

## 7 Project Scoping and Design Reports / Systems Engineering Analysis

### 7.1 *Project Scoping*

The output of the project scoping stage is a Project Scoping Report. The Project Scoping Report documents the scoping decisions and the considerations upon which those decisions were made. The scoping report is a structured record of the evolution of a project and ensures that project needs have been well defined, a consensus on objectives has been achieved, design criteria established, feasible alternative(s) identified, and a cost estimate prepared.

The scoping report includes an analysis of existing conditions and explains what will be designed, reviews alternate design options, and recommends an alternative. A well prepared Project Scoping Report provides a clear, understandable, and acceptable “picture” of what is to be accomplished. Information in the Project Scoping Report includes estimating the resources required to complete the project, the roles and responsibilities of the agencies and departments involved, and defining the constraints on the project.

The Project Scoping Report is also used to grant scope approval and to guide subsequent stages of project development. The Project Scoping Report becomes a first draft of a draft design report or draft design report/environmental document. The format of the report serves as a checklist to ensure that relevant issues are considered prior to project scope approval. The same document, with appropriate changes and details, can also be used for design approval. Following this format, makes it possible to use the same report format to cover the scoping and project design phases I-IV.

### 7.2 *Project Design*

Moving from concept to design, the Project Design stage of a NYSDOT project consists of six design phases, some of which may not apply depending on the type of project, scope of work, environmental classification, public involvement, etc. The first four design phases make up the preliminary design stage of a project and the last two design phases make up the final (or detailed) design stage.

- **Design Phase I - Development of Feasible Design Alternatives, Identification and Assessment of Impacts.** Design Phase I consists of the steps necessary to continue the involvement of all stakeholders to further develop the design alternatives and to prepare the draft design approval document and progress appropriate reviews.
- **Design Phase II - Advisory Agency Review.** Design Phase II is the distribution of the draft design approval document for review and comment by federal, state and local advisory agencies. This phase will not apply to most projects.

- **Design Phase III - Public Hearing/Information Meeting.** Design Phase III consists of the steps necessary to prepare for and conduct the public hearing or information meeting. This phase will not apply to most projects.
- **Design Phase IV - Final Evaluation, Recommendation, and Design Approval.** This phase consists of the approval of a design report. The design report contains the final evaluation of comments received from the public and advisory agencies, and the selection of the preferred alternative. All plans and profiles should contain sufficient detail to support the selection of the build alternative.
- **Design Phase V - Advance Detail Plans (ADPs).** This phase consists of the steps necessary for the preparation of 90% complete plans and the review of the plans within NYSDOT and, if applicable, by FHWA, local agencies, and organizations with jurisdiction over the project area.
- **Design Phase VI - Final Plans, Specifications And Estimates (PS&E).** This design phase consists of the steps necessary to prepare and submit the Final PS&E for contract letting.

### **7.3 Systems Engineering Analysis**

The intent of the FHWA Rule / FTA Policy on ITS Architectures is to provide policies and procedures by which to implement ITS projects in an efficient manner and to accelerate the deployment of integrated Intelligent Transportation Systems (ITS). There are two (2) key requirements resulting from the FHWA Rule/FTA Policy: the first requirement is the development of a regional ITS architecture in a region for ITS projects; the second requirement is that all ITS projects in the region be developed using a systems engineering analysis.

The Systems Engineering Analysis will typically be delivered together with the Final Design (Design Approval) Report, as part of Design Phase IV.

The Systems Engineering Analysis (SEA) is the document that defines a project scope and systems engineering approach for these ITS projects, and is required for projects that use federal funds. There are 7 requirements for a SEA, of which several sections address details about the application of ITS standards in projects.

An annotated example SEA is contained in Appendix I.

**1. Portion of Regional ITS Architecture Being Implemented.** The SEA identifies those portions of the regional ITS architecture being implemented. The SEA identifies the ITS elements and architecture flows (information and control exchanges) applicable to the ITS project for which funding is requested. Given a list of architecture flows, one can make a project-specific selection of applicable ITS standards, as the architecture flows are mapped to the ITS Standards in the National ITS Architecture. This analysis can be accomplished by conducting a preliminary review of the customized market package diagrams from the New York Statewide ITS Architecture or regional ITS architecture, the ITS Inventory, and the “sausage

diagram.” As will be shown in the example, ITS elements and architecture flows that do not apply are shown grayed out.

**2. Participating Agencies Roles and Responsibilities.** Based on the regional ITS architecture and concept of operations it is straight forward to identify participating agencies and roles.

**3. Requirements Definition.** The SEA identifies the functional requirements for systems (and/or system interfaces) that will be developed within the ITS project. This section may use the system functional requirements defined in the regional ITS architecture as a starting point, or include a listing of the most relevant use cases and requirements developed.

**4. Alternative System Configuration and Technology Options.** The SEA includes a summary of alternative system configuration and technology options. The scoping report alternatives and design report recommendation provide an excellent starting point. The communications framework ensures that standards have been developed to support a variety of design choices.

**5. Applicable ITS Standards and Testing Procedures.** The SEA discusses the applicable ITS standards and testing procedures. Again, an ITS communications framework paves the way for developing this section of the SEA. This section of the SEA should include a discussion about which standards were considered for implementation and which were selected for the project. It also explains why, where one or more standards exist for implementation, an ITS standard will not be considered for the project. For example, the justification may include an explanation that the standard is not mature, or that there are not sufficient vendors that have implemented the standard in their products, etc.

This section of the SEA needs to specify WHAT needs to be in the project's PS&E or consultant contract regarding ITS Standards.

This section of the SEA also identifies the data communications options/protocols required.

- For center-to-center communications, list of applicable messages, but not necessarily specific message content, and whether to use DATEX or XML.
- For center-to-field communications, a complete list of ITS standards required for the project, per device, including support standards (e.g., 1100 series, Global Objects, etc.) but not the specific data objects themselves.

Examples of data communications options that are relevant to center-to-field communications and covered by the ITS Standards include: Ethernet, Dial-up, and FSK modem. Example of center-to-center data communications options include XML-based, and DATEX protocols.

For testing procedures, this section of the SEA should provide an outline of what needs to be tested, and an outline of what test procedures need to be specified in the PS&E.

**6. Procurement Options.** This section of the SEA should be developed based on existing planning documents, such as a Transportation Improvement Program (TIP) or an agency's capital plan. The key point of this section is to show traceability to the Federal, State, or Local

sources of funds, and to indicate what portions of the project are covered by those funds (e.g., capital costs, operations, maintenance, staff, etc.). Especially helpful is showing the “project identifiers” used in the existing planning documents, and cost estimates as they relate to the project/system life cycle.

**7. Procedures and Resources Necessary for the Operations and Management of the System.** This section includes a description of organizational procedures or practices appropriate to the system(s). This section should make use of the concept of operations and operational scenarios.

Finally, while not stated explicitly in the rule, any general background information related to the project should be included, for example, the specific roadway sections, transit routes, or geographic areas being considered; and project objectives.