WELCOME

RITA Intelligent Transportation Systems
Joint Program Office

Welcome

Shelley Row, P.E., PTOE

Director

ITS Joint Program Office

Shelley.Row@dot.gov

WWW.PCB.ITS.DOT.GOV/STANDARDSTRAINING

T202
Overview of Test Design Specifications, Test Cases, and Test Procedures

Target Audience

- Engineering Staff
- Operational Staff
- Maintenance Staff
- Testing Staff (testing personnel and systems integrators, with specialized capabilities)

Instructor

Russ Brookshire

Product Manager

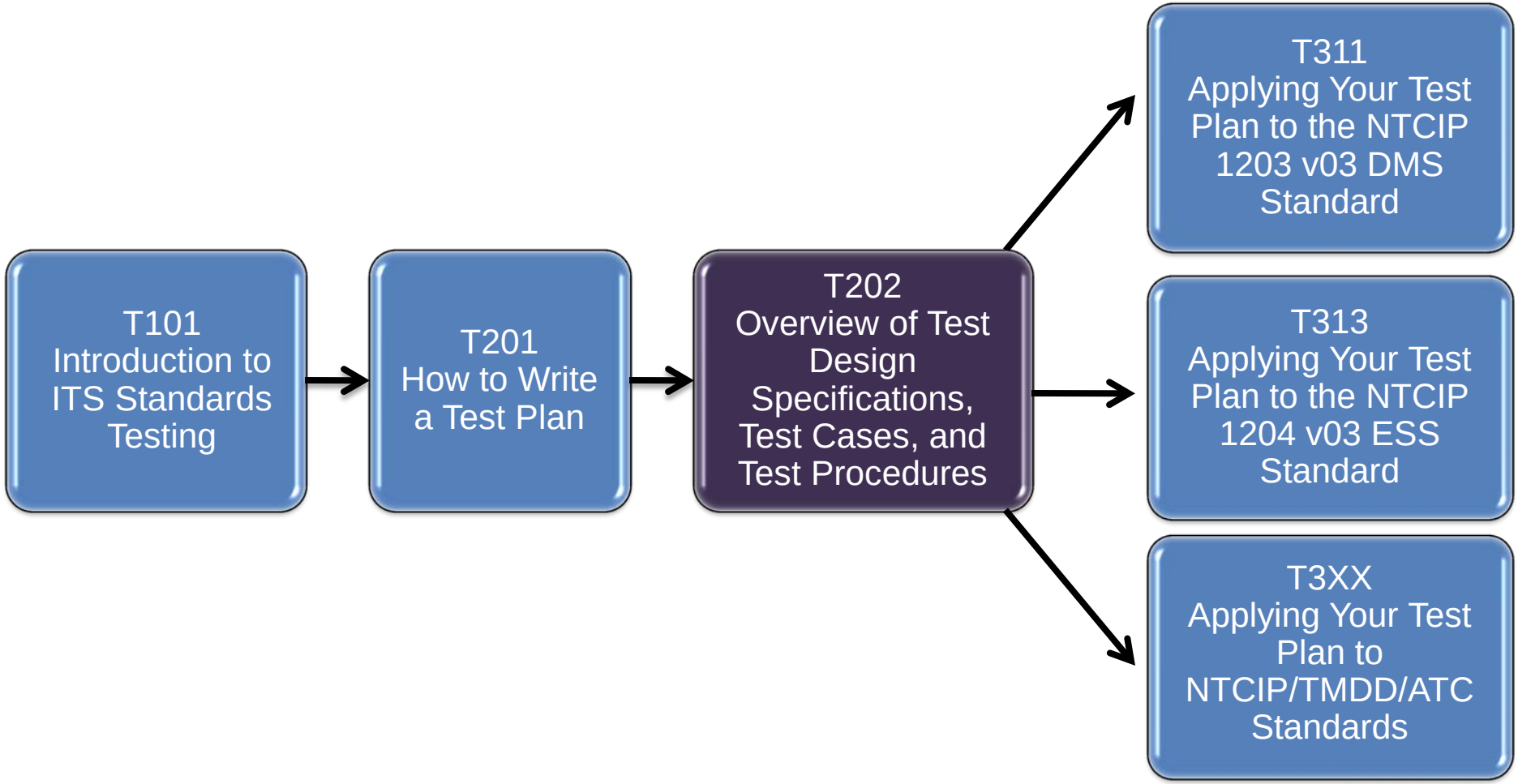
Intelligent Devices

Suwanee,GA,USA

Recommended Prerequisites

- T101: Introduction to ITS Standards Testing
- T201: How to Write a Test Plan

Curriculum Path (Testing)



Learning Objectives

1. Describe, within the context of the testing lifecycle, the role of Test Plans, Test Design Specifications, Test Cases and Test Procedures

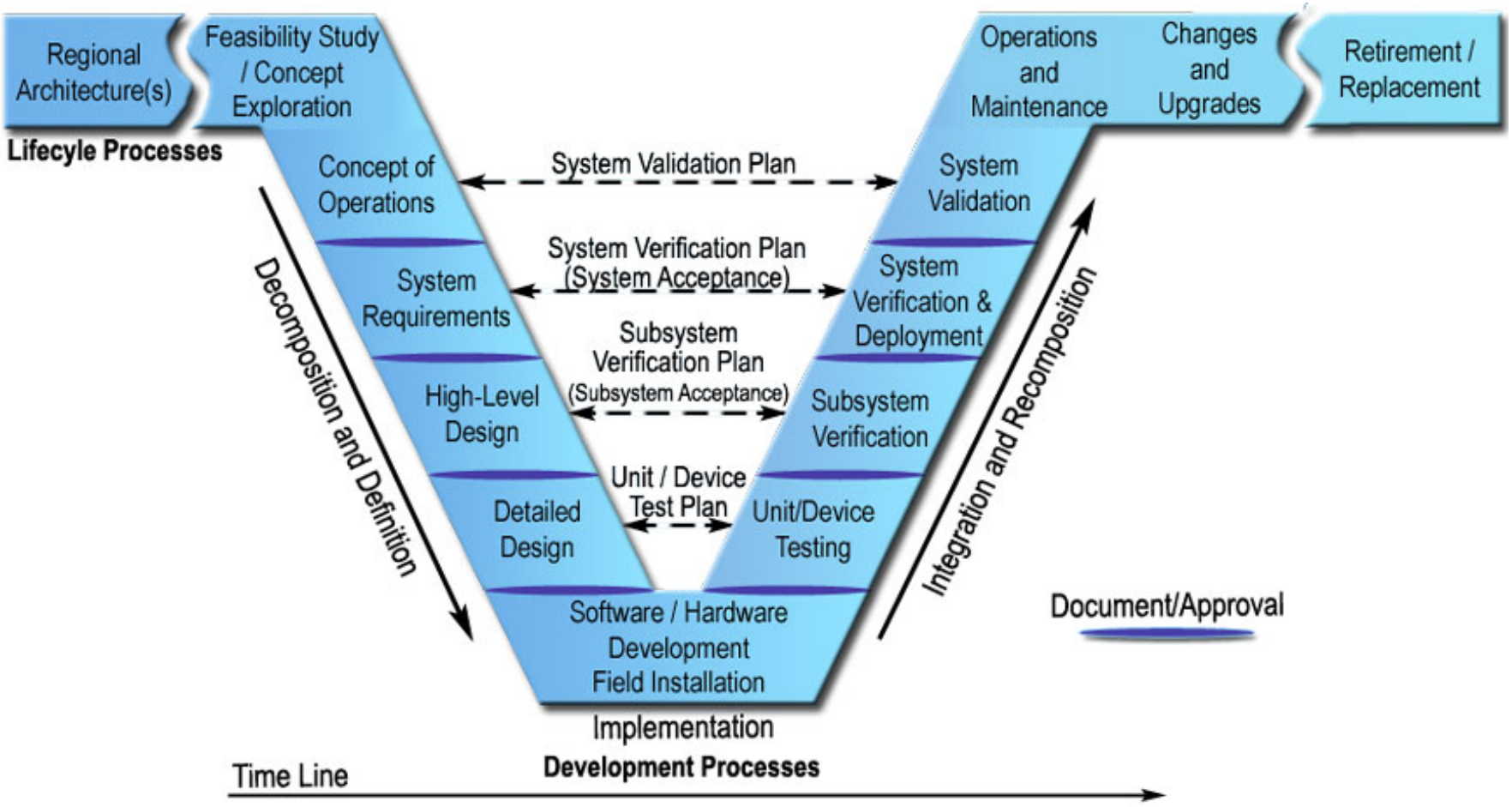
2. Describe the purpose and content of Test Design Specifications, Test Cases, and Test Procedures

Learning Objectives (Cont'd)

3. For standards using the Systems Engineering Process (SEP), detail the manner that Protocol Requirements Lists (PRLs) and Requirements to Test Cases Traceability Matrices (RTCTMs) can be used to create Test Specifications

4. For standards that do not use SEP, detail the manner that Conformance Groups can be used to create Test Specifications

Testing and the Project Life Cycle



Pages 7 and 8 in the Supplement

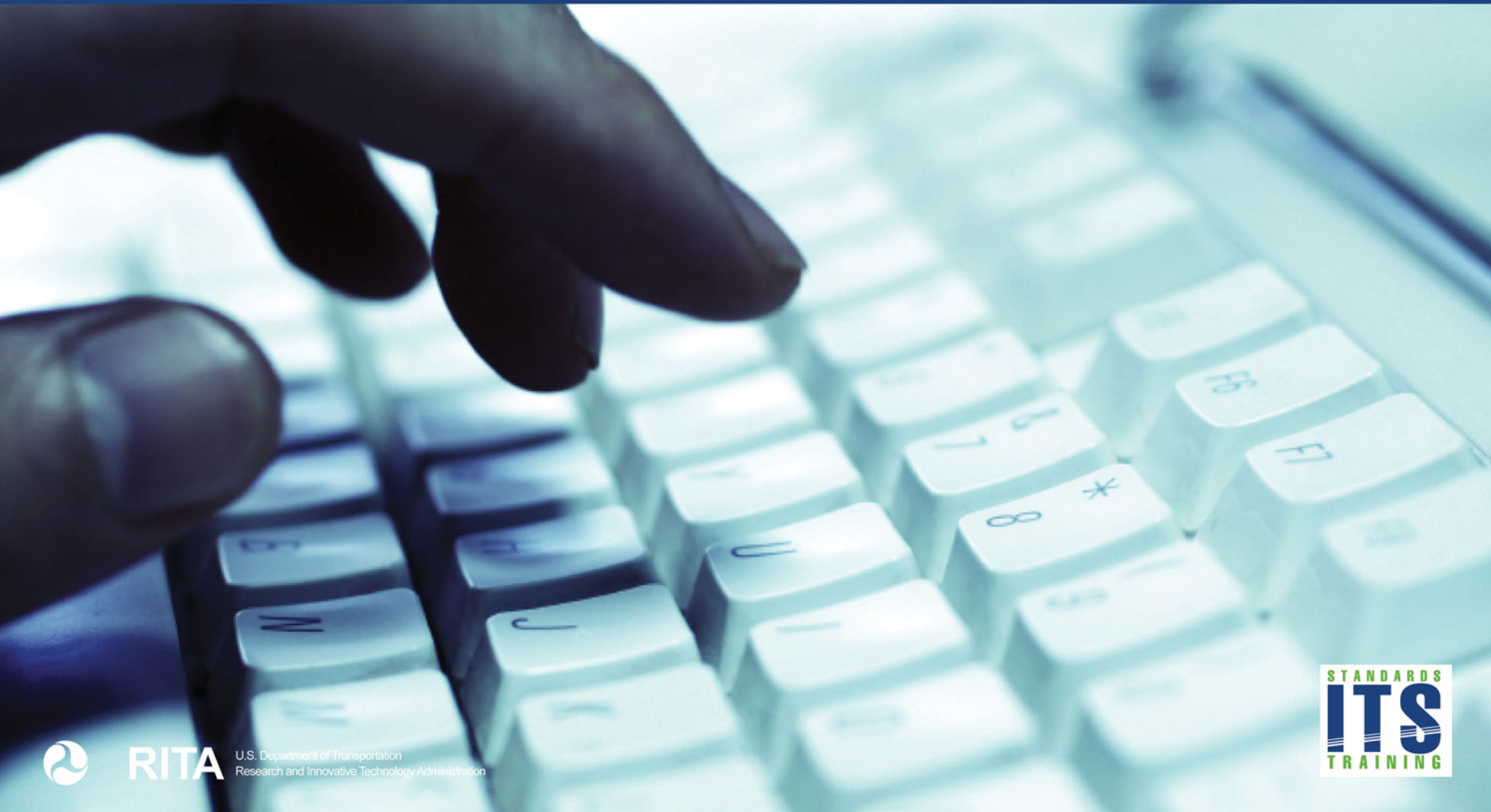
Why Test?

- To validate the system against the user needs
- To verify compliance with the procurement specifications
- To verify conformance to the standard, ensuring interoperability and interchangeability

Testing Methods

- Inspection – verification by physical and visual examination
- Analysis – verification by means of calculations
- Demonstration – verification of a function observed under a specific condition
- Formal Testing – verification of a function observed under controlled exercises using real or simulated stimulus

ACTIVITY



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STANDARDS ITS TRAINING

What are some of the benefits of NTCIP Conformance Testing?

Enter response in the chat box

Benefits of Conformance Testing

- Testing for compliance with the project specifications only shows that the system works as specified.
- NTCIP conformance testing promotes **interoperability** of system elements by means of standardized dialogs, test cases, and test procedures.
- Standardization also reduces overall system cost and risk.

Test Plans

- Test Plans are defined in IEEE 829, and covered in detail in Module T201 – How to Write a Test Plan

- Typically developed during "Decomposition and Definition" phase of the Project Life Cycle (left-side of "V" diagram); not provided in NTCIP standards

- Test Plan: high-level document that defines:
  - What item is to be tested and when it is to be tested
  - In what detail the item is to be tested
  - How is the item to be tested
  - Who is to design and perform testing

What Item is to be Tested, and When is it to be Tested

- Unit / Device Test – covers an item and its interfaces
- Subsystem Verification – tests the item, its communications, and other items that communicate with the test item
- System Verification – ensures that the entire system meets the system requirements
- System Validation – used to show that the system as implemented meets the original user needs

In What Detail is the Item to be Tested

- Communications: serial, Ethernet, packet errors
- Functionality: camera zoom, sign brightness, monitoring of air temperature
- Performance: speed, reliability, capacity
- Hardware: materials, strength, vibration
- Environmental: temperature, humidity, water intrusion, ice buildup

How is the Item to be Tested?

- NTCIP testing - a combination of communications testing and functional testing
- Communications testing can be performed by NTCIP test software and/or protocol analyzers
- Functional testing may require specialized equipment to simulate testable conditions
- Data that are communicated with the device must correlate at some point with observable behavior, which constitutes the functionality to be tested.

Who is to Design and Perform the Testing

- Agency personnel, out-of-house expert, manufacturer's representative?
- Note that each have pros and cons
- In many instances, a combination is the answer

Additional Considerations for Test Plans

- Item Pass/Fail Criteria
- Suspension Criteria and Resumption Requirements

Test Specifications

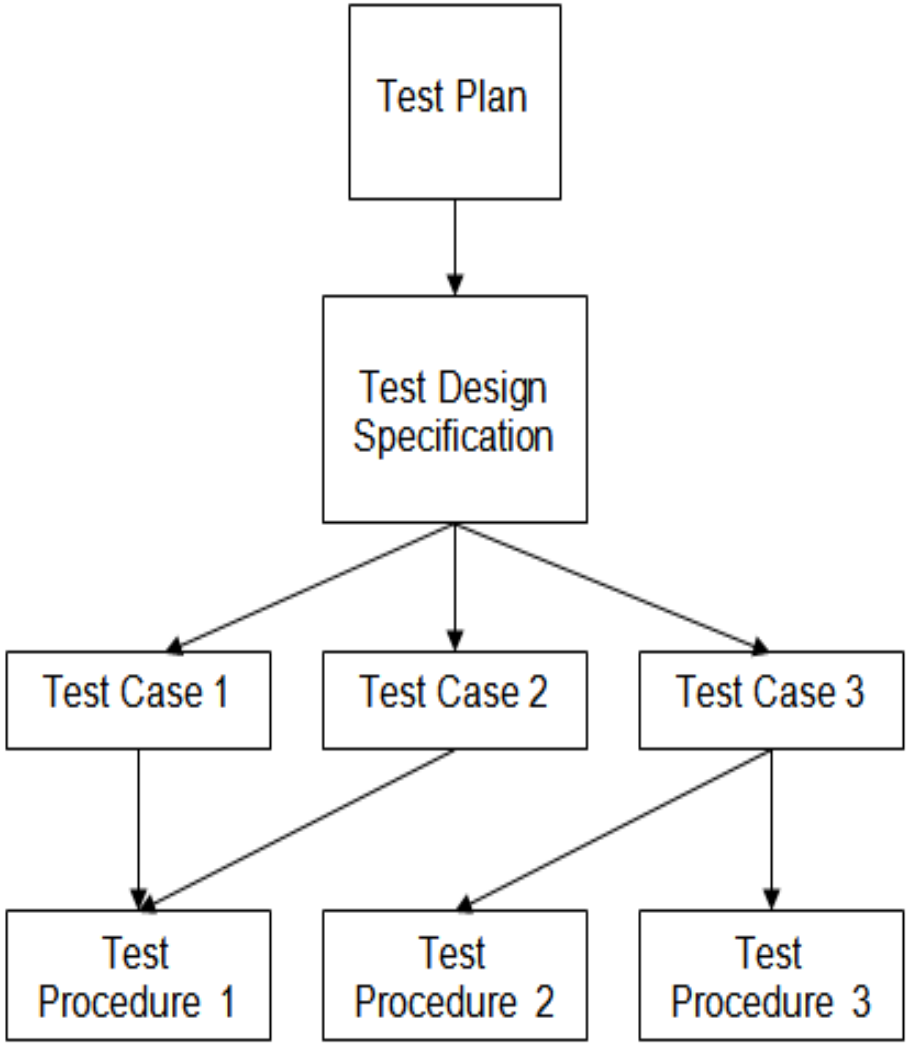
- Test Design Specification (TDS) – *A document specifying the details of the test approach for a…feature or combination of…features and identifying the associated tests.*

- Test Case Specification (TCS) – *A document specifying inputs, predicted results, and a set of execution conditions for a test item.*

- Test Procedure Specification (TPS)– *A document specifying a sequence of actions for the execution of a test.*

Definitions per IEEE 829

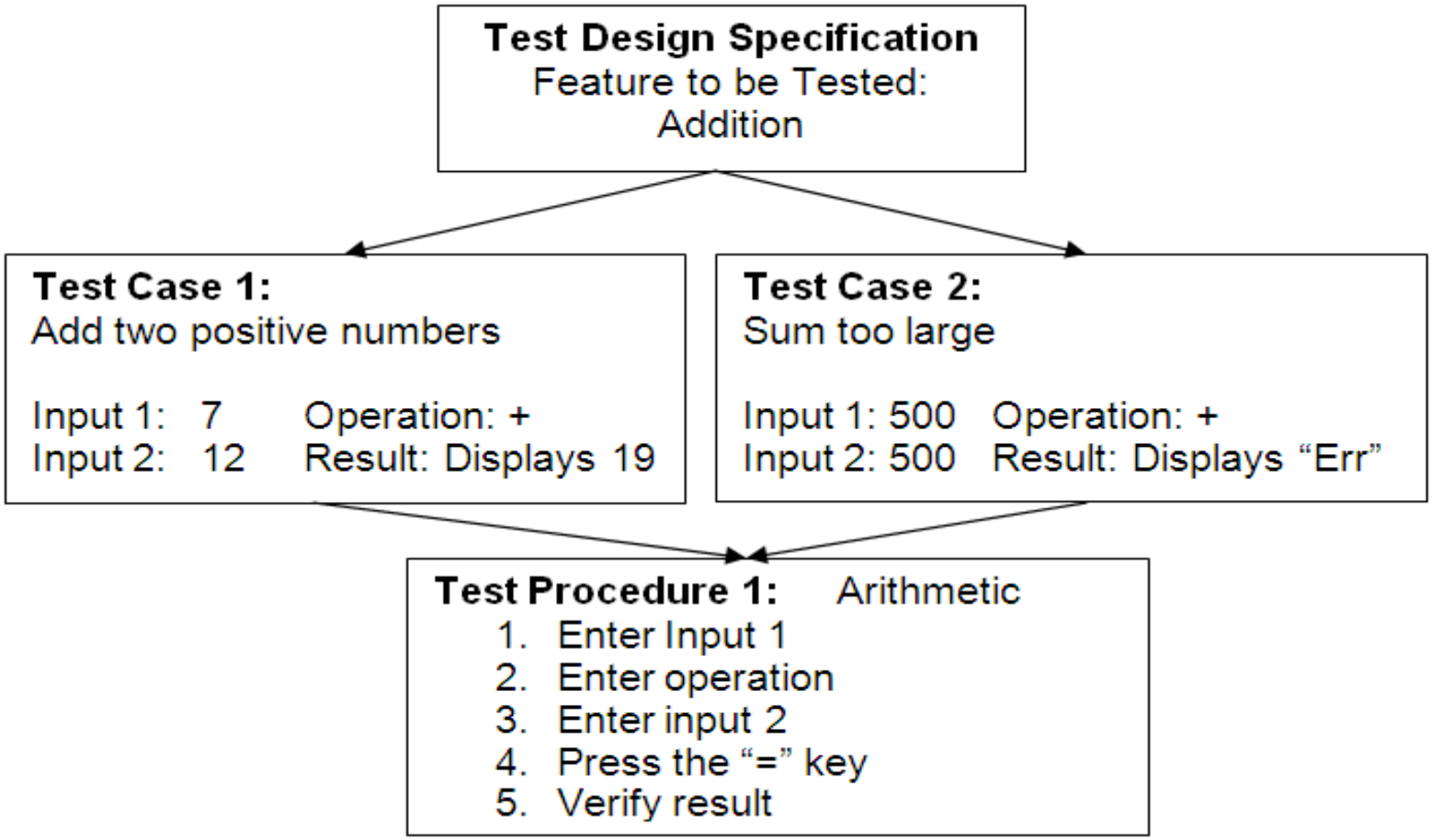
Test Documentation Components



- Each Test Plan has a Test Design Specification
- Each Test Design Specification may reference multiple Test Case Specifications
- Each Test Case Specification may reference multiple Test Procedure Specifications and vice versa

Example of Test Specifications

Test Item: Calculator



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Which of the following are included in NTCIP standards?

1. Test Design Specifications (TDS)
2. Test Case Specifications (TCS)
3. Test Procedure Specifications (TPS)
4. All three
5. It depends

Summary of Test Documents

- Test Plan - *Overview of entire testing process*
- Test Design Specification (TDS) - *Specifies details of the test approach*
- Test Case Specification (TCS) - *Specifies inputs, outputs and conditions*
- Test Procedure Specification (TPS) - *Specifies a sequence of actions for the execution of a test.*

CASE STUDY

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STANDARDS ITS TRAINING

Case Study: NTCIP 1203 v03 - DMS

- SEP-based Standard Provides Test Cases and Test Procedures for Device Testing
- Case Study shows how to Create TDS and Select Correct Test Cases and Test Procedures

Case Study: NTCIP 1203 v03 - DMS

DMS Configuration:

- Character matrix
- Three lines by 18 characters
- Each character is 7 rows high by 5 columns wide

Courtesy: Intelligent Devices, Inc.

Content of Test Design Specifications

Not included in NTCIP standards

- Test design specification identifier – must be unique
- Features to be tested – identify the test items and the specific features to be tested
- Approach refinements – include specific test techniques; summarize common attributes of any test cases
- Test identification – identify the test cases to be used
- Feature pass/fail criteria

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Case Study: TDS for DMS

Selecting Features using PRL

- Features are selected by the specifying authority using the Protocol Requirements List in NTCIP 1203 v03.
- Functional Requirement "DMS Display Matrix Configuration" is Mandatory

NTCIP 1203 Protocol Requirements List (PRL)

USER NEED SECTION NUMBER	USER NEED	FR SECTION NUMBER	FUNCTIONAL REQUIREMENT	CONFORMANCE	SUPPORT / PROJECT REQUIREMENT	ADDITIONAL PROJECT REQUIREMENTS
2.3.2.3	DMS Display Matrix Configuration			M	Yes	The DMS shall be 9,000 millimeters wide (0..65535) and 2,700 millimeters high (0..65535), inclusive of borders. The Sign's Border shall be at least 400 millimeters wide (0..65535) and 400 millimeters high (0..65535).
2.3.2.3.1	Non-Matrix			O.2 (1)	Yes / No	
2.3.2.3.2 (Matrix)	Matrix			O.2 (1)	Yes / No	The pitch between pixels shall be at least 66 millimeters (0..255).
2.3.2.3.2.1	Full Matrix			O.3 (1)	Yes / No	The sign shall be ___ pixels wide (0..65535) and ___ pixels high (0..65535).
2.3.2.3.2.2	Line Matrix			O.3 (1)	Yes / No	The sign shall have ____ lines with each line being ___ pixels wide and ___ pixels high.
2.3.2.3.2.3	Character Matrix			O.3 (1)	Yes / No	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).

Case Study: TDS for DMS

Selecting Features using PRL (Cont'd)

- O.# (range) means these options are part of an option group. Support of the number of items indicated by the "(range)" is required from all options labeled with the same numeral #.

NTCIP 1203 Protocol Requirements List (PRL)

USER NEED SECTION NUMBER	USER NEED	FR SECTION NUMBER	FUNCTIONAL REQUIREMENT	CONFORMANCE	SUPPORT / PROJECT REQUIREMENT	ADDITIONAL PROJECT REQUIREMENTS
2.3.2.3	DMS Display Matrix Configuration			M	Yes	The DMS shall be 9,000 millimeters wide (0..65535) and 2,700 millimeters high (0..65535), inclusive of borders. The Sign's Border shall be at least 400 millimeters wide (0..65535) and 400 millimeters high (0..65535).
2.3.2.3.1	Non-Matrix			O.2 (1)	Yes / No	
2.3.2.3.2 (Matrix)	Matrix			O.2 (1)	Yes / No	The pitch between pixels shall be at least 66 millimeters (0..255).
2.3.2.3.2.1	Full Matrix			O.3 (1)	Yes / No	The sign shall be ___ pixels wide (0..65535) and ___ pixels high (0..65535).
2.3.2.3.2.2	Line Matrix			O.3 (1)	Yes / No	The sign shall have ____ lines with each line being ___ pixels wide and ___ pixels high.
2.3.2.3.2.3	Character Matrix			O.3 (1)	Yes / No	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).

Case Study: TDS for DMS

Selecting Features using PRL (Cont'd)

- Because "Matrix" was selected, several requirements are mandatory, including the ones selected below.

NTCIP 1203 Protocol Requirements List (PRL)

USER NEED SECTION NUMBER	USER NEED	FR SECTION NUMBER	FUNCTIONAL REQUIREMENT	CONFORMANCE	SUPPORT / PROJECT REQUIREMENT	ADDITIONAL PROJECT REQUIREMENTS
2.5.1.2	Determine Sign Display Capabilities			O	Yes / No	
		3.5.1.2.1.1	Determine the Size of the Sign Face	M	Yes	
		3.5.1.2.1.2	Determine the Size of the Sign Border	M	Yes	
		3.5.1.2.1.3	Determine Beacon Type	M	Yes	
		3.5.1.2.1.4	Determine Sign Access and Legend	M	Yes	
		3.5.1.2.2.1	Determine Sign Face Size in Pixels	Matrix:M	Yes / NA	
		3.5.1.2.2.2	Determine Character Size in Pixels	Matrix:M	Yes / NA	
		3.5.1.2.2.3	Determine Pixel Spacing	Matrix:M	Yes / NA	

Test Design – Features to be Tested

Requirements Traceability Matrix (RTM)

- RTM maps Functional Requirements to Dialogs and Objects.

Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.1.2.2	Determine Matrix Capabilities				
3.5.1.2.2.1	Determine Sign Face Size in Pixels	G.1			
			5.3.3	vmsSignHeightPixels	
			5.3.4	vmsSignWidthPixels	
3.5.1.2.2.2	Determine Character Size in Pixels	G.1			
			5.3.1	vmsCharacterHeightPixels	
			5.3.2	vmsCharacterWidthPixels	
3.5.1.2.2.3	Determine Pixel Spacing	G.1			
			5.3.5	vmsHorizontalPitch	
			5.3.6	vmsVerticalPitch	

Test Design – Test Identification

Using RTCTM to Select Test Cases

- RTCTM links a Functional Requirement to one or more test cases
- All test cases referenced must be performed to verify conformance.

Table 1. Requirements to Test Case Traceability Table

Requirement		Test Case	
ID	**Title**	**ID**	**Title**
3.5.1.2.2	Determine Matrix Capabilities		
3.5.1.2.2.1	Determine Sign Face Size in Pixels		
		C.3.1.6	Determine Sign Face Size in Pixels
3.5.1.2.2.2	Determine Character Size in Pixels		
		C.3.1.7	Determine Character Size in Pixels
3.5.1.2.2.3	Determine Pixel Spacing		
		C.3.1.8	Determine Pixel Spacing

Test Case Specifications (TCS)

TCS – *A document specifying inputs, predicted results, and a set of execution conditions for a test item.*

- Test Case Specification Identifier
- Purpose
- Test Items
- Input Specifications
- Output Specifications
- Environmental Needs
- Special Procedural Requirements
- Intercase Dependencies

Pages 7–9 in the Supplement

Test Case Specifications

Inputs from PRL

- The individual test cases are provided with Test Case IDs, each of which defines the required inputs, and references the associated NTCIP 1203 Test Procedures.

NTCIP 1203 Test Case / Test Procedure ID	Test Case / Test Procedure	Selected	Variable	Reference	Value
1.6	Determine Sign Face Size in Pixels	X	Required_Sign_Pixel_Height	PRL 2.3.2.3.2.1-2.3.2.3.2.3,	21
			Required_Sign_Pixel_Width	PRL 2.3.2.3.2.1-2.3.2.3.2.3	90
1.7	Determine Character Size in Pixels	X	Required_Character_Pixel_Height	PRL 2.3.2.3.2.3	7
			Required_Character_Pixel_Width	PRL 2.3.2.3.2.3	5
1.8	Determine Pixel Spacing	X	Required_Horizontal_Pitch	PRL 2.3.2.3.2	66 (mm)
			Required_Vertical_Pitch	PRL 2.3.2.3.2	66 (mm)

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Test Case Specifications

Example NTCIP Test Case/Test Procedure

- NTCIP combines Test Cases and Test Procedures as shown below, which does not strictly follow IEEE 829.

C.3.1.6 Determine Sign Face Size in Pixels

Test Case: 1.6	**Title:**	**Determine Sign Face Size in Pixels**	
	Description:	This test case verifies that the DMS indicates that it has a height and width in pixels that meet the requirements of the specifications.	
	Variables:	Required_Sign_Pixel_Height	PRL 2.3.2.3.2.1-2.3.2.3.2.3
		Required_Sign_Pixel_Width	PRL 2.3.2.3.2.1-2.3.2.3.2.3
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the sign height in pixels as required by the specification (PRL 2.3.2.3.2.1-2.3.2.3.2.3). RECORD this information as: »Required_Sign_Pixel_Height		

Test Procedure Specification (TPS)

- TPS – *A document specifying a sequence of actions for the execution of a test.*
- Standard test procedures ensure that the conformance testing is performed in the same manner on separate test occasions.
- It is important not to skip any steps in the Test Procedures to ensure proper conformance testing.

See Supplement

Test Procedures

- Per the IEEE 829 definition, the Test Procedure only defines the steps necessary to test the feature.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the sign height in pixels as required by the specification (PRL 2.3.2.3.2.1-2.3.2.3.2.3). RECORD this information as: »Required_Sign_Pixel_Height		
2	CONFIGURE: Determine the sign width in pixels as required by the specification (PRL 2.3.2.3.2.1-2.3.2.3.2.3). RECORD this information as: »Required_Sign_Pixel_Width		
3	SET-UP: Determine the actual sign height in pixels. RECORD this information as: »Actual_Pixel_Height		
4	SET-UP: Determine the actual sign width in pixels. RECORD this information as: »Actual_Pixel_Width		
5	GET the following object(s): »vmsSignHeightPixels.0 »vmsSignWidthPixels.0	Pass / Fail (Section 3.5.1.2.2.1)	
6	VERIFY that the RESPONSE VALUE for vmsSignHeightPixels.0 is equal to Required_Sign_Pixel_Height.	Pass / Fail (PRL 2.3.2.3.2.1-2.3.2.3.2.3)	
7	VERIFY that the RESPONSE VALUE for vmsSignWidthPixels.0 is equal to Required_Sign_Pixel_Width.	Pass / Fail (PRL 2.3.2.3.2.1-2.3.2.3.2.3)	
8	VERIFY that the RESPONSE VALUE for vmsSignHeightPixels.0 is equal to Actual_Pixel_Height.	Pass / Fail (Section 3.5.1.2.2.1)	
9	VERIFY that the RESPONSE VALUE for vmsSignWidthPixels.0 is equal to Actual_Pixel_Width.	Pass / Fail (Section 3.5.1.2.2.1)	

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CASE STUDY

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STANDARDS ITS TRAINING

Case Study: NTCIP 1209 v02 - TSS

- Transportation Sensor Systems (TSS) are used to monitor vehicle volume, occupancy and speed over a selectable period of time.
- SEP-based Standard has PRL and Dialogs, but no Test Cases or Test Procedures
- Test Design Specifications can be created as shown in the previous DMS Case Study.
- This Case Study shows how to create Test Cases and Test Procedures

Pages 11–12 in the Supplement

TSS Case Study: PRL and RTM

3.2.8 Protocol Requirements List (PRL) Table

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Specifications
2.5.2.1	Reset the TSS					
		3.4.1.3.1	Restart the TSS	M	Yes	
		3.4.1.3.2	Reinitialize User Settings	M	Yes	
		3.4.1.3.3	Restore Factory Defaults	M	Yes	
		3.4.1.3.4.	Retune	M	Yes	
		3.4.1.3.8	Execute Pending Configuration	O.1	Yes/No	
		3.4.1.3.9	Abort Pending Configuration	O.1	Yes/No	
		3.4.1.3.10	Validate Pending Configuration	O.1	Yes/No	

REQUIREMENTS TRACEABILITY MATRIX (RTM)

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.3	Control the TSS				
3.4.1.3.1	Restart the TSS				
		4.3.1.1	Reset and Synchronize the TSS		
				5.2.1	sensorSystemReset
				5.2.2	sensorSystemStatus

Pages 11-12 in the Supplement

TSS Case Study - Dialog

4.3.1.1 Reset and Synchronize the TSS

The standardized dialog for a management station to restart, reinitialize, restore, retune, re-sync, run short diagnostics or long diagnostics of a TSS shall be as follows:

a) (Precondition) None
b) The management station shall GET the sensorSystemStatus.x state. If the state of sensorSystemStatus is 'initializing', 'pendingConfigurationChange', or 'validatingPendingConfiguration', then the management station shall abort the process
c) The management station shall SET the sensorSystemReset.y state to 'restart', 'reinitializeUserSettings', 'restoreFactoryDefaults', 'retune', 'resyncSamplingPeriods', 'shortDiagnostics', or 'fullDiagnostics'
d) The management station shall GET the sensorSystemStatus.x state
e) If the management station gets no response, then repeat Step d up to maximum TSS initialization time
f) If the sensorSystemStatus.x state is 'initializing', then repeat Step d
g) If sensorSystemStatus.x state is 'oK', then the TSS reset is complete
h) If sensorSystemStatus.x state NOT 'oK', then the reset may not have completed, did not complete normally, or an error was encountered during the process. The management station shall abort the process

Pages 11-12 in the Supplement

TSS Case Study – Test Case Specification

- From the Dialog, only one parameter need be passed to the Test Procedure – the command
- The result should be sensorSystemStatus.0 = oK

Test Case Number	Test Case Name	Test Procedure	Object(s) Under Test	Variables	Result
TC1205-001	Restart TSS	TP1205-001	sensorSystemStatus.0, sensorSystemReset.0	Reset_Command = 'restart'	sensorSystemStatus.0 = oK

Pages 11-12 in the Supplement

TSS Case Study – Test Procedure

Test Procedure: **TP1209-001**	*Title:* **Reset the TSS** Description: This Test Case verifies that the operator can correctly reset the TSS. Pass/Fail Criteria: The DUT shall pass every verification step included within the Test Case in order to pass the Test Case. Variables: Reset_Command Command to be implemented	
Test Step Number	*Test Step*	*Results*
1.	GET sensorSystemStatus.0	Pass / Fail
2.	IF the RESPONSE VALUE to sensorSystemStatus.0 is 'initializing', 'pendingConfigurationChange', or 'validatingPendingConfiguration' EXIT the Test Procedure, and correct the deficiency before restarting the test.	
3.	SET sensorSystemReset.0 to Reset_Command.	Pass / Fail
4.	GET sensorSystemStatus.0	Pass / Fail
5.	IF the RESPONSE VALUE for sensorSystemStatus.0 equals 'initializing', then GOTO Step 4. NOTE--If the RESPONSE VALUE remains at 'initializing' for more than the maximum TSS initialization time, this test fails.	Pass / Fail
6.	VERIFY that the RESPONSE VALUE for sensorSystemStatus.0 equals 'oK'.	Pass / Fail

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According to IEEE 829, which of the following are included in Test Procedures?

1. Inputs
2. Execution conditions
3. Steps to execute
4. Expected results
5. All of the above

Standards developed without SEP

- NO User Needs, Functional Requirements, or PRLs.
- Test Design Specifications, Test Cases, and Test Procedures must be generated by the specifying authority.

Conformance Groups

Purpose

- Used by NTCIP standards that were not created using SEP
- Combine objects that are similar
- Define whether groups of objects are mandatory or optional
- Can be used to specify requirements and generate Test Specifications.

CASE STUDY

RITA U.S. Department of Transportation
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STANDARDS ITS TRAINING

NTCIP 1205 CCTV Example

- NTCIP 1205, Cameras, was not created using SEP
- No PRL
- No Test Cases or Test Procedures
- Conformance Groups are used instead

Photo by Kent Flemmer, Flemmer Photography

Conformance Groups

Mandatory and Optional Groups

- CCTV Configuration Conformance Group is Mandatory.

- CCTV Motion Control Conformance Group is Optional, but is selected as being Supported.

Table 4-2: Conformance Statement Table

Conformance Group	Reference	Conformance Requirement
Configuration	NTCIP 1201:1996	mandatory
Database Management	NTCIP 1201:1996, Amendment 1	optional
Time Management	NTCIP 1201:1996, Amendment 1	optional
CCTV Configuration	NTCIP 1205	mandatory
Extended Functions	NTCIP 1205	optional
Motion Control	NTCIP 1205	optional
On-Screen Menu Control	NTCIP 1205	optional

NTCIP 1205 CCTV Example

Test Design Specification

- Excerpts from two Conformance Groups show the Mandatory objects for the Zoom feature.

4.1.1 CCTV Configuration Conformance Group

OBJECT OR TABLE NAME	REFERENCE	CONFORMANCE REQUIREMENT WITHIN THE GROUP
rangeZoomLimit	NTCIP 1205	mandatory
timeoutZoom	NTCIP 1205	mandatory

4.1.3 Motion Control Conformance Group

OBJECT OR TABLE NAME	REFERENCE	CONFORMANCE REQUIREMENT WITHIN THE GROUP
positionZoomLens	NTCIP 1205	mandatory

NTCIP 1205 CCTV Example
Test Design Specification

- positionZoomLens – allows the Central to command the camera to change its zoom setting
- rangeZoomLimit – defines the maximum zoom level
- timeoutZoom – limits how long a zoom can continue

NTCIP 1205 CCTV Example

Test Cases

- Excerpt from a TCS showing three of the Test Cases required to show conformance for the Zoom feature.

Appendix A:

Test Case Number	Test Case Name	Test Procedure Steps	Object(s) Under Test	Variables	Result
TC1205-001	Zoom absolute - maximum telephoto	TP1205-003 Steps 4-10	positionZoomLens.0	Mode = 2 (absolute) Speed_Tele_Fast = 127 Offset = rangeZoomLimit.0	Camera should zoom to its maximum setting at its maximum speed
TC1205-007	Zoom past rangeZoomLimit.0	TP1205-003 Steps 39-41	positionZoomLens.0; rangeZoomLimit.0	Mode = 1 (absolute) Speed_Tele_Fast = 127 Offset = 65535	Response Error is badValue
TC1205-008	Zoom for greater duration than timeoutZoom.0	TP1205-003 Steps 40-46	positionZoomLens.0; timeoutZoom.0	Mode = 3 (continuous) Speed_Tele_Slow = 10 Offset = rangeZoomLimit.0	Camera begins zooming toward its maximum telephoto setting, but stops after Zoom_Timeout seconds

Pages 14-16 in the Supplement

NTCIP 1205 CCTV Example

Test Procedures

- Excerpt from the TPS for the Zoom feature
- Referenced by TC1205-001: Zoom Absolute - Maximum Telephoto
- Causes the camera to zoom in to its zoom limit

Test Procedure: **TP1205-003**	*Title:* **Zoom Camera** Description: This Test Case verifies that the operator can correctly zoom the camera in and out. Pass/Fail Criteria: The DUT shall pass every verification step included within the Test Case in order to pass the Test Case. Variables: Speed_Tele_Fast [85..127] Speed_Wide_Fast [-85..-128] Speed_Tele_Mid [42..84] Speed_Wide_Slow [-1..-41] Speed_Tele_Slow [1..41] Zoom_Timeout [0..65535] (in milliseconds)	
Test Step Number	*Test Step*	*Results*
1.	**Get** rangeZoomLimit.0	Pass / Fail
2.	RECORD this integer value and its two-byte hex value as: >> Zoom_Limit >> Zoom_Limit_Hex	
3.	**Set** timeoutZoom.0 to 0, turning off this feature.	Pass / Fail
4.	**Set** positionZoomLens.0 to Mode: 2 (absolute) Speed: Speed_Tele_Fast Position or Offset: Zoom_Limit	Pass / Fail
5.	Delay for 10 seconds	
6.	**Verify** that the camera zoomed to its absolute telephoto position.	Pass / Fail
7.	**Get** positionZoomLens.0	Pass / Fail
8.	**Verify** that the **Response Value** equals Mode: 02 Speed: Speed_Tele_Fast Position or Offset: Zoom_Limit_Hex	Pass / Fail
9.	**Get** positionQueryZoom.0	Pass / Fail
10.	**Verify** that the **Response Value** equals Zoom_Limit. A **Response Error** of noSuchName indicates that positionQueryZoom.0 is unsupported.	Pass / Fail / Pass Unsupported

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Additional Test Documents

These are used in addition to the Test Plan and Test Specifications.

- A **Test Item Transmittal** is used to document transferring a test item between entities, and includes its status.
- **Test Incident Reports** provide a means of recording anomalies that occurred during the testing.
- The **Test Summary** is typically a one-page report providing the results of the testing.
- **Test Logs** document the testing that occurred.

Learning Objectives

1. Describe, within the context of the testing lifecycle, the role of Test Plans, Test Design Specifications, Test Cases, and Test Procedures

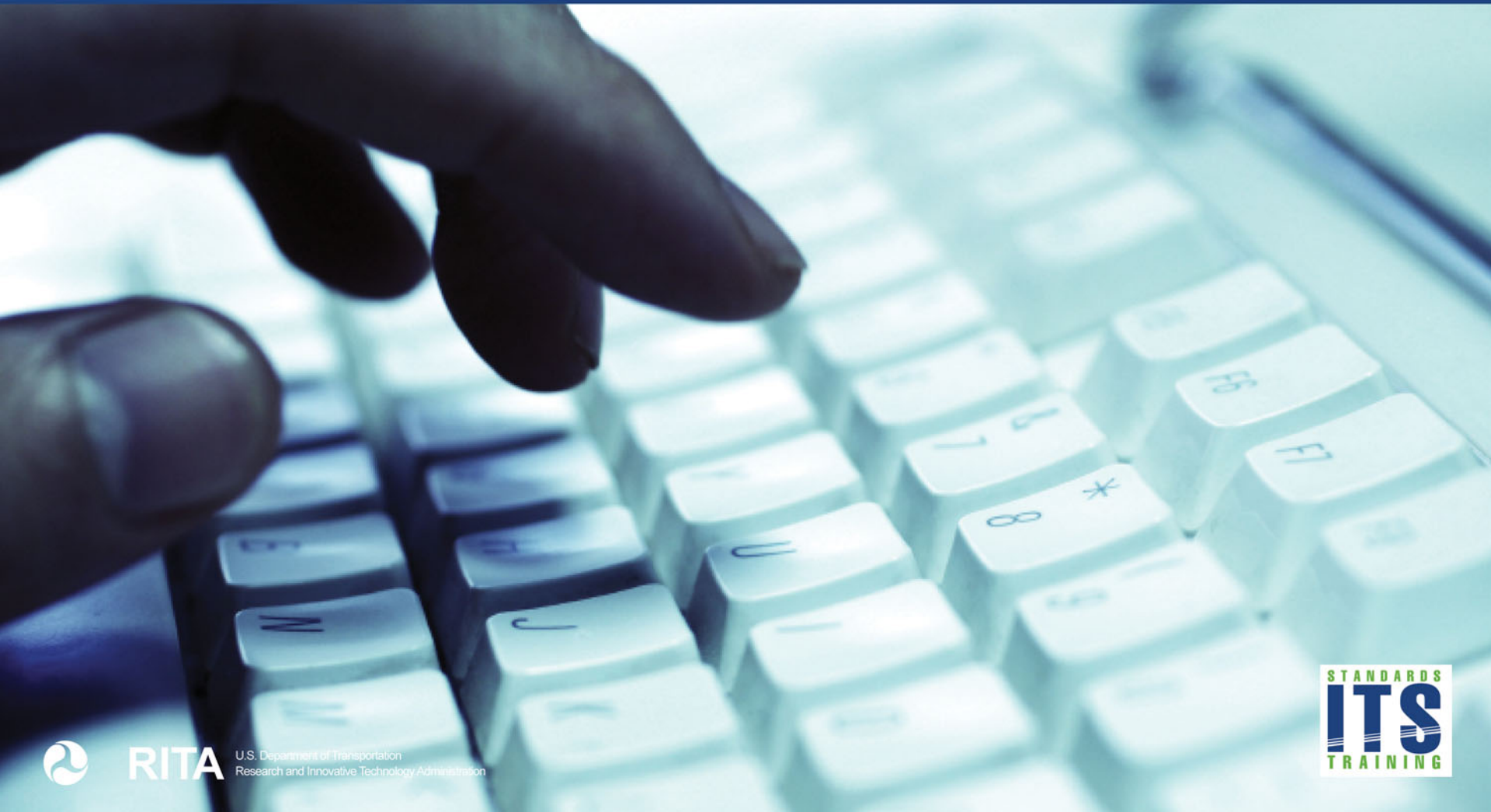
2. Describe the purpose and content of Test Design Specifications, Test Cases, and Test Procedures

Learning Objectives (Cont'd)

3. For standards using Systems Engineering Process (SEP), detail the manner that Protocol Requirements Lists (PRLs) and Requirements to Test Cases Traceability Matrices (RTCTMs) can be used to create Test Specifications

4. For standards that do not use SEP, detail the manner that Conformance Groups can be used to create Test Specifications

ACTIVITY



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STANDARDS ITS TRAINING

What Did We Learn Today?

1) The Test Plan is created early in the Project Life Cycle, and defines the testing to be performed from a management-level perspective.

2) Test Design Specifications detail the testing to be performed.

3) Test Cases define the inputs, expected results, and test conditions.

4) Test Procedures define the steps to be performed to execute the tests.

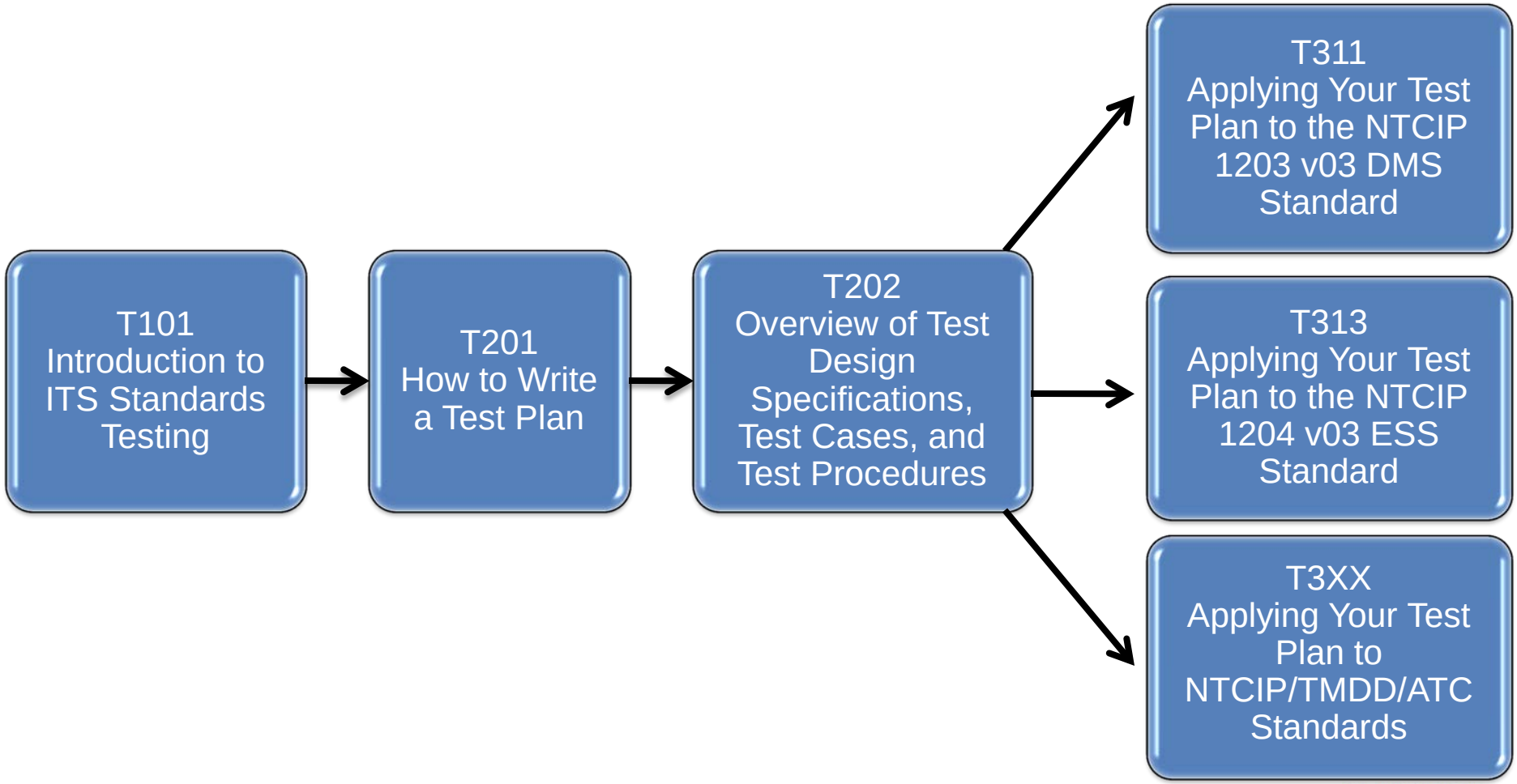
5) PRL and RTM are two items found in standards created using SEP.

6) Conformance Groups are found in standards created without using SEP.

For More Information

- **Systems Engineering Guidebook for Intelligent Transportation Systems Version 3.0** (The "V" Systems Engineering Model) (http://ops.fhwa.dot.gov/publications/seitsguide/seguide.pdf)
- **IEEE Std 829-1998 -** IEEE Standard for Software Test Documentation
- **NTCIP 1204 Version v03.08,** National Transportation Communications for ITS Protocol, Object Definitions for Environmental Sensor Stations (ESS) (www.ntcip.org)
- **NTCIP 1201 Version v03.13a,** National Transportation Communications for ITS Protocol, Global Object Definitions (www.ntcip.org)
- **NTCIP 8007 Version 1.21,** National Transportation Communications for ITS Protocol, Testing and CA Documentation within NTCIP Standards (www.ntcip.org)
- **NTCIP 9001 Version v04,** National Transportation Communications for ITS Protocol, The NTCIP Guide (www.ntcip.org)

Curriculum Path (Testing)



QUESTIONS?

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