



A systems engineering analysis is required for all Intelligent Transportation Systems (ITS) projects using Federal funds according to the Final Rule on Architecture and Standards Conformity. The ITS Architecture Implementation Program identifies minimum systems engineering practices that must be included in the project implementation phase.

The primary benefit of doing systems engineering is that it will reduce the risk of schedule and cost overruns and will provide a system of higher integrity. Other benefits include:

- Better system documentation
- Higher level of stakeholder participation
- System functionality that meets stakeholders' expectation
- Potential for shorter project cycles
- Systems that can evolve with a minimum of redesign and cost
- Higher level of system reuse
- More predictable outcomes from projects.

US DOT recognized the potential benefit of the systems engineering approach for ITS projects and included requirements for a systems engineering analysis in the FHWA Rule that was enacted on January 8, 2001. The Rule requires a systems engineering analysis to be performed for ITS projects that use funds from the Highway Trust Fund. The Rule specifies seven requirements that the systems engineering analysis must include at a minimum including:

- Identifying which part of the regional architecture is being implemented
- Participating agencies and their responsibilities
- Defining of systems requirements
- Analyzing of alternative system configurations and tech options to meet the requirements
- Exploring procurement options
- Identifying of project-applicable standards and testing procedures
- Determining procedures and resources needed for operations and management of the system.

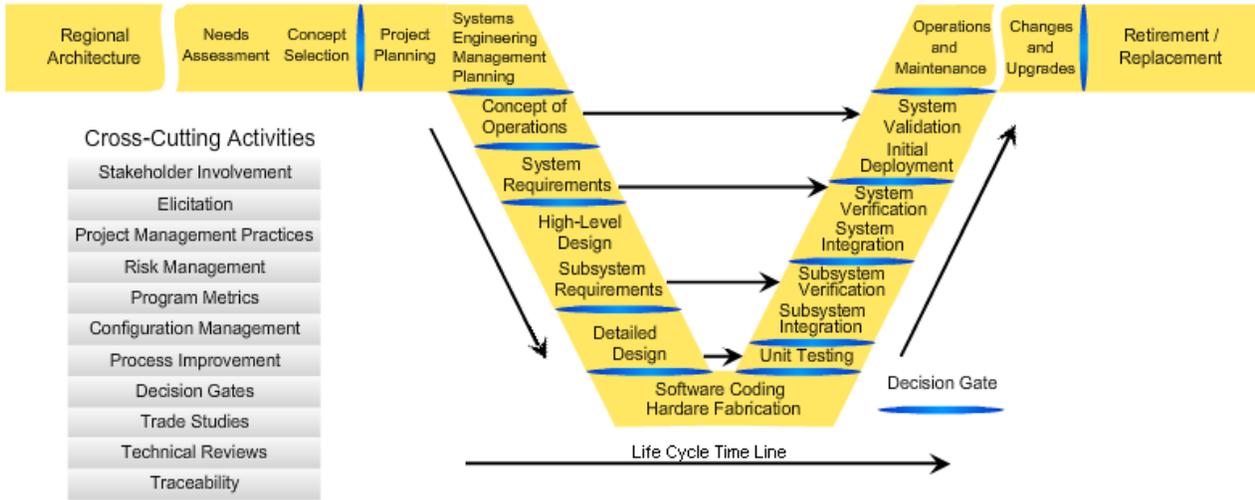
The Rule allows each project sponsor to use a systems engineering approach that is tailored to fit the needs of each ITS project. The systems engineering approach is actually broader than the seven specific requirements identified in the Rule. In order to implement a good systems engineering process, one must meet or exceed the specific systems engineering analysis requirements identified in the Rule. The FHWA Division determines how the systems engineering analysis requirements in the Rule should be applied to ITS projects in each region and how compliance should be demonstrated by each project sponsor. Federal oversight is provided based on oversight requirements defined in the stewardship agreements with each state. Several states have established checklists that prompt project sponsors to consider the systems engineering analysis requirements as part of the project development process.

Contact the FHWA Division Office for more information. The web address for FHWA's Wisconsin Division is <http://www.fhwa.dot.gov/widiv>.

The Rule in its entirety can be found at [http://www.access.gpo.gov/nara/cfr/waisidx\\_03/23cfr940\\_03.html](http://www.access.gpo.gov/nara/cfr/waisidx_03/23cfr940_03.html).

The Vee Development Model is the recommended development model for ITS projects. Illustrated in Figure 1.5-1 is the Vee Development model in the context of the life cycle framework. This model has gained wide acceptance in the systems engineering community. The reason for this acceptance is that the model illustrates some key systems principles about the relationship of the early phases of the development to the end results of the project. Detailed information regarding the Vee Development model and its use in ITS projects is explained on the FHWA website at <http://www.fhwa.dot.gov/cadiv/segb/views/process/index.htm>.

Phase -1	Phase 0	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Interfacing with Planning and the Regional Architecture	Concept Exploration and Benefits Analysis	Project Planning and Concept of Operations Development	System Definition and Design	System Development and Implementation	Validation, Operations and Maintenance, Changes & Upgrades	System Retirement / Replacement



**FIGURE 1.5-1 – Vee Development Model / Systems Engineering Process Overview**