

CHAPTER 5. VALIDATION PLAN GUIDANCE

The model Validation Plan can be found in Appendix E. The chapters required for the Validation Plan document are:

1. Purpose of Document
2. Scope of Project
3. Referenced Documents
4. Conducting Validation
5. Validation Identification

This document describes the activity of validation that the system being built meets the user needs and scenarios developed in the concept of operations. The validation documents will generally include three levels of validation documents:

- A plan to initially lay out the specific validation effort.
- The user's/operator's manual and/or a validation plan that defines the detailed operational procedures.
- A report on the results of the validation activities.

To ensure user needs and scenarios are validated by this activity, trace each need and scenario into a validation case, then into appropriate steps in the validation procedure.

A separate Validation Plan and procedures may be minimal for the simplest projects, especially where the system is commercially available and does not involve any custom software development, and where the agency staff have a very clear understanding of the purpose of the system. Preparation of a validation plan is strongly advised if:

- The system is more complex.
- There are several separate validation activities.
- Multiple deployment sites are involved.
- Multiple stakeholders have to be satisfied.

There is also the question of how comprehensive to make the validation effort. It is impossible to validate all possible combinations of actions under all possible operational situations. A good rule of thumb is: if it was important enough to write down as a need or scenario, then it should be validated, at least once. This may not, for example, validate all possible failure mode conditions

or all possible incident scenarios. In-process¹ validation performed on the needs will help ensure that end-to-end validation of the system will meet the stakeholder needs.

Once the Validation Plan has been prepared, use this checklist to ensure all critical information has been included.

- Does the Validation Plan answer all the questions of who, what, where, and when?
- Does the Validation Plan make clear what needs to happen if an unexpected situation or a failure is encountered?
- Does the Validation Plan document the configuration of the hardware and software?
- Are all applicable needs and scenarios traced to a validation case?

PURPOSE OF THE DOCUMENT (CHAPTER 1 OF THE VALIDATION PLAN DOCUMENT)

This section identifies the type of validation activity to be performed within this Validation Plan. For instance, this activity may validate the entire system, a sub-system, the deployment at a site, a burn-in, or any other validation activity called for in the Program Plan or in the Systems Engineering Management Plan.

SCOPE OF PROJECT (CHAPTER 2 OF THE VALIDATION PLAN DOCUMENT)

This section gives a brief description of the planned project and the purpose of the system to be built. Special emphasis is placed on the project's user needs and issues that must be addressed and validated.

This section also describes the environment in which the project operates. It identifies the organization structures that encompass all stakeholders. It also gives a brief description of the role to be played by each stakeholder. This includes ad hoc and existing management work groups and multi-disciplinary technical teams that should be formed to support the project.

REFERENCED DOCUMENTS (CHAPTER 3 OF THE VALIDATION PLAN DOCUMENT)

This is a list of all documents used in the preparation of this Validation Plan. This usually includes the Project Plan, (if one was written), and the applicable Requirements Documents. Reference to other documents, such as descriptions of external systems, standards, a Concept of Operations, and manuals may also be included.

¹ In-process validation is reviewing the needs and requirements during the definition stage by the stakeholders to ensure that all the needs have been identified and traced to appropriate requirements and have been reviewed for completeness for each of the needs.

CONDUCTING VALIDATION (CHAPTER 4 OF THE VALIDATION PLAN DOCUMENT)

This section provides details on how validation is accomplished. It defines: who does the validation; when and where it is to be done; the responsibilities of each participant before, during, and after validation; the deployed hardware and software configuration; and the documents to be prepared as a record of the validation activity.

This section also defines how anomalies are to be handled (that is, what to do when an unexpected situation or a failure occurs during validation).

In general, the following information should be included in this section:

- A description of the participating organizations, personnel, and identification of their roles and responsibilities. This may include for example, a validation conductor, validation recorder, operators, and/or engineering support.
- Identification of the location of the validation effort, that is, the place, or places, where the validation must be observed.
- The deployed hardware and software configuration for all of the validation cases, including hardware and software under validation and any supporting equipment, software, or external systems. Several configurations may be necessary.
- Identification of the documents to be prepared to support the validation, including Validation Procedures, a Validation Report and descriptions of special equipment and software.
- Details of the actual conduct of validation, including:
 - Notification of participants
 - Emphasis on the management role of the validation conductor
 - Procedures for approving last minute changes to the procedures
 - The processes for handling a failure, including recording of critical information, determination of whether to stop the validation, restart, or skip a procedure, resolution of the cause of a failure (e.g. fix the software, reset the system, and/or change the requirements), and determination of the re-validation activities necessary as a result of the failure.

VALIDATION IDENTIFICATION (CHAPTER 5 OF THE VALIDATION PLAN DOCUMENT)

This section identifies the specific validation cases to be performed. A validation case is a logical grouping of functions and performance criteria (all from the Concept of Operations Document) that are to be validated together. For instance, a specific validation case may cover Central

Traffic Signal System (CTSS) user permissions by the CTSS System Manager. There may be several individual user needs that define this capability, but they are validated in one case. The actual grouping of user needs into a case is arbitrary; however, the grouping is usually based on the grouping of user needs and the operational scenarios in the Concept of Operations. They should be related and easily combined into a reasonable set of procedure actions. Suggested validation cases that may be used in the Validation Plan document are included in the Validation Plan Sample Cases table (Appendix E).

Each case should contain at least the following information:

- A description name and a reference number.
- A description of the objective of the validation case, usually taken from the wording of the user need and/or scenario, to aid the reader understanding the scope of the case.
- A complete list of user needs and scenarios to be validated. For ease of tracing of user needs and scenarios into the Validation Plan and other documents, the user needs and scenarios are given numbers, so they can be accurately and conveniently referenced without repetition.
- Any data to be recorded or noted during validation, such as expected results of a step. Other data, such as a recording of a digital message sent to an external system, may be required to validate the performance of the system.
- A statement of the pass/fail criteria. Often this is just a statement that the system operates per the user need or scenario.
- A description of the validation configuration. That is a list of the hardware and software items needed for validation and how they should be connected (in most cases this is the deployed system configuration). Often, the same configuration is used for several validation cases.
- A list of any other important assumptions and constraints necessary to conduct the validation case.

Each validation case in Appendix E corresponds to the same name of a section of user needs in Section 4 of the Concept of Operations (ConOps) model document. The applicable operational scenarios defined in section 8 of the ConOps are referenced in each validation case. The details of each validation case will need to be added as the system is further defined.

APPENDIX A: VALIDATION PLAN SAMPLE CASES

Case #	Case Name	Case Description	Need #	Need Category
1	Configure TSS	This validation case will validate the user needs associated with configuring the TSS. The TSS Manager's user needs of configuring user permissions as well as allowing a set number of users with TSS access with arbitration of user requests for access will be validated. In addition, validation of the ability of the TSS User to enter and store information about the TSS and TSS Field Equipment characteristics will be covered by this validation case. This validation case also covers TSS and ASCT failure and fallback.	4.1	System Configuration
2	Managing the Signal System and Field Device Database	This validation case will validate the user needs associated with managing the traffic signal system and field device database. The user needs are grouped by general database development and general database management.	4.2	Managing Signal System and Field Device Database
3	TSS Control	This validation case will validate the user needs associated with TSS control including coordination (by time of day, local schedule, central schedule, manual command, external control, or traffic responsive selection of pattern), simulating controller inputs, central priority and preemption, and controller time clock resynchronization.	4.3	TSS Control
4	Adaptive System Operations	This validation case will validate the user needs associated with adaptive system operations. The user needs are grouped in the following categories: Adaptive Strategies, Adaptive Monitoring and Control, Adaptive Coordination across Boundaries, Adaptive Queuing Interactions, Adaptive Accommodation of Pedestrians, Adaptive Accommodation of Preemption and Priority, Non-Adaptive Situations, Adaptive System	4.4	Adaptive System Operations

Responsiveness, Adaptive Complex Coordination and Controller Features and Adaptive Alerts.				
5	Traffic and Operational Performance Measurement, Monitoring and Reporting	This validation case will validate the user needs associated with traffic and operational performance measurement, monitoring and reporting. The user needs are grouped in the following categories: Logging and reports; alarms and alerts; performance measurement, analysis, and reporting; and real-time monitoring.	4.5	Traffic and Operational Performance Measurement, Monitoring, and Reporting
6	Data Storage	This validation case will validate the user needs associated with data storage. The primary user need is for the TSS Operator to access the data stored by the TSS for a specified period of time after which it will be archived.	4.6	Data Storage
7	Constraints	This validation case will validate the user needs associated with constraints imposed on the TSS design. The TSS Designer may be constrained to using particular equipment, communications, protocols and software in particular environmental conditions within a specified project budget.	4.7	Constraints
8	Training	This validation case will validate the user needs associated with TSS/ASCT training. All staff involved in operations and maintenance will be trained on TSS, ASCT and ATSPM as appropriate for the procured system.	4.8	Training
9	External Interfaces	This validation case will validate the user needs associated with external interfaces to adjacent systems. System clock synchronization, coordinated and compatible signal timings, sharing of signal operational data with external systems, external system control, and control of external devices such as signs are some of the user needs validated by this case.	4.9	External Interfaces
10	Maintenance	This validation case will validate the user needs associated with making sure the system meets all needs during the life of the system. The ability to repair faults and keep the software and software environment updated is covered by this validation	4.10	Maintenance, Support and Warranty

case. Validation of the needs of the TSS Maintainer to safely maintain the TSS Field Equipment will also be covered by this validation case.