

Systems and Technology Guidance

✓ LEVEL 1 TO LEVEL 2

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

From	Ad hoc approaches outside systematic systems engineering (L1)
To	Systems engineering employed and consistently used for ConOps, architecture and systems development (L2)
By	Introducing systems engineering into project development processes

Key Sub-dimensions

- [Regional Architecture](#)
- [Systems Engineering/Testing/Validation](#)
- [Standards/Interoperability](#)

Regional Architecture Action Plan (L1 to L2)

Strategy Summary

Ensure that agency is an active participant in the development, maintenance and use of the regional architecture for planning and project development

Key Actions

- A** Assign responsibility for leading architecture developments/improvement/maintenance to a qualified individual within the agency
- B** Convene Architecture Review Committee
- C** Monitor system developments and other agency activities to ensure that architectural relevancy is maintained

ACTIONS

Action A: Assign responsibility for leading architecture developments/improvement/maintenance to a qualified individual within the agency

Rationale: The systems architecture provides the framework for institutional agreement and technical integration for the implementation of ITS projects or groups of projects. It is required to obtain federal funding for the implementation of an Intelligent Transportation System and must be continuously updated as the TSM&O program develops.

A.1 Identify an individual (designated here as the Architecture Lead) with a knowledge of TSM&O concepts of operations (ConOps).

A.2 Provide the individual with the opportunity to attend training in the development of ITS architecture. Alternatively, employ a consultant to provide needed architectural leadership and identify appropriate individual to provide agency oversight.

Responsibility and Relationships: Implemented by senior management with appointment of responsible individual with appropriate background as "Architecture Lead" within central office (or district/region as appropriate).

Action B: Convene Architecture Review Committee

Rationale: The architectures involve concepts, systems and roles for a range of service providers who must be involved in reaching a consensus approach.

B.1 Assign Architecture Lead responsibility for assembling and convening an Architecture Review Committee of individuals representing stakeholder organizations related to the regional architecture. Stakeholders include organizations representing all surface transportation modes within the region.

B.2 Brief Architecture Review Committee on the principles of the regional architecture (new or existing) and then introduce the draft architecture being considered for the region.

B.3 Review systems and functions of all stakeholders to ensure that they are adequately represented by the architecture.

B.4 Prepare and present the “business case” for maintaining current architecture in terms of expected program, system or technology improvements.

Responsibility and Relationships: The creation and operation of the architecture review committee is the responsibility of the Architecture Lead. All organizations within the region that are stakeholders in the architecture development and implementation must be participants in the Architecture Review Committee.

Action C: Monitor system developments and other agency activities to ensure that architectural relevancy is maintained

Rationale: As systems are developed and as needs for improvements emerge, the impact on the existing architecture must be reviewed for needed updates if it is to remain current.

C.1 Monitor system developments and other agency activities to ensure that architectural relevancy is maintained. This is performed through periodic stakeholder meetings, during which the architecture is reviewed in terms of the technological developments and needs of the participating agencies.

Responsibility and Relationships: Periodic reviews are the responsibility of the Architecture Review Committee which is convened by the Architecture Lead. All organizations within the region that are stakeholders in the architecture development and implementation must be participants in the Architecture Review Committee.

Examples/References:

- The requirements for a regional architecture are defined by Part 940 of the Code of Federal Regulations: <http://law.justia.com/us/cfr/title23/23-1.0.1.11.47.html>
- Information about the committee to be formed for the development of a regional architecture “National ITS Architecture”: <http://www.iteris.com/itsarch/>
- “Turbo Architecture: A Tool for Leveraging the National ITS Architecture”
<http://www.tfsrc.gov/pubrds/mayjun00/turbo.htm>
- An online course that provides an introduction to the National ITS Architecture is available at <http://www.citeconsortium.org>. The course name is “Introduction to the National ITS Architecture”.

Systems Engineering/Testing/Validation Action Plan (L1 to L2)

Strategy Summary

Require that all projects of above a certain size adhere rigorously to the systems engineering process

Key Actions

- A** Adopt the systems engineering process as a requirement for the procurement and development of new systems
 - B** Provide training to agency personnel involved at all levels in high-tech system developments
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ACTIONS

Action A: Adopt the systems engineering process as a requirement for the procurement and development of new systems

Rationale: Systems engineering is the methodology by which complex systems should be designed, updated and managed. Systems engineering is an interdisciplinary process that from concept, to design, to operations focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation.

A.1 Develop an agency-wide policy that requires the use of systems engineering for the procurement of new systems and the enhancement of existing systems utilizing advanced technology.

A.2 Specify the process to define the systems engineering steps to be executed, including risk management, configuration management, incremental development, concept of operations, requirements, design and testing.

A.3 Incorporate reporting procedures and acceptable procurement processes.

Responsibility and Relationships: The policy on using systems engineering must be established by senior management and developed by qualified staff. Outside technical assistance may be required.

Action B: Provide training to agency personnel involved at all levels in high-tech system developments

Rationale: The continuing evolution of the TSM&O and related architecture, systems, and technology requires a sustainable technical competency to manage and execute architecture and system maintenance and development.

B.1 Require all agency personnel involved with the management of projects involving the development, enhancement and/or utilization of advanced technology to attend at least 16 hours of training that describes the systems engineering process as it is applied to advanced transportation projects.

B.2 Attend available training as indicated in the examples/references. Training should be associated with both the regional architecture and the use of the Turbo Architecture (see References below).

Responsibility and Relationships: Senior management to require the development of an agency-wide training program for appropriate personnel.

Examples/References:

- Requirements definition (USDOT) in its Code of Federal Regulations Part 940, ITS Architecture and Standards: <http://law.justia.com/us/cfr/title23/23-1.0.1.11.47.html>
- Available online training is recommended for the architecture. See Consortium for ITS Training and Education course "Introduction to the National ITS Architecture" at: <http://citeconsortium.org>
- Information about the Turbo Architecture can be found at: <http://www.tfhrc.gov/pubrds/mayjun00/turbo.htm>
- Turbo Architecture Support Page: <http://www.iteris.com/itsarch/html/turbo/turbomain.htm>

Standards/Interoperability Action Plan (L1 to L2)

Strategy Summary

Identify applicable standards for all new system implementations

Key Actions

- A** Identify and require relevant standards as an integral step of the system design process
- B** Require training for all systems development personnel who might be involved in the specification and usage of standards

ACTIONS

Action A: Identify and require relevant standards as an integral step of the system design process

Rationale: Working together in a region requires standards that support the interoperability of various systems and facilitation of the interchange of field and central system hardware and software operations. Standards developed for the ITS industry are used for harmonizing data communications, database exchanges, and information displays among diverse systems. It is essential that standards be integrated into the system development and acquisition program.

A.1 Review system acquisitions that have occurred during the previous five years and upcoming procurements to identify features and functions for which existing standards are applicable.

A.2 Compile a list of relevant standards, and develop a guidebook for their application to all future developments.

Responsibility and Relationships: The policy on standards must be established by senior management and developed by qualified staff with the involvement of all agencies that are part of a region's TSM&O. Outside technical assistance may be required.

Action B: Require training for all systems development personnel who might be involved in the specification and usage of standards

Rationale: A basic background in the full range of ITS standards is important for staff that is going to be involved.

B.1 Identify available training courses for the application of standards identified in Action A.

B.2 Prepare training budget and require that project management personnel or other appropriate staff members with responsibility for the implementation of systems incorporating the standards attend relevant programs.

Responsibility and Relationships: Senior management to require the development of an agency-wide training program for appropriate personnel involved in the development of high technology systems.

Examples/References:

- Standards are available for a broad range of ITS applications, communication, information exchange, databases etc. Standards are used for communication between a central computer and field equipment (traffic signals, dynamic message signs, highway advisory radio, etc.). Database standards are available to ensure that data is archived in a manner that will enhance the agency's ability to share the information with other agencies and jurisdictions. It is essential that standards be integrated into the system development and acquisition program. Overview and detailed information on the entire range of ITS standards can be found at:
<http://www.standards.its.dot.gov/>
- Managers need training that provides an overview of the standards framework and an appreciation of their benefits, while technical professionals involved with the specification, acquisition and testing of standards require more detailed instruction. A listing of available ITS standards training can be found at:
<http://www.standards.its.dot.gov/DeploymentResources/Training>