Chapter 1050 Intelligent Transportation Systems

1050.01 General

Intelligent Transportation Systems (ITS) improve transportation safety and mobility and enhance productivity through the use of advanced communications technologies and their integration into the transportation infrastructure and in vehicles. These systems encompass a broad range of wireless and wire line communications-based information and electronics technologies.

The purpose and direction of ITS for the Washington State Department of Transportation (WSDOT) can be found in the Statewide Intelligent Transportation Systems (ITS) Plan. A current copy of this plan can be obtained online (see References) or by contacting the State Traffic Engineer. The plan identifies the current and long-term ITS needs to meet the objectives identified in Moving Washington, WSDOT's program to fight traffic congestion.

The Statewide ITS Plan is a comprehensive document that discusses:

- The history of ITS deployment in Washington.
- How ITS meets WSDOT's transportation vision and goals.
- The current state of ITS deployment.
- WSDOT's near-term ITS plans.
- How projects are prioritized.
- What long-term ITS issues WSDOT needs to begin planning for.

Due to the dynamic nature of ITS, printed guidance is soon outdated. Detailed design guidance and current practices are located on the following websites. For additional information and direction, contact the region Traffic Engineer or the State Traffic Engineer (www.wsdot.wa.gov/design/traffic/).

1050.02 References

23 Code of Federal Regulations (CFR), Part 940, Intelligent Transportation System Architecture and Standards

USDOT's *Systems Engineering for Intelligent Transportation Systems*, FHWA-HOP-07-069, January 2007
http://ops.fhwa.dot.gov/publications/seitsguide/index.htm

Manual on Uniform Traffic Control Devices for Streets and Highways, USDOT, FHWA; as adopted and modified by Chapter 468-95 WAC "Manual on uniform traffic control devices for streets and highways" (MUTCD)
www.wsdot.wa.gov/publications/manuals/mutcd.htm

SAFETEA-LU (Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users)
http://www.fhwa.dot.gov/safetealu/index.htm

FHWA's and Caltrans' *Systems Engineering Guidebook for ITS*
http://www.fhwa.dot.gov/cadiv/segb/

WSDOT Northwest Region Traffic Design
http://www.wsdot.wa.gov/northwest/trafficdesign

WSDOT Statewide Intelligent Transportation Systems (ITS) Plan, April 2009
http://wwwi.wsdot.wa.gov/maintops/traffic/pdf/itsplan32409.pdf

WSDOT Traffic Design
http://www.wsdot.wa.gov/design/traffic/

1050.03 Systems Engineering

Systems engineering is a systematic process that was developed specifically for complex technology projects. Systems engineering processes are required on all highway trust fund projects, as noted in 23 CFR 940.11. It is WSDOT policy that systems engineering processes be used on all ITS projects regardless of the funding source.

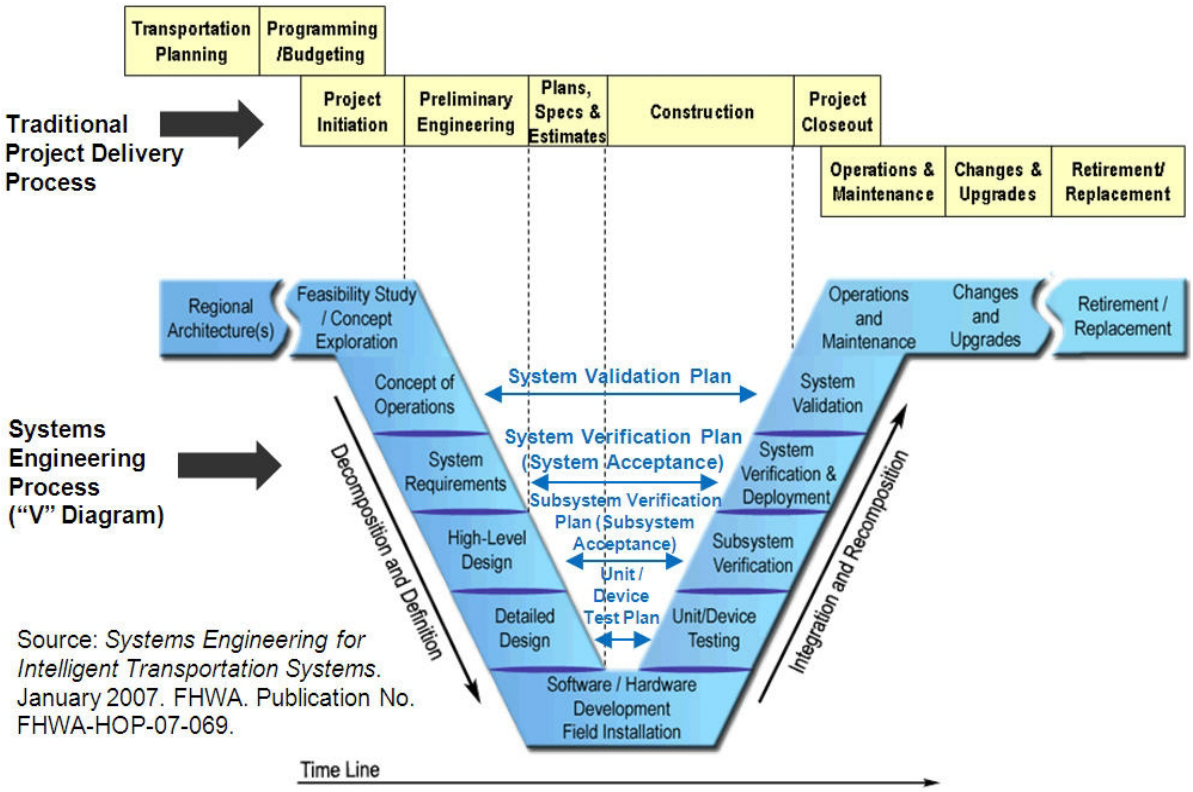
Using systems engineering on ITS projects has been shown to increase the likelihood of project success (that is, projects that are completed on time and on budget, meet stakeholder/project sponsor expectations, and are efficient to operate and maintain).

The systems engineering process, often referred to as the "V" diagram, is shown in Exhibit 1050-1. As shown in the exhibit, the systems engineering process contains a number of steps that are not included in the traditional project delivery process.

An ITS project begins in the upper left side of the "V" diagram and progresses down the "V" and up the right side. Upon reaching the upper right corner, reverse the process to ensure the project being completed meets the initial requirements.

During the component-level "Detailed Design," specific subsystems and/or components (such as wireless communications, variable message signs, cameras, roadway weather information systems, highway advisory radio systems, or software) should be identified as requiring specialized knowledge and skills. These issues are to be coordinated between the Project Engineer and the region Traffic Engineer.

Construction oversight and approvals are addressed in the systems engineering process as you validate/verify the right side of the "V" diagram with the left side. The key to successful construction oversight is traceability. Trace each step on the right side of the "V" diagram back to a requirement on the left side.



Systems Engineering Process ("V" Diagram)

Exhibit 1050-1

23 CFR 940 defines the minimum requirements for fulfilling the systems engineering process on a project. It is WSDOT policy that these requirements apply to all ITS projects regardless of the funding source. They include the following:

- Identify the portions of the regional ITS architecture being implemented. Refer to the ITS architecture or regional planning document.
- Identify the roles and responsibilities of participating agencies.
- Define the system requirements.
- Provide an analysis of alternative system configurations and technology options to meet requirements.
- Identify procurement options.
- Identify applicable ITS standards and testing procedures.
- Delineate the procedures and resources necessary for operations and management of the system.

Completing the "ITS Project Systems Engineering Review Form" (see Exhibit 1050-2) will fulfill these minimum requirements for a project. However, the level of systems engineering used for a project should be on a scale commensurate with the scope, size, and risk of the project.

For relatively small, low-risk ITS projects (such as adding a ramp meter to an existing ramp-metering system), completing the "ITS Project Systems Engineering Review Form" is a sufficient level of systems engineering. Conversely, relatively large, high-risk ITS projects (such as developing a new custom software system for sharing control of traffic signal systems across multiple agencies) should follow and document each step of the "V" diagram.

Include all ITS systems engineering documentation in the Design Documentation Package (DDP). All systems engineering documentation requires region Traffic Engineer approval. As each phase of an ITS project is completed, a report is to be submitted to the region Traffic Engineer. Approvals for ITS project are dependent upon with project complexity and cost. (See Chapter 300 for ITS project approval requirements.)

Systems engineering costs are to be estimated and incorporated into the construction engineering (CE) and project engineering (PE) portions of the construction estimate.

1050.04 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:
www.wsdot.wa.gov/design/projectdev/

This form (or a reasonable facsimile) must be completed for all Intelligent Transportation Systems (ITS) projects and included in the DDP. Submit the form to FHWA with the construction authorization request for all federal-aid projects that include ITS.

Name of Project:

Regional ITS Architecture:

1. **Identify the portions of the Regional ITS Architecture being implemented. Is the project consistent with the architecture? Are revisions to the architecture required?**

   Identify which user services, physical subsystems, information flows, and market packages are being completed as part of the project and explain how these pieces are part of the regional architecture.

2. **Identify the participating agencies, their roles and responsibilities, and concept of operations:**

   For the user services to be implemented, define the high-level operations of the system, including where the system will be used; functions of the system; performance parameters; the life cycle of the system; and who will operate and maintain the system. Establish requirements or agreements on information sharing and traffic device control responsibilities. The regional architecture operational concept is a good starting point for discussion.

3. **Define the system requirements:**

   Based on the above concept of operations, define the "what" and not the "how" of the system. During the early stages of the systems engineering process, break down the process into detailed requirements for eventual detailed design. The applicable high-level functional requirements from the regional architecture are a good starting point for discussion. A review of the requirements by the project stakeholders is recommended.

4. **Provide an analysis of alternative system configurations and technology options to meet requirements:**

   The analysis of system alternatives should outline the strengths and weaknesses, technical feasibility, institutional compatibility, and life cycle costs of each alternative. The project stakeholders should have input in choosing the preferred solution.

ITS Project Systems Engineering Review Form (With Instructions)
Exhibit 1050-2

5. **Identify procurement options:**

Some procurement (contracting) options to consider include: consultant design/low-bid contractor, systems manager, systems integrator, task order, and design/build. The decision regarding the best procurement option should consider the level of agency participation, compatibility with existing procurement methods, role of system integrator, and life cycle costs.

There are different procurement methods for different types of projects. If the project significantly meets the definition of construction, then construction by low-bid contract would be used. If the project significantly meets the definition of software development/ hardware acquisition (in other words, an information technology project), then follow the acquisition processes outlined in the WSDOT Purchasing Manual. This option includes services for systems integration, systems management, and design.

Contact the WSDOT HQ Traffic Office for additional guidance and procurement options.

6. **Identify the applicable ITS standards and testing procedures:**

Include documentation on which standards will be incorporated into the system design and justification for any applicable standards not incorporated. The standards report from the regional architecture is a good starting point for discussion.

7. **Delineate the procedures and resources necessary for operations and management of the system:**

In addition to the above concept of operations, document any internal policies or procedures necessary to recognize and incorporate the new system into the current operations and decision-making processes. Resources necessary to support continued operations, including staffing and training must also be recognized early and be provided for. Such resources must also be provided to support necessary maintenance and upkeep to ensure continued system viability.

ITS Project Systems Engineering Review Form (With Instructions)
Exhibit 1050-2 (continued)