, and new technology incorporated (L3)</th>
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<tr>
<td>To</td>
<td>Systems and technology routinely upgraded and utilized to improve efficiency and performance (L4)</td>
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<tr>
<td>By</td>
<td>Coordinating and updating architectural activities with performance measurement on a continuous basis</td>
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Key Sub-dimensions

- Regional Architecture
- Systems Engineering/Testing/Validation
- Standards/Interoperability
Regional Architecture Action Plan (L3 to L4)

Strategy Summary

Monitor ongoing system developments as well as changing needs to ensure that the architecture is both followed and updated as needed.

Key Actions

A Supplement the activities of the Architecture Review Committee to include proactive review of the regional architecture to ensure performance measurement is an integral function

B Develop concepts of operation for regional operations activities such as major incidents, weather emergencies, etc.; evaluate the ability of the regional architecture to support the requirements as defined by the ConOps

ACTIONS

Action A: Supplement the activities of the Architecture Review Committee to include proactive review of the regional architecture to ensure performance measurement is an integral function

Rationale: The functionalities supported and data developed by the systems may require modification to produce the outcome and output measures needed for performance management and reporting.

A.1 Review performance measures in use by participating agencies to identify those measures with regional applicability.

A.2 Identify additional measures (or locations for performance measurement) that reflect the quality of regional operations.

A.3 Review all systems developed as part of the architecture to ensure that needed regional performance measures can be evaluated.

A.4 Recommend changes to systems to appropriate participating agencies.

Responsibility and Relationships: Periodic reviews are the responsibility of the Architecture Review Committee which is convened by the Architecture Lead. Both project personnel and managers of organizations within the region that are stakeholders in the architecture development and implementation are involved.
**Action B:** Develop concepts of operation for regional operations activities such as major incidents, weather emergencies, etc.; evaluate the ability of the regional architecture to support the requirements as defined by the ConOps

**Rationale:** The Architecture Review Committee should evolve into an organization with the ability to assist in the coordination of regional transportation management and operations especially for events requiring multijurisdictional cooperation, such as weather, major emergencies and special events.

**B.1** Develop concepts of operations to define the roles of all participants, the channels of communication, command hierarchies etc.

**B.2** Evaluate the ability of existing and planned systems to support the regional event.

**B.3** Review the Regional Architecture to identify enhancements required for alignment with the ConOps.

**Responsibility and Relationships:** Periodic reviews are the responsibility of the Architecture Review Committee which is convened by the Architecture Lead. Both project personnel and managers of organizations within the region that are stakeholders in the architecture development and implementation are involved.

**Examples/References:**

- It is imperative that performance measurement be an integral functionality of any newly developed or enhanced system. In the Maryland Coordinated Highways Action Response Team (CHART) traffic management system, performance measurement was included at the earliest stages of the system design, including the concept of operations. The CHART system documentation including reference to performance measurement can be found at: [http://www.chart.state.md.us/downloads/readingroom/chart_ii_documents/BAA-Report-BodyFinal.pdf](http://www.chart.state.md.us/downloads/readingroom/chart_ii_documents/BAA-Report-BodyFinal.pdf)
- The importance of performance measurement is emphasized at: [http://ops.fhwa.dot.gov/publications/regisarchguide/7use.htm](http://ops.fhwa.dot.gov/publications/regisarchguide/7use.htm)
- An excellent example of a concept of operations for a broad range of traffic management applications can be found within the Maryland CHART Advanced Traffic Management System design documentation at: [http://www.chart.state.md.us/downloads/readingroom/chart_ii_documents/BAA-Report-BodyFinal.pdf](http://www.chart.state.md.us/downloads/readingroom/chart_ii_documents/BAA-Report-BodyFinal.pdf)
- Information that deals specifically with the regional concept of operations can be found at: [http://ops.fhwa.dot.gov/publications/rctoprimer/index.htm](http://ops.fhwa.dot.gov/publications/rctoprimer/index.htm)
Systems Engineering/Testing/Validation Action Plan (L3 to L4)

Strategy Summary

Implement continuous training program emphasizing philosophy, procedures and benefits

Key Actions

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<td>A</td>
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<tr>
<td>B</td>
<td>Develop a certification process for individuals involved with system development, operation and maintenance to ensure that they are qualified to participate in the process</td>
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<td>C</td>
<td>Develop a personnel advancement program to reward personnel who have become certified in the systems engineering process</td>
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ACTIONS

Action A: Implement/adapt a training program to ensure that all personnel associated with system development, operation and maintenance are fully conversant with the principles of systems engineering

Rationale: Placing the agency on a continuous improvement basis requires developing internal capability to upgrade and augment existing systems to provide wider and more effective TSM&O.

A.1 Identify personnel involved at the project management and assistant project management levels with responsibility for leading the acquisition, development or enhancement of high technology assets.

A.2 Develop a systems engineering training curriculum for these personnel using available resources from FHWA, universities and online. The curriculum development should be the responsibility of either agency personnel or other resources with knowledge of the systems engineering process.

A.3 Develop a systems engineering training curriculum for those personnel that includes the identification of specific individuals to be trained, the training schedule, and the training resources to be used. The curriculum should also include a budget and funding sources to be used to support the program.

Responsibility and Relationships: Senior management personnel overseeing system implementation are responsible for budgeting for the acquisition of the tools, and ensuring their use and involving program managers and agency technical staff.
Action B: Develop a certification process for individuals involved with system development, operation and maintenance to ensure that they are qualified to participate in the process

Rationale: Institutionalizing systems engineering within the agency requires establishing a systematic basis for determining the qualifications for recruitment and promotion that meet the agencies technical requirements for management and upgrades the existing systems.

B.1 Define the knowledge, skills and abilities (KSAs) that must be possessed by individuals involved with the planning, design, development, operations, maintenance, and project management of high technology systems.

B.2 Use the KSAs as a resource for a certification program to identify the skill levels that must be attained by either existing or new agency employees for assignment to various positions within the agency involving high technology systems.

B.3 Using outside support, develop a certification testing process to be used to ensure that candidates for these positions have achieved the required skill levels.

Responsibility and Relationships: The program to be developed by middle management for technical staff and approved by senior management. Outside technical support may be necessary.

Action C: Develop a personnel advancement program to reward personnel who have become certified in the systems engineering process

Rationale: Developing the basis for continuous improvement of the agency’s TSM&O program requires establishing the basis for career advancement that is closely related to the appropriate technical expertise, both for technical and management staff.

C.1 Develop an incentive program for agency personnel successfully completing the training curriculum. Depending on agency policy, incentives might include promotion, salary increases, bonus programs, and/or employee awards.

Responsibility and Relationships: The program to be developed by middle management for technical staff and approved by senior management. Outside technical support may be necessary.
Examples/References:

- Numerous systems engineering curricula are available at local colleges and universities for individuals and agencies willing to invest in intensive training on this subject. An effective approach to systems engineering training that has been used by several agencies is to schedule a blended training program (combination of online and instructor participation) through the Consortium for ITS Training and Education (CITE). Information on systems engineering curricula can be found at: http://www.citeconsortium.org

- Certifications currently exist in a number of fields including project management and traffic signal operations. University graduate level certificate programs also exist for systems engineering. Some agencies have developed certification processes to meet their specific job requirements, such as the Maryland State Highway Administration's certification program for CHART traffic management system operations personnel.

- CITE also offers certificates for ITS system engineering and ITS traffic management. These programs require completion of a suite of relevant courses within a predefined time period. Information related to these programs can be found at: http://www.citeconsortium.org
Standards/Interoperability Action Plan (L3 to L4)

Strategy Summary

Implement training program for project-level personnel, emphasizing utilization of standards and resulting benefits

Key Actions

A  Implement a standards training program for project-level personnel to familiarize them with the available standards and acquaint them with their potential benefits

B  Implement an executive level program for senior leadership of the region to acquaint them with the costs and benefits of regional interoperability

ACTIONS

Action A: Implement a standards training program for project-level personnel to familiarize them with the available standards and acquaint them with their potential benefits

Rationale: Placing the agency on a continuous improvement basis requires developing internal capability to upgrade and augment existing systems through an understanding of available standards and knowledge of the standards development process.

A.1 Establish a program for continuous skill development through both initial and follow-up training related to applicable standards.

A.2 Support professional activities for involvement in industry standards development and tracking recent standards development.

A.3 Provide direct support and incentives to ensure that this training and self-education is pursued on a continuing basis.

Responsibility and Relationships: Senior management sponsors the program and should involve all agencies within the region involved in the development of high technology systems. Outside technical assistance may be used as necessary.
**Action B:** Implement an executive level program for senior leadership of the region to acquaint them with the costs and benefits of regional interoperability

**Rationale:** Given the civil engineering culture of many transportation agencies, it is important to develop an understanding of the significance of systems engineering and standards development to continuous improvement in effective TSM&O.

**B.1** Develop materials for senior managers and other non-technical decision makers to explain the benefits of standards and the importance of systems engineering.

**Responsibility and Relationships:** Senior management sponsors the program and should involve all agencies within the region involved in the development of high technology systems. Outside technical assistance may be used as necessary.

**Examples/References:**

- Many agencies have recognized the importance of standards. The importance of standards is emphasized in various systems engineering courses found at: [http://www.standards.its.dot.gov/DeploymentResources/Training](http://www.standards.its.dot.gov/DeploymentResources/Training)
- To be effective, executive training must be brief and focused. Some have found it more effective to sponsor regional workshops that present the concept of standards with emphasis on their benefits and costs. The Minnesota DOT sponsored a regional workshop to initiate the process of regionally planning for the use of standards for the potential users of standards within the state: [http://ntl.bts.gov/lib/jpodocs/brochure/9r701!.pdf](http://ntl.bts.gov/lib/jpodocs/brochure/9r701!.pdf)