T204 Part 2 of 2: How to Develop Test Procedures for an ITS Standards-Based Test Plan, Part 2 of 2

Table of Contents

Module Description

This module is part of the non-systems engineering path, thus students must learn "How to Write a Test Plan" (T201), followed by an "Overview of Test Design Specifications, Test Cases, and Test Procedures" (T202), and then "How to Develop Test Cases for an ITS Standards-Based Test Plan" (T203 Part 1 and 2). Part 1 of this module (T204, Part 1) extended this discussion by providing participants with detailed information on how to prepare their own test procedure specifications, including using the test cases and creating test logs, test summaries, and anomaly reports. Part 1 ended with an overview of the Test Procedure Generator, which is an automated tool available at no cost from USDOT that students were allowed to download and try before beginning Part 2 of this module. Part 2, covered here, provides examples of how to perform tests using the TPG.

1. Introduction/Purpose

The purpose of this module is to teach the student how to develop a Test Procedure Specification (TPS) and how that document fits into the testing process and relates to the Test Plan, Test Design Specification, and Test Case Specification. In addition, the student will be taught how to develop the TPS to meet the specific project requirements for the interface (as found in the Protocol Requirements List (PRL) or Needs to Requirements Traceability Matrix (NRTM).
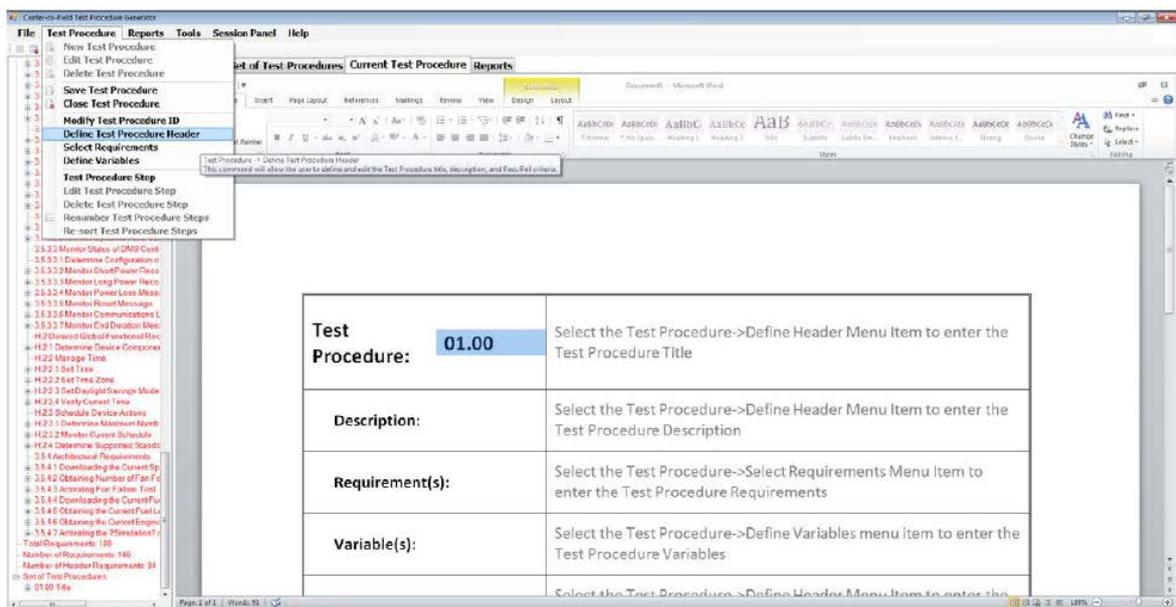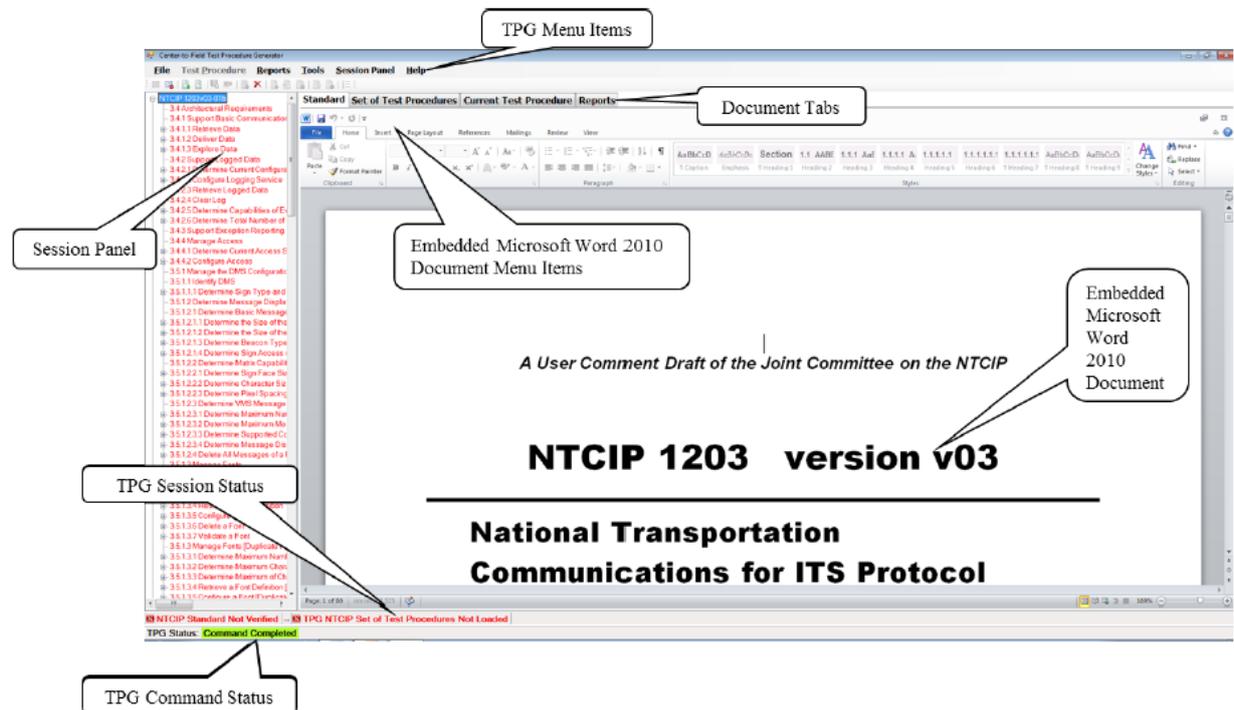
2. Samples/Examples

2.1. Review of T203 and T204.1
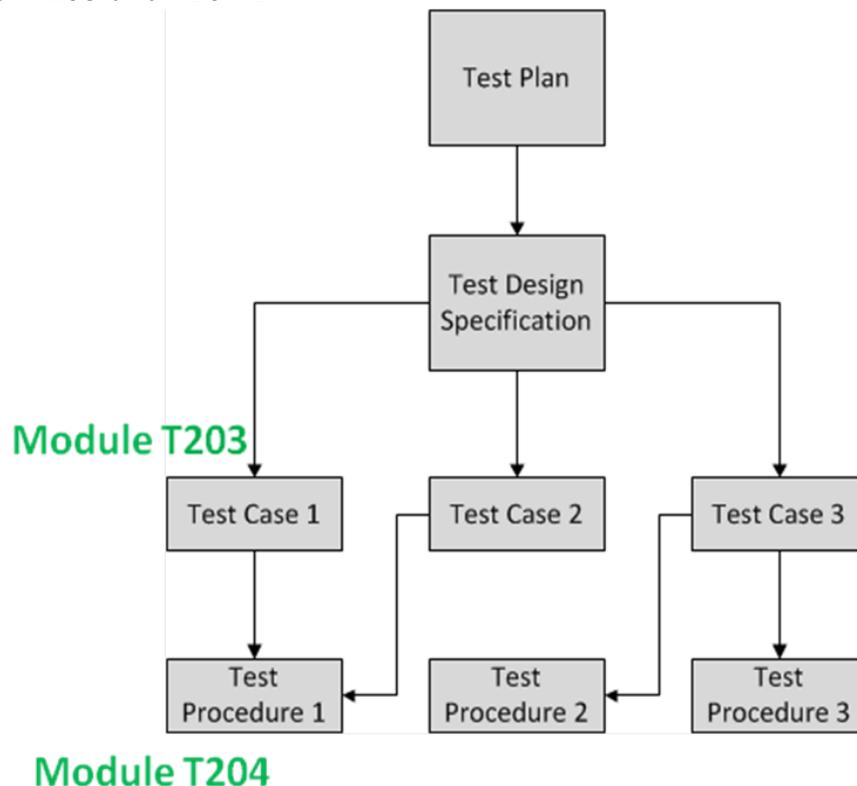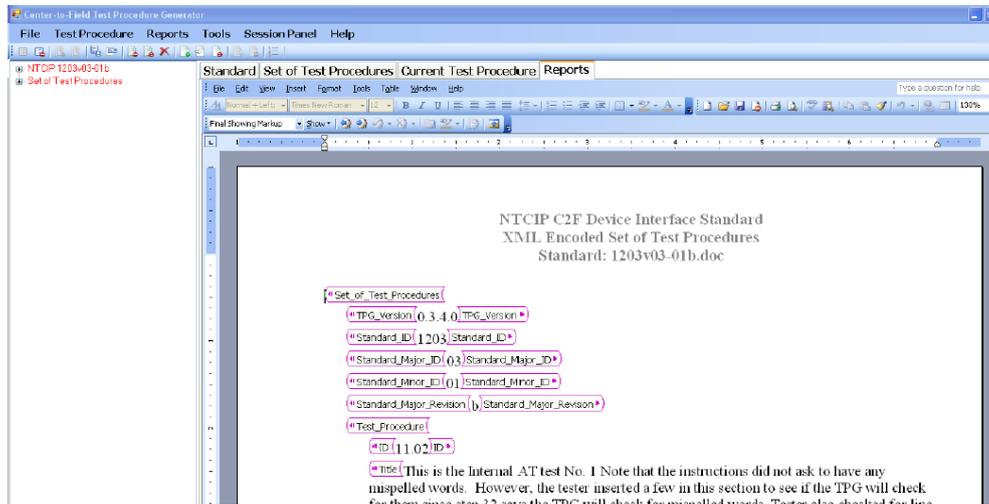
2.2. Using the Test Procedure Generator to generate Test Procedures for a variety of equipment.

- NTCIP 8002 Annex B1

- Role of TPG

- TPG successful installation

- Example Test Procedure for NTCIP 1203v03 Dynamic Message Sign (DMS)
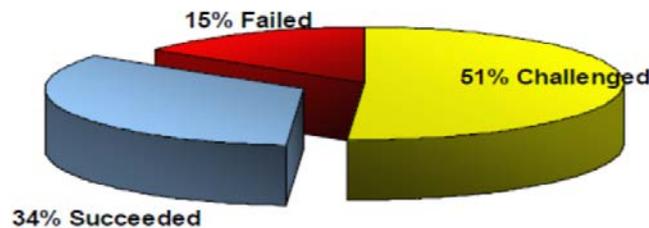
2.3. Installation and operation of TPG
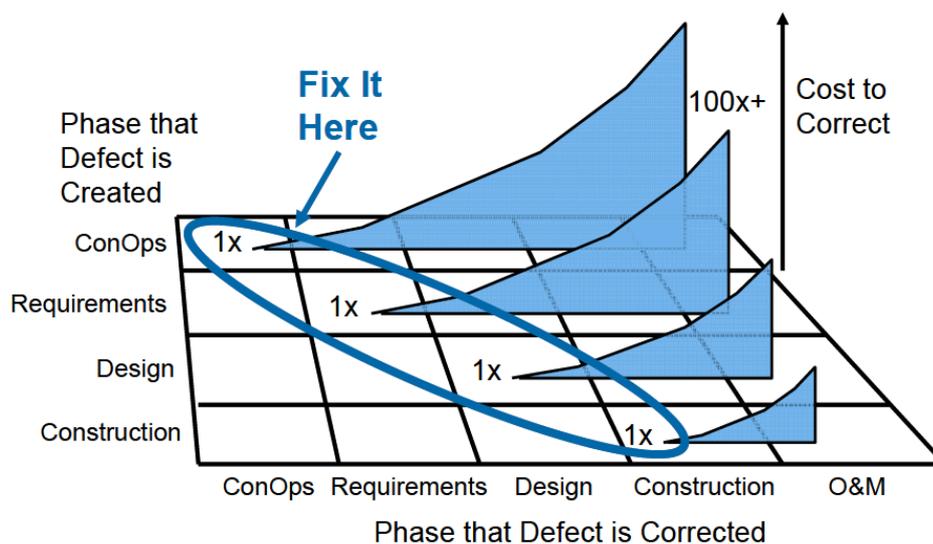
2.4. Output of TPG in XML format

2.5. Adapt the generated Test Procedure to procurement contract Terms and Conditions for successful project conclusion

- Lessons learned from unsuccessful ITS projects and how to avoid repetition.

- Find and correct problems early in the project

- Test Procedure defines the steps to perform the test

2.6. Synchronize the Test Procedure specification to the contract Terms and Conditions (T&Cs) for successful contract execution

- The odds are against success. The typical highway project model does not work well for ITS projects

- Structure the contract Terms and Conditions from the viewpoint of the project's end, including test specification, test plan, test scripts, and common equipment, if possible.
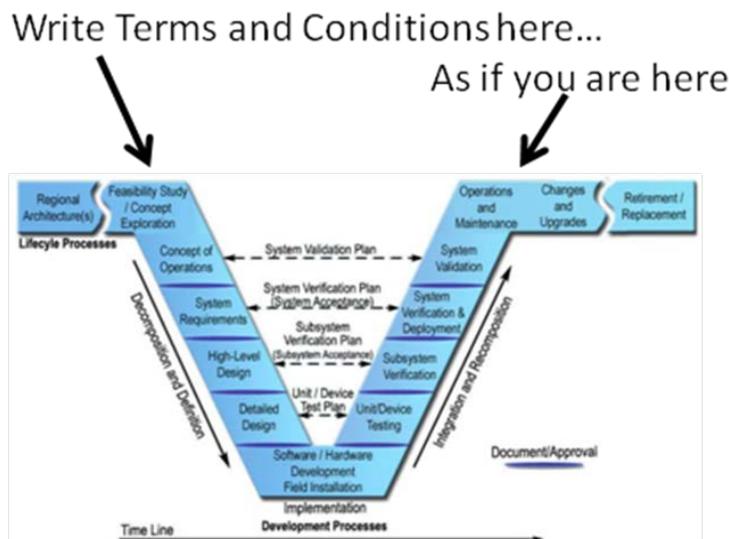
2.7. Write the reports produced at the end of testing and understand their relationship to successful Procurement Contracts

- Logs, including the data, information, files, and fulfilled requirements that are captured during the test

- Anomaly Report, including a failure description and the investigation process to resolve

- Level Test Report, providing a measure of success compared to the stated goals and scope of the Test Plan

- Master Test Report covering Level Test Reports

```
                        ┌──────────────┐
                        │  Test Plan   │
                        └──────┬───────┘
                               │
                               ▼
                        ┌──────────────┐
                        │ Test Design  │
                        │Specification │
                        └──────────────┘
                               │
         ┌─────────────────────┼─────────────────────┐
         ▼                     ▼                     ▼
   ┌───────────┐         ┌───────────┐         ┌───────────┐
   │Test Case 1│         │Test Case 2│         │Test Case 3│
   └─────┬─────┘         └───────────┘         └─────┬─────┘
         ▼                     ▼                     ▼
   ┌───────────┐         ┌───────────┐         ┌───────────┐
   │   Test    │◄────────│   Test    │◄────────│   Test    │
   │Procedure 1│         │Procedure 2│         │Procedure 3│
   └─────┬─────┘         └─────┬─────┘         └─────┬─────┘
      ┌──┴──┐                  │                     │
      ▼     ▼                  ▼                     ▼
 ┌───────┐┌───────┐      ┌───────┐            ┌───────┐
 │Output ││Output │      │Output │            │Output │
 │Records││Records│      │Records│            │Records│
 │   1   ││   2   │      │   3   │            │   4   │
 └───────┘└───────┘      └───────┘            └───────┘
```
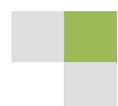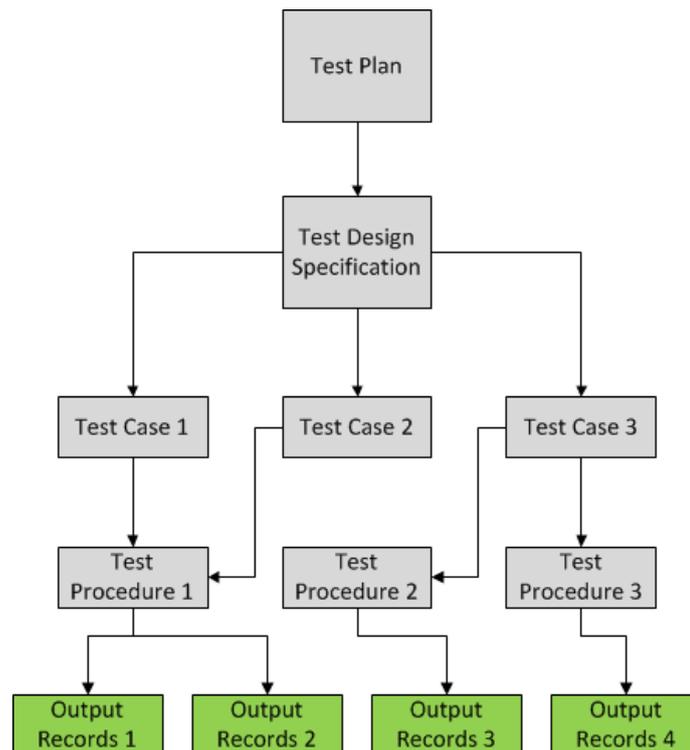
2.8. Use tools to develop the Test Procedures for a sample TPS structure

- Test Procedure Generator (TPG) is an automated tool

- TPG guides the development of uniform Test Procedures

- How to obtain the TPG from USDOT at no cost

- Installation of TPG

- Step-by-step TPG use and the results

- Demonstrating a typical error and how it is handled

- Use of uniform Key Words with a common understanding of the ITS standards
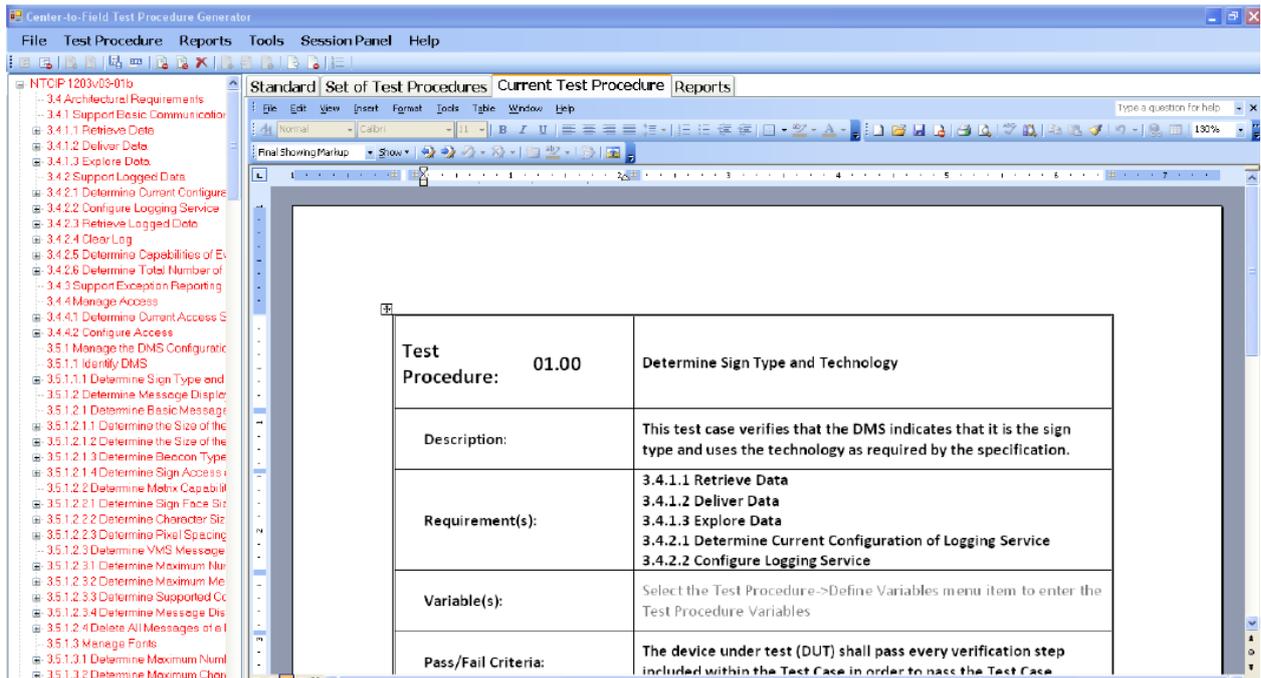
2.9. Use XML script outputs from TPG as inputs to automated test tools
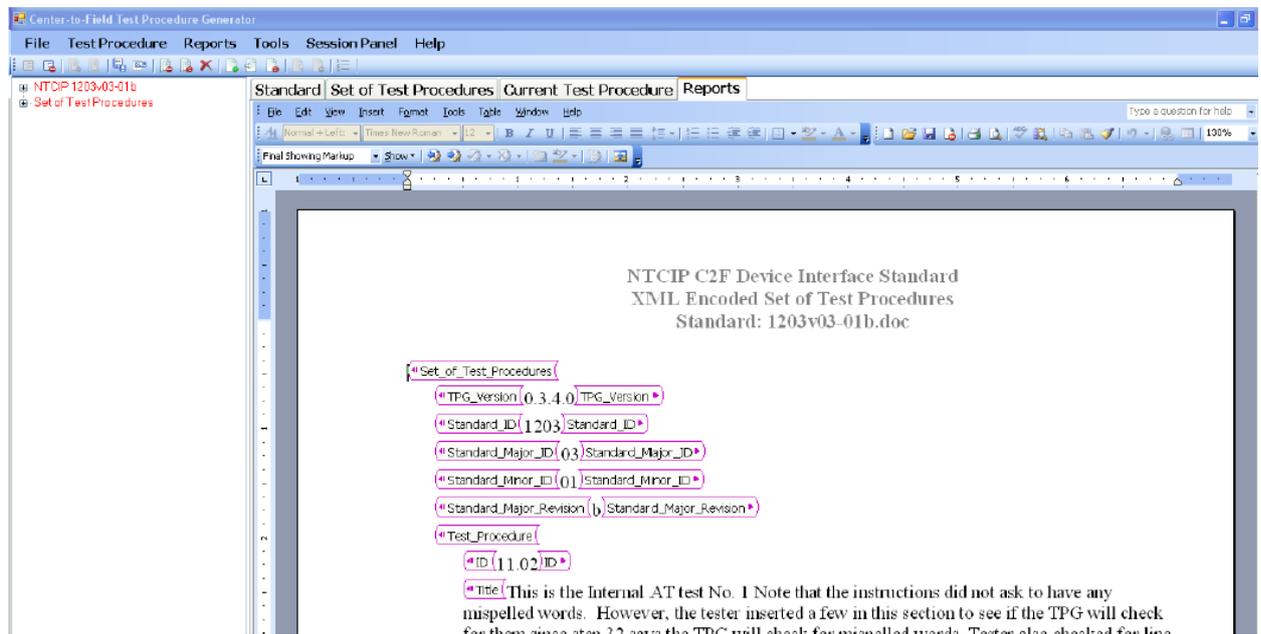
3. Reference to Other Standards

- IEEE 829-2008, *IEEE Standard for Software and System Test Documentation.* IEEE Computer Society, July 18, 2009

- Institute of Transportation Engineers, *ATC 5201 Advanced Transportation Controller (ATC) Standard Version 06.* ATC Joint Committee, 30 July 2012.

- Institute of Transportation Engineers, *ATC 5202 Model 2070 Controller Standard Version 03.* ATC Joint Committee, 28 December 2012.

- Institute of Transportation Engineers, *Intelligent Transportation System (ITS) Standard Specification for Roadside Cabinets v01.02.17b.* ATC Joint Committee, 16 November 2006.

- National Electrical Manufacturers Association, *NEMA Standards Publication TS 2-2003 v02.06 Traffic Controller Assemblies with NTCIP Requirements.* NEMA, 2003

4. Glossary

Term	Definition
Agency Specification	A document that has been prepared by an agency to define requirements for a subject item or process when procured by the agency.
Compliance	A condition that exists when an item meets all of the requirements of an agency specification.
Concept of Operations	A document that describes the purpose of a system project, including a description of the current and proposed system, as well as key user needs that the new system is required to address.
Conformance	A condition that exists when an item meets all of the mandatory requirements as defined by a standard. It can be measured on the standard as a whole, which means that it meets all mandatory (and applicable conditional) requirements of the standard or on a feature level (i.e., it conforms to feature X as defined in section X.X.X), which means that it meets all mandatory (and applicable conditional) requirements of the feature.
IT	Information Technology
T&C	Terms and Conditions
TCS	Test Case Specification
TDS	Test Design Specification
TPG	Test Procedure Generator
TPS	Test Procedure Specification
XML	Extensible Markup Language

5. References

- IEEE 829: IEEE Standard for Software and System Test Documentation
  http://standards.ieee.org/findstds/standard/829-2008.html

- NTCIP 1204 v03 ESS, www.ntcip.org

- PCB Website: Module T201, T202, http://www.pcb.its.dot.gov/stds_training.aspx

- US Department of Transportation, *Systems Engineering for Intelligent Transportation Systems.* USDOT, January 2007

- Center to Field Test Procedure Generator User Manual, v1.7, Federal Highway Administration. October 18, 2012

6. Study Questions

1. How does the TPG relate to NTCIP 8002?

   a) Draft standards are verified to NTCIP 8002 compliance

   b) Unbroken traceability from requirements through testing

   c) Uniformity of test procedure content and numbering

   d) All of the above

2. Which is the order of TPG example workflow?

   a) XML Requirement Step Object Variable

   b) Object Variable Requirement Step XML

   c) Requirement Variable Step Object XML

   d) Object Requirement Variable Step XML

3. ITS project cost and schedule should be developed in which of the following orders?

   a) From the test procedures back through the project workflow

   b) From the requirements only

   c) To enforce the contract terms at the end of the project

   d) To minimize the planning costs up front