Welcome

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T204 Part 1 of 2:
How to Develop Test Procedures for an ITS Standards-Based Test Plan
Instructor

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Chair: NEMA / AASHTO / ITE
Joint Committee on ATC
Chair: 3TS Technical Committee

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Target Audience

- Traffic management and engineering staff
- Maintenance Staff
- System developers
- Test personnel
- Private and public sector users including manufacturers
Recommended Prerequisite(s)

- T101: Introduction to ITS Standards Testing
- T201: How to Write a Test Plan
- T202: Overview of Test Design Specifications, Test Case Specifications and Test Procedures
- T203 Part 1 of 2: How to Develop Test Cases for an ITS Standard-based Test Plan, Part 1 of 2
- T203 Part 2 of 2: How to Develop Test Cases for an ITS Standard-based Test Plan, Part 2 of 2
Acronyms and Terminology Used

- **TP**  Test Plan
- **TDS**  Test Design Specification
- **TPS**  Test Procedure Specification
- **TPG**  Test Plan Generator
- **TCS**  Test Case Specification
- **DMS**  Dynamic Message Sign
- **TMDD**  Traffic Management Data Dictionary
- **RTM**  Requirements Traceability Matrix
- **RTCM**  Requirements to Test Case Matrix

See Student Supplement for Details
Learning Objectives

Part 1 of 2
1. Recognize the purpose and structure of a test procedure
2. Identify the role of a Test Procedure Specification (TPS) within a test plan and the overall testing process
3. Synchronize the test procedure specification to the contract terms and conditions for successful contract execution
4. Write the reports produced at the end of testing and understand their relationship to successful procurement contracts
5. Use tools to develop the test procedures for a sample TPS structure

Part 2 of 2
6. Use the Test Plan Generator (TPG) to generate test procedures for a variety of equipment
7. Adapt the generated test procedures to procurement contract terms and conditions for successful project conclusion
8. Develop complex test procedures that pull together NTCIP elements using the TPG
Learning Objective #1: Recognize the Purpose and Structure of a Test Procedure Specification

- Explain structure of a Test Procedure Specification (TPS)
- Discuss inputs and expected outputs from a test procedure
- Explain special needs from a test procedure standpoint
Definitions

- **A test procedure** provides detailed instructions for the setup, execution, and evaluation of results for a given test case (IEEE Std 829)

- **Test Procedure Specification (TPS)** is a document that defines the steps to execute a test and relates to test cases

- TPS is used in ITS project as part of a test plan prepared for a system acceptance
Purpose and Structure of a Test Procedure

Purpose of Test Procedure

- A standardized test procedure provides meaningful results (outputs) to a user for evaluating the system:
  
  *Did we build the system as intended by the project specification (user)?*

- In the previous Module, T203, we learned how to develop test cases for DMS and TMDD-based ITS projects

- Continuing further, in this module we will learn how to develop TPS using IEEE Std 829 format and definitions
What does IEEE Std 829 Provide?

- Guidance and formats for preparing testing documentation:
  - Test Plan
  - Test Design Specification
  - Test Case Specification
  - Test Procedure Specification (TPS)
  - Test Reports
    - Test Logs
    - Test Anomaly Report
    - Test Report

- Testing professionals across ITS are familiar with these definitions and the sequence of the testing workflow
Purpose and Structure of a Test Procedure (cont.)

Structure of a Test Procedure (IEEE Standard 829)

1. Introduction
   - Document identifier
   - Scope
   - References
   - Relationship to other procedures

2. Details
   - Inputs, outputs, and special requirements
   - Ordered description of the steps to be taken to execute the test cases

3. General
   - Glossary
   - Document change procedures and history
Purpose and Structure of a Test Procedure (cont.)

Related Details

- Test resources
- Test schedule
- Items to be tested
- Features to be tested
- Test tasks to be performed
- Test personnel required to conduct tests
- Test risks
Where does TPS Fit in Documentation Structure?

TPS defines the steps to execute a test and relates to test cases.

Source: PCB Module-IEEE 829-1998
Inputs and Expected Outputs

A Test Procedure is Conducted on Test Inputs to Produce Test Outputs

Test Results:
- Test Logs
- Test Summaries
- Discrepancy Reports—documents unexpected outputs
- The deliverables are formatted per IEEE 829

Outputs Categories:
- Expected outputs ("PASS")
- Unexpected outputs (requires further investigation)
Role of Test Procedures

- Test procedure ultimately traces back to the user needs—a starting point in a SE life cycle of an ITS project:
  - Test procedure traces back to test cases
  - Test cases trace back to requirements
  - Requirements trace back to user needs
Role of Test Procedures (cont.)

Test Procedure Insures the System is Built Correctly as Expected by the User

- Verifying that we built the system correctly:
  - Design used standard objects and dialogs correctly
  - Design implemented special contract provisions (if any) correctly
  - The system performs as expected by the user

Did we build the system as intended by a project specification? - users, owners, developers, vendors

Source: FHWA
Special Needs from a Test Procedure Standpoint

Test Procedure

Special Needs Outside of the Standards
- Special security measures
- Special access rights (permission) to data bases
- Documentation control for archiving deliverables
- Configuration management to reproduce the same results
- Records of any automated test tools
- Special skill sets required of test operators

Special contract provisions (if any):
- Special needs do not show up for the first time in the TPS
- Special Needs of contracts move through TDS and TCS
# IEEE 829 Level Test Procedure Steps

<table>
<thead>
<tr>
<th>LEVEL TEST PROCEDURE # ID</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOG:</strong> Logging tools and methods</td>
</tr>
<tr>
<td>List ...</td>
</tr>
<tr>
<td><strong>SETUP:</strong> Sequence of actions to prepare for testing</td>
</tr>
<tr>
<td>List ...</td>
</tr>
<tr>
<td><strong>START:</strong> Actions to begin test execution</td>
</tr>
<tr>
<td>List ...</td>
</tr>
<tr>
<td><strong>MEASUREMENT:</strong> Describe how measurements are to be made</td>
</tr>
<tr>
<td>List ...</td>
</tr>
<tr>
<td><strong>SHUT DOWN:</strong> Actions to suspend testing for unscheduled events</td>
</tr>
<tr>
<td>List ...</td>
</tr>
<tr>
<td><strong>RESTART:</strong> Procedure to restart testing from shutdown</td>
</tr>
<tr>
<td>List ...</td>
</tr>
<tr>
<td><strong>STOP:</strong> Procedure for orderly halt to testing</td>
</tr>
<tr>
<td>List ...</td>
</tr>
<tr>
<td><strong>WRAP UP:</strong> Actions after execution has been completed</td>
</tr>
<tr>
<td>List ...</td>
</tr>
<tr>
<td><strong>CONTINGENCIES:</strong> Actions necessary to deal with anomalies</td>
</tr>
<tr>
<td>List ...</td>
</tr>
</tbody>
</table>
Which of the following is a FALSE statement?

**Answer Choices**

a) ITS standards define objects and dialogs to be tested  
b) ITS standards provide format and steps for test procedures  
c) Test procedures can merge with test cases  
d) Test cases trace to requirements
**Review of Answers**

a) ITS standards define objects and dialogs to be tested

*Incorrect. Objects defined in the ITS standards. The most recent version of several NTCIP standards include dialogs.*

b) ITS standards provide format and steps for test procedures

*Correct! ITS standards do not provide formats and steps for TPS, ONLY IEEE 829 does.*

c) Test procedures can merge with test cases

*Incorrect. Std 829 links test cases as inputs to a test procedure.*

d) Test cases trace to requirements

*Incorrect. A test cases traces to requirements.*
Summary of Learning Objective #1

Recognize the Purpose and Structure of a Test Procedure

- Discussed the purpose and structure of a TPS based on IEEE 829 format and definitions
- Reviewed the inputs and expected outputs in a test procedure
- Reviewed special needs that arise from outside of ITS standards and contractual requirements
Learning Objective #2: Identify the Role of a Test Procedure Specification Within a Test Plan and the Overall Testing Process

- Briefly review the role of Test Design Specification (TDS)
- Briefly review the role of Test Case Specification (TCS)
- Discuss test procedure steps
Brief Review of Test Design Specification (TDS)

TDS Details What a Test is to Demonstrate

- TDS is a document that:
  - Specifies the details of the test approach
  - Specifies what is to be verified
  - Identifies the associated tests

- Each test identified in the TDS may identify and detail:
  - A test of a single requirement
  - A test of a combination of multiple requirements
## Example of TDS

### TDS Outlines Requirements to Be Tested

#### NTCIP 1203 Protocol Requirements List (PRL)

<table>
<thead>
<tr>
<th>USER NEED SECTION NUMBER</th>
<th>USER NEED</th>
<th>FR SECTION NUMBER</th>
<th>FUNCTIONAL REQUIREMENT</th>
<th>CONFORMANCE</th>
<th>SUPPORT / PROJECT REQUIREMENT</th>
<th>ADDITIONAL PROJECT REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3.2.3</td>
<td>DMS Display Matrix Configuration</td>
<td></td>
<td>M</td>
<td>Yes</td>
<td></td>
<td>The DMS shall be 9,000 millimeters wide (0.65535) and 2,700 millimeters high (0.65535), inclusive of borders.</td>
</tr>
<tr>
<td>2.3.2.3.1 Non-Matrix</td>
<td></td>
<td></td>
<td>O.2 (1)</td>
<td>Yes/No</td>
<td></td>
<td>The Sign’s Border shall be at least 400 millimeters wide (0.65535) and 400 millimeters high (0.65535).</td>
</tr>
<tr>
<td>2.3.2.3.2 (Matrix)</td>
<td>Matrix</td>
<td></td>
<td>O.2 (1)</td>
<td>Yes/No</td>
<td></td>
<td>The pitch between pixels shall be at least 66 millimeters (0.255).</td>
</tr>
<tr>
<td>2.3.2.3.2.1 Full Matrix</td>
<td></td>
<td></td>
<td>O.3 (1)</td>
<td>Yes/No</td>
<td></td>
<td>The sign shall be __ pixels wide (0.65535) and ____ pixels high (0.65535).</td>
</tr>
<tr>
<td>2.3.2.3.2.2 Line Matrix</td>
<td></td>
<td></td>
<td>O.3 (1)</td>
<td>Yes/No</td>
<td></td>
<td>The sign shall have ____ lines with each line being ____ pixels wide and ____ pixels high.</td>
</tr>
<tr>
<td>2.3.2.3.2.3 Character Matrix</td>
<td></td>
<td></td>
<td>O.3 (1)</td>
<td>Yes/No</td>
<td></td>
<td>The sign shall be 18 characters wide and 3 characters high with each character being 5 pixels wide (0.255), 7 pixels high (0.255).</td>
</tr>
</tbody>
</table>

Source: NTCIP 1203 DMS
Brief Review of Test Case Specification (TCS)

TCS Specifies Conditions and Sequence of Verification

- TCS is a document that specifies:
  - The inputs to the test
  - The outputs of the test – the predicted results
  - A set of execution conditions for the test

- Section 1: Introduction
  - Document identifier
  - References to other documents
  - Context required outside of the TCS document
  - Notation description, such as numbering systems
Brief Review of TCS (continued)

TCS Specifies Purpose of Verification

- Section 2: Test Case Details
  - Test case identifier, unique to each
  - Test objective and focus
  - Inputs required to execute the test
  - Expected outcomes and behaviors
  - Environmental needs for setup, execution and recording the results
  - Special procedures
  - Interdependencies to other test cases

- Section 3: General
  - Glossary
  - Document change procedure and change history
Role of TPS within Test Plan & Testing Process

TPS Defines the Steps to Perform the Test

- TSP is a document that:
  - Specifies a sequence of actions (steps) for the execution of a test
  - TPS based on TDS and TCS
  - In general, TPS specifies the steps of the verification such as inspection, demonstration, analysis and a test procedure
Role of TPS within Test Plan & Testing Process

Requirements to Test Case Matrix (RTCM) : Example from NTCIP 1204 ESS v03, C.2.2

ANNEX C TEST PROCEDURES [NORMATIVE] .................................................................................................................. 152

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C.1.1 Scope ............................................................................................................................................................... 152
C.1.2 Keywords .......................................................................................................................................................... 152
C.1.3 Rules for Following Test Procedures ................................................................................................................ 153

C.2 Testing Requirements ........................................................................................................................................... 153
C.2.1 Field Device Test Environment ....................................................................................................................... 153

Source: NTCIP 1204 ESS v03
Role of TPS within Test Plan & Testing Process

Test Workflow: Continued from Module T202

- **Test Workflow Steps:**
  - Overall Test Plan
  - Test Design Specification
  - Multiple Test Cases per TDS
  - Multiple Test Procedures
    - Each test procedure may cover one independent test case
    - Each test procedure may cover multiple dependent test cases
In addition to inputs, outputs, and execution conditions, test case specification includes:

**Answer Choices**

a) Test objective to provide guidance to the test operator  

b) Test environment hardware and software  

c) Special procedures, such as automated tools  

d) All of the above
Review of Answers

a) Test objective to provide guidance to the test operator

All are true.

b) Test environment hardware and software

All are true.

c) Special procedures, such as automated tools

All are true.

d) All of the above

Correct! All are true.
Summary of Learning Objective #2

Role of Test Procedure Specification within a Test Plan and Overall Testing Process

- Briefly reviewed the role of Test Design Specification (TDS) as per Standard IEEE 829
- Briefly reviewed the role of Test Case Specification (TCS) as per Standard IEEE 829
- Discussed test procedure steps and overall role within a test plan and testing process
Learning Objective #3: Synchronize the Test Procedure Specification to the Contract Terms and Conditions for Successful Contract Execution

- Discuss ITS project background
- Discuss how to structure contract terms and conditions from viewpoint of project end successfully
ITS Projects Background (cont.)

- Study has shown that of 280,000 Information Technology projects surveyed, 142,000 were late or over budget; 42,000 failed and were canceled.

- Factors contributing to failures:
  - Lack of user involvement
  - Few limits on project scope
  - Lack of firm requirements
  - No consensus of project success at project kickoff

See student supplement for reference
Synchronizing the TPS to the Contract Terms and Conditions

Start the Project with an Eye on the Finish Line

- In the beginning: What constitutes success at the end?
- For project acceptance at the end, project terms and conditions should include:
  - Design specifications
  - Test case specifications
  - Test procedures
  - Testing of interfaces by suppliers before integration
Synchronizing the TPS to the Contract Terms and Conditions (cont.)

- Expect systems engineering and planning effort to consume over 15% of the project budget to avoid ambiguities and system defects at project end.

- Good planning includes test documentation.
Synchronizing the TPS to the Contract Terms and Conditions (cont.)

- Terms and conditions should include IEEE 829 elements:
  - Test plan
  - Test design specification
  - Test case specification
  - Test procedures with “fill-in-the-blank” fields for test outputs

Write Terms and Conditions here... as if you are here.
Synchronizing the TPS to the Contract Terms and Conditions (cont.)

Additional Concerns to be Aware Of

- Terms and conditions could also specify:
  - Third party test equipment model-requirements
  - Test scripts as deliverables
  - Test procedure for common test equipment and test scripts
  - Example: Type of ASC, ATC, 2070, etc.
The TPS should be synchronized to the contract terms and conditions…

Answer Choices

a) Project ending without unexpected issues
b) Minimizing the project planning costs and time
c) Replicating the wording of a similar prior project
d) Enforcement after the project is late and over budget
Review of Answers

a) Project ending without unexpected issues

Correct! Contract terms including the tests allow the suppliers to test deliverables throughout the project, eliminating unexpected results.

b) Minimizing the project planning costs and time

Incorrect. Studies of IT project show that investing 15% or more of the total project cost in planning will save more than 15% in cost overruns.

c) Replicating the wording of a similar prior project

Incorrect. Replication of “boilerplate” acceptance wording does not provide clear acceptance criteria for differing equipment and software.

d) Enforcement after the project is late and over budget

Incorrect. Enforcing design changes for unexpected results is more expensive than planning the final acceptance before the project begins.
Summary of Learning Objective #3

Synchronize the TPS to the Contract Terms and Conditions for Successful Contract Execution

- Discussed ITS project background, how they present challenges
- Discussed how to structure contract terms and conditions from the viewpoint of project end successfully
Learning Objective #4: Write the Reports Produced at the End of the Testing and Understand Their Relationship to Successful Procurement Contracts

- Logs, including data, information, files, and needs that are captured during the test
- Incident report, including a failure description and the investigation process
- Summary report, providing a measure of success compared to the stated goals and scope of the test plan
Reports Produced at the End of Testing and Their Relationship to Successful Procurement

Logs, Including the Data, Information, Files and Fulfilled Requirements That are Captured During the Test

- Outputs captured during the test
  - Test Logs
  - Test Data
  - Test Information
  - Test Files
- Output documentation is tailored to each test procedure from the formats available in IEEE 829
- We will demonstrate how the outputs are populated during a test procedure that includes more than one test case
Reports Produced at the End of Testing and Their Relationship to Successful Procurement

**Workflow: Test Procedure Outputs**

- We have created (gray):
  - Test Plan
  - Test Specification
  - Test Cases
  - Test Procedures
- Using test cases as inputs, test procedures will create output records (green):
  - Test Logs
  - Test Data
  - Test Information
  - Test Files
Reports Produced at the End of Testing and Their Relationship to Successful Procurement

Anomaly Report, Including a Failure Description and the Investigation Process

- Discovery of anomalies:
  - Evaluate the test procedure outputs
  - Identify data that is out-of-bounds of the expected result
  - Out-of-bounds data is unexpected and requires investigation
  - AKA “incidences”, “errors”, “problems”, “defects”, “issues”

- Anomaly report includes:
  - Unexpected results in the test procedure outputs
  - A description of each unexpected result
  - Investigation plan as the next step for disposition of each anomaly

1. Introduction
   1.1. Document identifier
1.2. Scope
1.3. References

2. Details
   2.1. Summary
   2.2. Date anomaly discovered
   2.3. Context
   2.4. Description of anomaly
   2.5. Impact
   2.6. Originator’s assessment of urgency (see IEEE 1044-1993 [B13])
   2.7. Description of the corrective action
   2.8. Status of the anomaly
   2.9. Conclusions and recommendations

3. General
   3.1. Document change procedures and history

- **Introduction**
  - Document identifier
  - Scope of testing
  - References, such as standards documents

- **Details**
  - Summary: What was found to be out of bounds?
  - Date, context, description: When, Where, What?
  - Impact and urgency: Major or minor impact to project cost & schedule?
  - Action: Stop and fix or investigate further?
  - Status: Open, investigating, or resolved and closed? Who decides?
  - Conclusions and Recommendations: Next steps for stakeholders

- **General:** Document control numbers, versions, history

- Description
  - Test inputs used
  - Expected outputs from the plan
  - Actual results observed
  - Gap between expected and actual
  - Test procedure step
  - Test environment
  - Attempts to repeat the test
  - Test operators, who conducted the test?
  - Observers
Level Test Reports Produced at the End of Testing

Level Test Report, Providing a Measure of Success Compared to the Stated Goals and Scope of the Test Plan

- Level test report:
  - Measure of success
  - Identify gap between current situation and stated goals
  - Clear objective metrics based on anomaly report and remaining disposition of open issues

- Clear conclusions and recommendations:
  - Ready for deployment
  - Ready with minor modifications
  - Not ready
Level Test Report: IEEE Standard 829 Format

- For each level of integration test
- Introduction
  - Document ID
  - Scope of testing
  - References, if any
- Details
  - Overview of test results
  - Detailed test results
  - Rational
  - Recommendations
- General: Document control

1. Introduction
   1.1. Document identifier
   1.2. Scope
   1.3. References
2. Details
   2.1. Overview of test results
   2.2. Detailed test results
   2.3. Rationale for decisions
   2.4. Conclusions and recommendations
3. General
   3.1. Glossary
   3.2. Document change procedures and history
Example of a Level Test Report

- For ASC Timing
- Introduction
  - Document ID
  - Scope of testing
  - References, if any
- Details
  - Overview of test results
  - Detailed test results
  - Rational
  - Recommendations
- General: Document control
Master Test Report Produced at the End of Testing

- For all levels of integration test
- Introduction
  - Document ID
  - Scope of testing
  - References, if any
- Details
  - Overview of test results
  - Detailed test results
  - Rational
  - Recommendations
- General: Document control

1. Introduction
   1.1. Document identifier
   1.2. Scope
   1.3. References

2. Details of the Master Test Report
   2.1. Overview of all aggregate test results
   2.2. Rationale for decisions
   2.3. Conclusions and recommendations

3. General
   3.1. Glossary
   3.2. Document change procedures and history
ACTIVITY
Which of the following statements is FALSE?

Answer Choices

a) Only one test case used as input to each test procedure

b) A test procedure can use multiple test cases as inputs
Review of Answers

a) Only one test case used as input to each test procedure

Correct! This statement is false. Test cases that are independent of each other will likely be the single input to a test procedure. However, several dependent test cases are often used as multiple inputs to one test procedure.

b) A test procedure can use multiple test cases as inputs

Incorrect. This statement is true. Test cases that require similar equipment with related functions can be tested with one procedure.
Summary of Learning Objective #4

Reports Produced at the End of Testing and Their Relationship to Successful Procurement

- Learned the format and content of logs, including data, information, files, and needs that are captured during the test
- Learned the format and content of an incident report, including a failure description and the investigation process, and an anomaly report
- Learned the format and content of the level test report and summary report, providing a measure of success compared to the stated goals and scope of the test plan
Learning Objective #5: Using the Test Procedure Generator (TPG) to Develop the Test Procedures for a Sample TPS Structure

- Test Procedure Generator (TPG) Tool
  - Purpose of TPG
  - How to obtain a copy of the TPG
  - Show a quick overview of installation
  - Explain each step and the results
  - Learn how to handle an error in a sample TPS structure

- Understand pre and postconditions, and different types of steps
Using a Tool to Develop the Test Procedures

Test Procedure Generator (TPG) for a Sample TPS Structure

- TPG is a software tool developed by USDOT
- Guides the development of uniform test procedures:
  - NTCIP standards that can typically use the TPG have:
    - Management Information Base (MIB)
    - With standardized dialogs
    - Requirements Traceability Matrix (RTM) defining performance
- Creates XML scripts
  - Consistent interpretation among stakeholders
  - Eliminates errors of manual creation of scripts
  - Can be used on any automated test equipment
Using TPG to Develop the Test Procedures

Test Procedure Generator (TPG)

- TPG is used to develop test procedures from NTCIP standards with:
  - Management Information Base (MIB)
  - Data exchange dialogs
  - Requirements Traceability Matrix (RTM)

- Advantages of using the TPG:
  - Creates scripts in commonly-understood XML format
  - Creates uniform scripts for use in multiple projects
  - Creates uniform scripts for each stakeholder within a project
  - Eliminates syntax errors and manual entry errors
Using a Tool to Develop the Test Procedures

Test Procedure Generator (TPG)

- Will be able to request a copy of TPG to be added to distribution list
- Will be able to download the TPG, including:
  - TPG executables
  - TPG installation procedure
  - TPG instruction manual
How to Use TPG (cont.)

Opening a New TPG Session
How to Use TPG (cont.)

Opening a Standard

Learning Objective #5
How to Use TPG (cont.)

Create a New set of Test Procedures
How to Use TPG (cont.)

Test Procedure 01.00
How to Use TPG (cont.)

Define the Test Procedure Header

<table>
<thead>
<tr>
<th>Test Procedure:</th>
<th>01.00</th>
<th>Select the Test Procedure -&gt; Define Header Menu Item to enter the Test Procedure Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td></td>
<td>Select the Test Procedure -&gt; Define Header Menu Item to enter the Test Procedure Description</td>
</tr>
<tr>
<td>Requirement(s):</td>
<td></td>
<td>Select the Test Procedure -&gt; Select Requirements Menu Item to enter the Test Procedure Requirements</td>
</tr>
<tr>
<td>Variable(s):</td>
<td></td>
<td>Select the Test Procedure -&gt; Define Variables menu item to enter the Test Procedure Variables</td>
</tr>
<tr>
<td>Pass/Fail Criteria:</td>
<td></td>
<td>Select the Test Procedure -&gt; Define Header Menu Item to enter the Test Procedure Pass/Fail Criteria</td>
</tr>
</tbody>
</table>
How to Use TPG (cont.)

Test Procedure Header Window Defined

Learning Objective #5
How to Use TPG (cont.)

Select a Requirement

Learning Objective #5
How to Use TPG (cont.)
Select a Requirement From Window
How to Use TPG (cont.)

Requirements Populated
How to Use TPG (cont.)

Define Variables

<table>
<thead>
<tr>
<th>Test Procedure:</th>
<th>Determine Sign Type and Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>This test case verifies that the DMS indicates that it is the sign type and uses the technology as required by the specification.</td>
</tr>
</tbody>
</table>
| Requirement(s): | 3.4.1.1 Retrieve Data  
3.4.1.2 Deliver Data  
3.4.1.3 Explore Data  
3.4.2.1 Determine Current Configuration of Logging Service  
3.4.2.2 Configure Logging Service |
| Variable(s):    | Select the Test Procedure > Define Variables menu item to enter the Test Procedure Variables |
| Pass/Fail Criteria: | The device under test (DUT) shall pass every verification step included within the Test Case in order to pass the Test Case |
Learning Objective #5

How to Use TPG (cont.)

Saving a Test Procedure
How to Use TPG (cont.)

Closing a Test Procedure

NTCIP 1203v03-01b
National Transportation Communications for ITS Protocol
NTCIP 8007 Conformant Set of Test Procedures
Version 10 - Jun 03, 2011
How to Use TPG (cont.)

Save XML Set of Test Procedures

NTCIP 1203v03-01b
National Transportation Communications for ITS Protocol
How to Use TPG (cont.)

XML Representation

Learning Objective #5
How to Use TPG (cont.)

Other TPG Functionality

- Delete a test procedure step
- Resort test procedure steps
- Renumber test procedure steps
- Modify test procedure identification
- Edit a test procedure
- Print a test procedure
Understanding Pre and Postcondition and Different Types of Steps

- Preconditions and Postconditions:
  - Constructed of key words
  - Key words are consistent with the common understanding of the ITS standards
  - Key words entered are validated, creating consistent test procedures that are interoperable among manufacturers
Which statement is TRUE? The TPG…

Answer Choices

a) Takes test cases directly as inputs
b) Guides test procedures having MIBs, Dialogs, and RTM
c) Creates outputs in commonly understood XLS files
d) Executes test procedures automatically
Review of Answers

a) Takes test cases directly as inputs
   *Incorrect. The TPG does not read in test cases. It pulls information from various sections of the standard and reads non-TPG created test procedures.*

b) Guides test procedures having MIBs, Dialogs and RTM
   *Correct! The TPG is used to develop test procedure with uniform key words, dialogs and requirements traceability matrix to eliminate manual entry errors and to enable test procedures to be reused.*

c) Creates outputs in commonly-understood XLS files
   *Incorrect. The TPG creates outputs in commonly-understood XML scripts.*

d) Executes test procedures automatically
   *Incorrect. The TPG does not execute test procedures. TPG XML scripts can be used as inputs to automated test equipment.*
Summary of Learning Objective #5

How to Use Tools to Develop the Test Procedures for a Sample TSP Structure

- Introduced Test Procedure Generator (TPG) Tool and showed how to use it to produce test procedures
- Discussed pre and postconditions, and different types of steps
What We Have Learned in Part 1

1) Test Procedure Specification (TSP) inputs are **test cases** used to create outputs of **expected results** and **anomaly reports** of unexpected results in **IEEE 829** standard format.

2) A **test design specification** details what a test is to demonstrate, a **test case specification** is a specific example that assigns values, while a **test procedure** defines the steps to perform the test.

3) Contract Terms and Conditions should be viewed from the project’s end including **test case specifications** and **test procedures**.

4) A **master test report** measures project success to **stated goals**.

5) Test Procedure Generator (TPG) is an **automated tool** that generates **XML scripts** using consistent **key words** for interoperability.
Resources

- NTCIP 1204 v03 ESS, www.ntcip.org
- PCB Website: Module T201, T202 Available
- 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
Next Course Module

Module T204 Part 2 of 2:
How to Develop Test Procedures for ITS Standards-based Test Plan
Part 2 of 2
(We will cover Learning Objectives 6, 7, and 8)
Next Course Module

Homework between T204 Part 1 and T204 Part 2

- Request a copy of the Test Procedure Generator at the address: [blake.christie@noblis.org](mailto:blake.christie@noblis.org)
- Register at the same link to receive updates
- Download and install the TPG on a computer
- Create a simple Test Procedure to become familiar with the TPG before we begin T204 Part 2
- Have the TPG up and running when we begin Part 2
QUESTIONS?