Chapter 41 General Project Types

41.1 General Discussion

This chapter identifies the design standards document, deviation approval authority, and design approval for a specific facility. The deviation process, Work Zone Safety and Mobility, and Intelligent Transportation Systems are also discussed.

This part of the manual is organized into six chapters relating to the design phase General Design Information; City and County Design Standards for Non NHS facilities; Location and Design Approval; Plans, Specifications, and Estimates; State Advertising and Award Procedures; and Local Advertising and Award Procedures.

Compliance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 is required in the design, construction, operation and maintenance of transportation facilities (i.e., pedestrian facilities, park and ride lots). Where sidewalks are provided, public agencies shall provide pedestrian access features such as continuous, unobstructed sidewalks, and curb cuts with detectable warnings at highway and street crossings. See 28 CFR Part 36, Appendix A, for minimum federal requirements for curb ramps. The design standards and deviation and design approval authority are shown in the following table.

Facility	Design Standards	Deviation Approval	Design Approval
Interstate			
New/Reconstruction	WSDOT *Design Manual*	WSDOT/FHWA	WSDOT/FHWA
ITS Over $1,000,000	WSDOT *Design Manual*	WSDOT HQ	WSDOT HQ
All Other	WSDOT *Design Manual*	WSDOT HQ	WSDOT Region
National Highway System (NHS)			
State Highways outside of incorporated cities, or on a limited access highway	WSDOT *Design Manual*	WSDOT HQ	WSDOT Region
State Highways within incorporated cities between back of curb to back of curb	WSDOT *Design Manual*	WSDOT HQ	WSDOT Region
State Highways within incorporated cities beyond curb line	*City and County Design Standards See Chapter 42	WSDOT Local Programs	City
City Streets (non-State highways)	*City and County Design Standards See Chapter 42	WSDOT Local Programs	City
County Roads	*City and County Design Standards See Chapter 42	WSDOT Local Programs	County

Facility	Design Standards	Deviation Approval	Design Approval
Non-National Highway Systems (Non-NHS)			
State Highways outside of incorporated cities, or on a limited access highway	WSDOT *Design Manual*	WSDOT HQ	WSDOT Region
State Highways within incorporated cities between back of curb to back of curb	WSDOT *Design Manual*	WSDOT HQ	WSDOT Region
State Highways within incorporated cities beyond curb line	*City and County Design Standards See Chapter 42	WSDOT Local Programs	City
City Streets (non-State Highways)	*City and County Design Standards See Chapter 42	WSDOT Local Programs	City
County Roads	*City and County Design Standards See Chapter 42	WSDOT Local Programs	County

*Bicycle facilities and multi-use facilities per RCW 35.75.060 and 36.82.145 must follow the current AASHTO bicycle design standards and/or standards submitted by the local agency which have been approved by Local Programs for any facility allowing bicycle traffic.

Different standards apply to the design of new construction/reconstruction, 3-R (resurfacing, restoration, and rehabilitation), and 2-R (resurfacing and restoration). Each of these terms is defined in Chapter 42. Local agencies must determine which standards apply before beginning design. See Chapter 42 for design standards on non-NHS routes.

See Section 43.4 for information on Value Engineering.

41.2 Work Zone Safety and Mobility

All projects on the Interstate system must comply with 23 Code of Federal Regulations (CFR), Part 630, Subpart J: Work Zone Safety and Mobility and Subpart K: Temporary Traffic Control Devices. It is recommended that any other federally funded project over $10 million or any project that includes a detour also apply the rules. WSDOT *Design Manual* M 22-01 Chapter 1010 has a list of requirements and key elements as well as checklist for developing a formal Transportation Management Plan (TMP). A TMP is a set of strategies for managing the corridor-wide work zone impacts of a project.

41.3 Intelligent Transportation Systems (ITS)

Intelligent Transportation Systems (ITS) have the potential to reduce crashes and increase the mobility of transportation facilities. They also have the potential to enhance productivity through the use of advanced communications technologies and their integration into vehicles and the transportation infrastructure. These systems involve a broad range of wireless and wire line communications-based information, electronics, or information processing technologies. Some of these technologies include cameras, variable message signs, ramp meters, road weather information systems, highway advisory radios, traffic management centers, and adaptive signal control technology (ASCT). ASCT is a traffic signal system that detects traffic conditions and adjusts signal timing remotely in response.

Systems engineering is a typical part of any ITS project development process. It is required on any federal aid project that has an ITS work element, per 23 CFR 940.11. Systems engineering is an interdisciplinary step-by-step process for complex projects, such as ITS projects to:

- assess a system's needs and its relationship to the regional architecture.
- plan a project that meets those needs and meets stakeholder needs and expectations.
- define other specific requirements for the project/system.
- develop and implement the project/system.
- define the operations and maintenance requirements for the system.
- plan for the refinement or replacement of the system.

Using systems engineering on ITS projects has been shown to increase the likelihood of a project's success. A successful project is one that meets the project scope and stakeholder/project sponsor expectations, completed on time and within budget, and efficient and cost effective to operate and maintain.

The level of systems engineering used for a project should be on a scale commensurate with the scope, cost, and risk of the project. Complete the Intelligent Transportation Systems (ITS) Systems Engineering Analysis Worksheet in Appendix 41.53, or a document with the same information, for all federal aid projects that include ITS elements. Completing the worksheet will meet the minimum requirements in 23 CFR 940.11 for systems engineering, determine the project's risk, and determine if a more in-depth systems engineering analysis is required.

As shown in the worksheet, a more in-depth analysis requires that the following four documents be completed and used to implement the project. These documents are produced as the result of the steps in the systems engineering process, often referred to as the "V" diagram, shown in Appendix 41.52.

1. **Concept of Operations** – This document defines the problem, the project's goals, stakeholder needs and expectations, constraints, and the way the ITS system is required to operate and be maintained.
2. **System Requirements** – This document contains specifications of what the system is required to do, how well it is required to do it, and under what conditions. These requirements are based on the goals, stakeholder needs and expectations, constraints, and operation and maintenance requirements documented in the Concept of Operations.
3. **System Verification Plan** – This document describes how the agency will verify that the system proposed meets the requirements in the System Requirements document. The agency will implement the System Verification Plan to ensure that all system requirements are verified before it accepts the system.

4. **System Validation Plan** – This document describes how the agency will assess the system's performance against the goals, stakeholder needs and expectations, constraints, and operation and maintenance requirements documented in the Concept of Operations. The goal is for the agency to understand and review the strengths and weaknesses of the system and identify any new opportunities and needs if appropriate. The agency will implement the System Validation Plan after it accepts the system. This evaluation sets the stage for the next time the system/project is changed or expanded.

For more guidance on developing the four systems engineering plans listed above, see the plan templates in the FHWA - Systems Engineering Guidebook for Intelligent Transportation Systems, Version 3, November 2009. (www.fhwa.dot.gov/cadiv/segb/files/segbversion3.pdf)

Pertinent page numbers include:

- Concept of Operations Template: Page 254
- System Requirements Template: Page 257
- Verification Documents Plan Template: Page 269
- Validation Documents Plan Template: Page 278

High risk ASCT projects require the use of the USDOT Model Systems Engineering Documents for Adaptive Signal Control Technology (ASCT) Systems, FHWA-HOP-11-027, August 2012, or a later addition. Visit FHWA's ASCT webpage (www.fhwa.dot.gov/innovation/everydaycounts/edc-1/asct.cfm) to obtain this document and learn more. The Illinois Center for Transportation's Safety Benefits of Implementing Adaptive Signal Control Technology: Survey Results, 2013, provides additional information on ASCT.

For guidance on contracting for ITS projects, see Appendix 41.54.

41.4 Deviations

.41 General – The Agency is authorized to design projects to the standards as indicated in the table shown in Section 41.1. In the event all design standards cannot be incorporated into the design, the agency shall submit a deviation request for review and approval.

.42 Documentation – An agency shall document their reasons for the deviation. The deviation request shall include a description of the problem and its proposed solution and a vicinity map in sufficient detail to aid in evaluating the problem. The deviation request document is a stand alone engineering document. If references to other sources or documents are required, the document should use the appropriate quotes and excerpts as necessary.

An analysis of the engineering and financial aspects of the proposal as compared to the standard and options considered shall be provided. The analysis shall specifically address safety issues, including collision history and projections. It shall address applicable operational characteristics, including traffic speeds, traffic volumes, capacity and route continuity. It should include financial considerations such as high construction costs, unusual or extraordinary site conditions, or environmental requirements that may impact the decision. The analysis may include a Benefit/Cost comparison, and/or Life

Cycle Costing of alternatives considered. The analysis should also include any other information which may be helpful as a future reference.

The level of detail of the request should be based on the relative complexity and scope of the project and the deviation requested. Requests will be considered based on the merits presented. This analysis and deviation request shall be documented and completed prior to the agency's completion of PS&E documents.

.43 Format – Appendix 41.51 is a Deviation Analysis Format sheet for use on locally owned facilities (deviations approved by WSDOT Local Programs). Refer to the WSDOT *Design Manual* M 22-01 for format on all other deviations. The intent of the example is to present format only.

41.5 Appendices

41.51 Deviation Analysis Format

41.52 System Engineering Process "V" Diagram

41.53 Intelligent Transportation Systems (ITS) Systems Engineering Analysis Worksheet

41.54 ITS Project Contracting Guidance

Washington State Department of Transportation

Deviation Analysis Format

Agency: Click here to enter text.

Project Title: Click here to enter text.

Project Number: Click here to enter text.

1. **Posted Speed Limit:** Click here to enter text.
2. **Physical Comparison:**
   a. **Standard Geometrics:** Click here to enter text.
   b. **Deviation Geometrics:** Click here to enter text.
   c. **Discussion:** Click here to enter text.
3. **Safety Issues:**
   a. **Collision History:** Click here to enter text.
   b. **Risk of future collisions:** Click here to enter text.
   c. **Discussion:** Click here to enter text.
4. **Cost Comparison:**

	Standard Cost	Deviation Cost	Discussion
Roadway	Click here to enter text.	Click here to enter text.	Click here to enter text.
Structure	Click here to enter text.	Click here to enter text.	Click here to enter text.
Other	Click here to enter text.	Click here to enter text.	Click here to enter text.

5. **Reasons standard cannot be achieved at this time:** Click here to enter text.
6. **Certification:** Click here to enter text.

I have examined this deviation request and believe it to be in the best public interest that it be granted.

Local Agency Engineer

Date

DOT 140-570
10/2015

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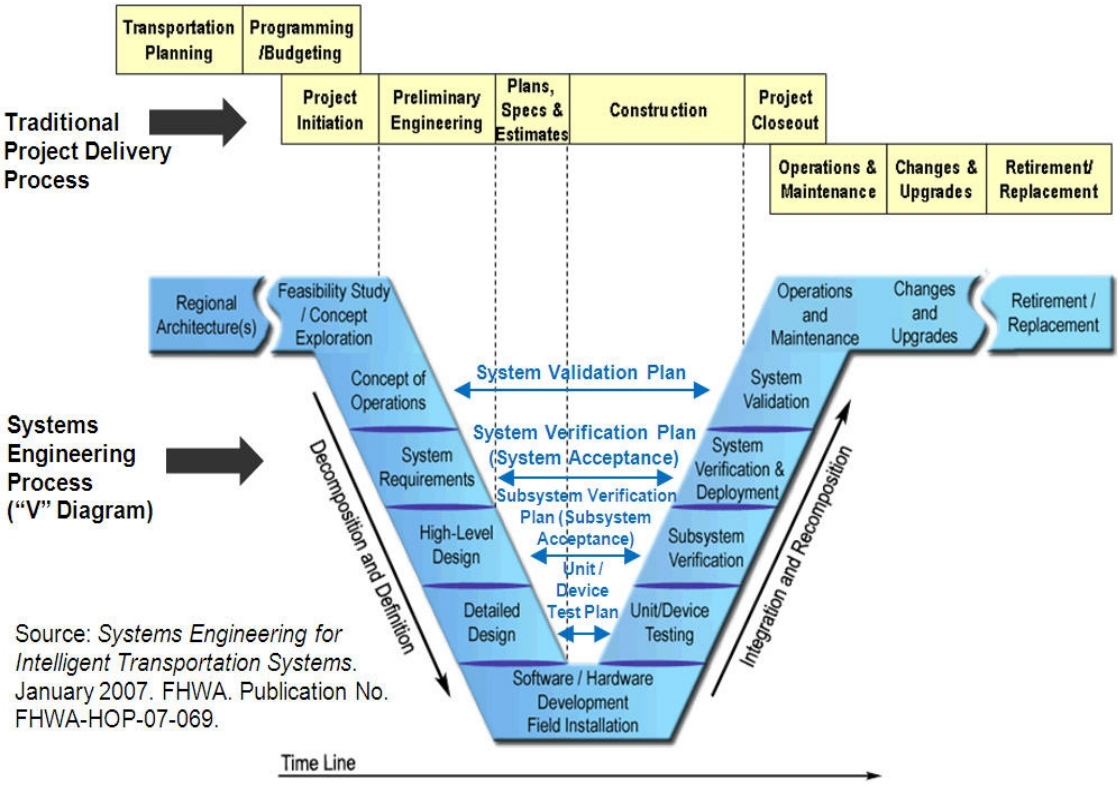
Appendix 41.52 Systems Engineering Process "V" Diagram

The systems engineering process contains a number of steps that are not included in a traditional project delivery process. The systems engineering process is often referred to as the "V" diagram, shown below. An ITS project begins on the left side of the "V" and progresses down the left side of the "V" and then up the right side. Then the project is evaluated by validating and verifying the elements on the right side of the "V" with the elements on the left side.

The Federal Highway Administration (FHWA) and WSDOT are in agreement that for project development and delivery, the most critical portions of the systems engineering process are the Concept of Operations, System Requirements, System Verification, and System Validation. As a result, the Intelligent Transportation Systems (ITS) Systems Engineering Analysis Worksheet in Appendix 41.53 is focused on these core areas.



Systems Engineering Process ("V" Diagram)

Washington State Department of Transportation

Intelligent Transportation Systems (ITS) Systems Engineering Analysis Worksheet

This worksheet, or a document with the same information, must be completed for all federal aid projects that include Intelligent Transportation Systems (ITS) elements. This worksheet must be completed prior to submitting a construction authorization request and must be kept in the project file for the entire document retention period of the project. If Concept of Operations, System Requirements, Verification Plan, and Validation Plan documents are required for the project, as determined by this worksheet, these documents must be submitted to the WSDOT Local Programs Engineer for review, who in turn will send them to the FHWA ITS/Operations Engineer for review, prior to submitting a construction authorization request. The documents must be kept in the project file for the entire document retention period of the project.

1. Project Name: Click here to enter text.
2. Project Number (if known): Click here to enter text.
3. Total project cost (includes preliminary engineering/design, right of way, and construction phases):

   Click here to enter text.
4. Amount of total project cost for ITS elements: Click here to enter text.
5. Select which of the following items, if any, apply to this project:

   ☐ The project implements an existing adaptive signal control technology (ASCT) system for the first time. Or the project expands on an existing ASCT system involving jurisdictions the agency has not worked with previously. Please explain why you selected or did not select this item.

   Click here to enter text.

   ☐ The project includes new and unproven hardware and/or communications technology that is considered "cutting edge" or not in common use. This could include custom developed or unproven commercial-off-the-shelf (COTS) technology that has not been used by the agency previously. Please explain why you selected or did not select this item.

   Click here to enter text.

   ☐ The project will add new software that will be custom developed for this project or will make major modifications to existing custom developed software. Please explain why you selected or did not select this item.

   Click here to enter text.

   ☐ The project will add new interfaces to systems operated or maintained by other agencies. Please explain why you selected or did not select this item.

   Click here to enter text.

   ☐ The project will develop new system requirements or require revisions to existing system requirements that are not well understood within the agency and/or well documented at this time. These system requirements will be included in a request for proposal, or plans, specifications, and estimate bid document package. Therefore it will require significant stakeholder involvement and/or technical expertise to develop these items during the project delivery process. Please explain why you selected or did not select this item.

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4/2017

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Click here to enter text.

☐ Multiple agencies will be responsible for one or more aspects of the project design, construction, deployment, and/or the ongoing operations and maintenance of the system. Please explain why you selected or did not select this item.

Click here to enter text.

6. If you selected any of the items in question 5, FHWA and WSDOT consider the project to be high risk. Use this table for additional requirements:

Total project cost for high risk ITS projects		
Adaptive signal control technology (ASCT) projects	**Other types of ITS projects**	
	Greater than or equal to $1,000,000[2]	**Less than $1,000,000[2]**
Additional systems engineering documents (Concept of Operations, System Requirements, Verification Plan, and Validation Plan)[1] are required.	Additional systems engineering documents (Concept of Operations, System Requirements, Verification Plan, and Validation Plan)[1] are required.	Additional systems engineering documents (Concept of Operations, System Requirements, Verification Plan, and Validation Plan)[1] are recommended. This decision requires FHWA concurrence through the WSDOT Local Programs Engineer prior to submitting a construction authorization request.

Notes:
1. See definitions in Section 41.3.
2. Use the amount from question 4.

7. What is the name of the regional ITS architecture and which portions of the architecture will be implemented? Is the project consistent with the architecture? Are revisions to the architecture required? Also, which user services, physical subsystem elements, information flows, and market/service packages will be completed, and how will these pieces be part of the architecture?

   Click here to enter text.

8. Identify the participating agencies, their roles and responsibilities, and the concept of operations. For the elements and market/service packages to be implemented, define the high-level operations of the system. This includes where the system will be used, its performance parameters, its life cycle, and which agency will operate and maintain it. Discuss the established requirements or agreements on information sharing and traffic device control responsibilities. The regional ITS architecture operational concept is a good starting point for discussion.

   If this is a high risk project and a more extensive Concept of Operations document is being prepared for this project (see question 6), this answer can be a simple reference to that document.

   Click here to enter text.

9. Define the system requirements. Based on the concept of operations, define the "what" and not the "how" of the system. Define the 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.

   If this is a high risk project and a more extensive System Requirements document is being prepared for this project (see question 6), this answer can be a simple reference to that document.

   Click here to enter text.

10. Provide an analysis of alternative system configurations and technology options to meet requirements. This analysis should outline the strengths and weaknesses, technical feasibility, institutional compatibility, and life cycle costs of each alternative. The project stakeholders should have had input in choosing the preferred solution.

    Click here to enter text.

11. Identify procurement/contracting options. Since there are different procurement methods for different types of projects, the decision regarding the best procurement option should consider the level of agency participation, compatibility with existing procurement methods, the role of the system integrator, and life cycle costs. Some options to consider include consultant design/low-bid contractor, systems manager, systems integrator, task order, and design/build.

    If the ITS portions of the project significantly meet the definition of construction, construction by low-bid contract would be used. Non-construction ITS portions of the project, such as services for software development, systems integration, systems deployment, systems management, or design, will be either engineering or service contracts. In these cases, a qualifications-based selection (QBS) or best value procurement may be more appropriate. For guidance on procurement options for ASCT systems, refer to Pages 15-20 of USDOT's *Model Systems Engineering Documents for Adaptive Signal Control Technology (ASCT) Systems*, FHWA-HOP-11-027, August 2012.

    Click here to enter text.

12. Identify the applicable ITS standards and testing procedures. Include documentation on which standards will be incorporated into the system design. Also include justification for any applicable standards not incorporated. The standards discussion in the regional architecture is a good starting point for discussion.

    Click here to enter text.

13. Outline the procedures and resources necessary for operations and management of the system. In addition to the 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. Also, resources necessary to support continued operations, including staffing and training must be recognized early and be provided for. Such resources must also be provided to support necessary maintenance and upkeep to ensure continued system viability.

    Click here to enter text.

Appendix 41.54 FHWA Washington Division ITS Project Contracting Guidance September 2012

Purpose

The purpose of this document is to provide basic guidance related to the procurement and administration of Federal-Aid Intelligent Transportation System (ITS) contracts.

Scope

This document is intended to be used by the Federal Highway Administration (FHWA) Washington Division Office, Washington State Department of Transportation (WSDOT), and local agencies as a guide on the proper types of procurement methods for various types of ITS projects. This guidance is not all encompassing as ITS projects can vary significantly in scope. However, it should provide adequate information to address a majority of situations. Specific questions about an individual ITS project should be directed to the Washington Division Office.

Construction vs. Non-construction

ITS improvements may be incorporated as part of a traditional federal-aid construction contract, or the contracting agency may elect to procure ITS services under a separate contract (i.e., stand-alone ITS projects). When procured as a separate contract, the scope of an ITS contract will determine the applicability of Federal procurement requirements. Title 23 United States Code Section 101(a)(3) provides a broad definition for construction for Federal-Aid eligibility purposes. FHWA generally interprets the definition broadly resulting in many types projects being classified as construction. Very simply, a contract that incurs costs incidental to the construction or reconstruction of a highway, including improvements that directly facilitate and control traffic flow (e.g., traffic control systems) are by definition construction contracts. This includes rehabilitation of an existing physical ITS infrastructure. Construction contracts must follow the regulatory requirements of 23 CFR 635 or 23 CFR 636 in the case of Design Build.

Non-construction type ITS contracts will be either Engineering Contracts or Service Contracts. Engineering is defined as professional services of an engineering nature as defined by state law. If the ITS contract primarily involves engineering then qualifications-based selection (QBS) procedures in compliance with the Brooks Act, must be followed. Service contracts (non-construction, non-engineering in nature) are to be procured in accordance with the *Common Rule for Grants and Cooperative Agreements to States and Local Governments* found at 49 CFR 18.36.

Types of ITS Projects

Stand-alone ITS projects can generally be categorized into one of the following types of ITS projects: 1) planning/research, 2) preliminary engineering/project development, 3) software development/system integration, 4) system deployments, 5) traditional construction, and 6) operations and maintenance. All Federal-Aid ITS projects in 23 CFR 940, regardless of the type, are directed to follow a Systems Engineering process. Refer to WSDOT *Design Manual* Chapter 1050 and WSDOT LAG Manual Chapter 41.

The following table provides further information about each of these ITS project types.

ITS Project Type	Description	Examples
Planning/ Research	Generally, involves studies that research new concepts or develop plans or procedures at a broader agency- or region-wide level. These are generally are not construction and often done by agency personnel.	• Regional ITS Architecture development and maintenance • Regional Concept of Operation • Traffic incident management planning • Standards testing and specification development • Public outreach and communication
Preliminary Engineering/ Project Development	Generally, a project or phase of a larger project, that leads to some type of ITS deployment/ construction. Typically involve some type of service or engineering contact, or work done by agency personnel and are generally not considered construction.	• Scoping/field surveys • Project-level Concept of Operation • Environmental Review • Development of RFPs • Development of PS&Es • Evaluation of technology, networking, system architecture alternatives
Software Development/ System Integration	Generally, involves projects that develop new or upgraded ITS-related software or involve integrating ITS services and equipment. These are typically not construction and often fall under a service contract.	• Traffic Management Center (TMC) central software design, development, installation • Modifying existing central system software to communicate with new field equipment • Incorporation of device control software into central systems • Acceptance testing and configuration management
System Deployments	Generally, includes total system implementation involving design, equipment, computer systems, telecommunications, and integration. Contracts are often non-construction in nature depending on the amount and type of field work relative to the overall project. These types of projects will often be the least cut and dry in terms of the appropriate contracting method.	• Road-weather information systems (RWIS) • Adaptive Signal Control Systems
Traditional Construction	Typical construction projects involving considerable installation of equipment or work in the field. Design-Bid-Build (low bid) or Design-Build contracting appropriate for this type of work.	• Installation of variable message signs • Installation of poles, controller cabinets, foundations, guardrail, gantries • Installation of radio towers and civil infrastructure for wireless systems • Installation of tolling field equipment (e.g. tag readers, video cameras, etc.) • Installation of underground infrastructure (trenching, cable installation, etc.)
Operations/ Maintenance	On-going operations and/or maintenance of ITS services, software, and equipment. Typically a service contract (non-construction)	• Operating costs for traffic monitoring, management, control systems (e.g., rent, communications, labor, utilities) • Preventative maintenance