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

STANDARDS
ITS
TRAINING

RITA Intelligent Transportation Systems
Joint Program Office

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

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Systems Engineering "V" Diagram

The "V" diagram used by the ITS industry, as shown in Figure 1, reflects a customization of the more general systems engineering process (SEP), but follows widely accepted guidelines.
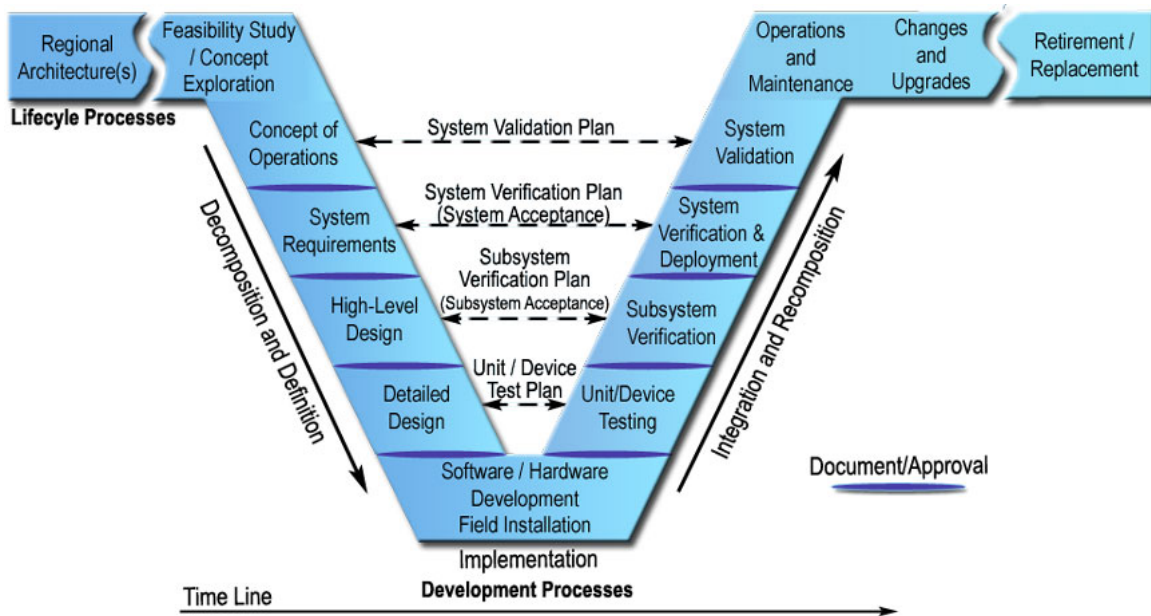

Figure 1: Systems Engineering "V" Diagram for ITS

The "V" starts with identifying the portion of the regional ITS architecture that is related to the project. Other artifacts of the planning and programming processes that are relevant to the project are collected and used as a starting point for project development. This is the first step in defining an ITS project.

Next, the agency develops a business case for the project. Technical, economic, and political feasibility is assessed; benefits and costs are estimated; and key risks are identified. Alternative concepts for meeting the project's purpose and need are explored, and the superior concept is selected and justified using trade study techniques. Once funding is available, the project starts with the next step.

The "V" then begins to dip downwards to indicate an increased level of detail. The project stakeholders reach a shared understanding of the system to be developed and how it will be operated and maintained. The Concept of Operations is documented to provide a foundation for more detailed analyses that will follow. It will be the basis for the system requirements that are developed in the next step.

At the system requirements stage, the stakeholder needs identified in the Concept of Operations are reviewed, analyzed, and transformed into verifiable requirements that define what the system will do but not how the system will do it. Working closely with stakeholders, the requirements are elicited, analyzed, validated, documented, and version controlled.

The system design is created based on the system requirements including a high-level design that defines the overall framework for the system. Subsystems of the system are identified and decomposed further into components. Requirements are allocated to the system components, and interfaces are specified in detail. Detailed specifications are created for the hardware and

software components to be developed, and final product selections are made for off-the-shelf components.

Hardware and software solutions are created for the components identified in the system design. Part of the solution may require custom hardware and/or software development, and part may be implemented with off-the-shelf items, modified as needed to meet the design specifications. The components are tested and delivered ready for integration and installation.

Once the software and hardware components have been developed, the "V" changes direction to an upward slope. The various components are individually verified and then integrated to produce higher-level assemblies or subsystems. These assemblies are also individually verified before being integrated with others to produce yet larger assemblies, until the complete system has been integrated and verified.

Eventually, the system is installed in the operational environment and transferred from the project development team to the organization that will own and operate it. The transfer also includes support equipment, documentation, operator training, and other enabling products that support ongoing system operation and maintenance. Acceptance tests are conducted to confirm that the system performs as intended in the operational environment. A transition period and warranty ease the transition to full system operation.

After the ITS system has passed system verification and is installed in the operational environment, the system owner/operator, whether the state DOT, a regional agency, or another entity, runs its own set of tests to make sure (i.e., validate) that the deployed system meets the original needs identified in the Concept of Operations.

Once the customer has approved the ITS system, the system operates in its typical steady state. System maintenance is routinely performed and performance measures are monitored. As issues, suggested improvements, and technology upgrades are identified, they are documented, considered for addition to the system baseline, and incorporated as funds become available. An abbreviated version of the systems engineering process is used to evaluate and implement each change. This occurs for each change or upgrade until the ITS system reaches the end of its operational life.

Finally, operation of the ITS system is periodically assessed to determine its efficiency. If the cost to operate and maintain the system exceeds the cost to develop a new ITS system, the existing system becomes a candidate for replacement. A system retirement plan will be generated to retire the existing system gracefully.

To find more information on the systems engineering process, see the links provided in the References section of this supplement.

Sample Test Design Specification - DMS

Test Design Specification Identifier
TDS-C-DMS

Introduction
This Test Design Specification is to clarify and expand on the details given in Test Plan TP-C-DMS2-1, which defines testing to be performed on a DMS to verify conformance with NTCIP 1203 v03.

Features to be Tested
All mandatory requirements of NTCIP 1203 v03 shall be tested. In addition, optional requirements selected in the NTCIP 1203 Protocol Requirements List (PRL) as shown below shall be tested.

Protocol Requirements List (excerpts)

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).

NTCIP 1203 Protocol Requirements List (PRL)

USER NEED SECTION NUMBER	USER NEED	FR SECTION NUMBER	FUNCTIONAL REQUIREMENT	CONFORMANCE	SUPPORT / PROJECT REQUIREMENT
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

Approach Refinements
The testing approach is to be as defined in the Test Plan TP-C-DMS2-1. In addition to the use of NTESTER v2.0 as a testing tool, Intelligent Devices' DeviceTester shall also be allowed.

Test Identification

Test Cases and Test Case Identifiers are as defined in the Test Case Specification TCS-C-DMS.

Feature Pass/Fail Criteria

Pass/Fail criteria shall be as defined in the test procedures defined in NTCIP 1203 v03.

SAMPLE Test Case Specification - DMS

Test Case Specification Identifier
TCS-C-DMS

Purpose
This document defines the test cases to be used to verify conformance of the DMS with NTCIP 1203 v03. They specify the input and output parameters and special conditions for use with the published NTCIP 1203 v03 Test Cases/Test Procedures.

Test Items
The items selected for testing are in accordance with the project Protocol Requirements List (PRL) as given in Test Design Specification TDS-C-DMS. The required test cases listed in Appendix A were determined by means of the Requirements to Test Cases Traceability Matrix found in NTCIP 1203 v03.

Input Specifications
The individual input specifications for each test case are given in Appendix A.

Output Specifications
The individual output specifications for each test case are defined in the NTCIP 1203 v03 Test Procedures.

Environmental Needs
In addition to the testing facilities defined in the Test Plan TP-C-DMS2-1, the following Test Cases will require special tools:

Test Case ID	Special Items Required:
TC 1.2	Tape measure, 30m, marked in mm
TC 1.3	Tape measure, 30m, marked in mm
TC 1.8	Tape measure, 30m, marked in mm

Special Procedural Requirements
No special procedural requirements exist.

Intercase Dependencies
Intercase Dependencies are as detailed in NTCIP 1203 v03.

* NOTE: Variables with the same name must be assigned the same value. The user only needs to define variable values for those test cases that are selected.

NTCIP 1203 Test Case/Test Procedure ID	Test Case/Test Procedure	Selected	Variable	Reference	Value
1.1	Determine Sign Type and Technology	X	Required_Sign_Type	PRL 2.3.2.1 and 2.3.2.3	4 (vmsChar)
			Required_Sign_Technology	PRL 2.3.2.2	2 (LED 0000 0010)
1.2	Determine the Size of the Sign Face	X	Required_Sign_Height	PRL 2.3.2.3	2700 (mm)
			Required_Sign_Width	PRL 2.3.2.3	9000 (mm)
1.3	Determine Size of the Sign Border	X	Required_Horizontal_Border	PRL 2.3.2.3	400 (mm)
			Required_Vertical_Border	PRL 2.3.2.3	400 (mm)
1.4	Determine Beacon Type	X	Required_Beacon_Configuration	PRL 2.3.2.4	2 (None)
1.5	Determine Sign Access and Legend	X	Required_Sign_Access	per specification	8 (front, bit 3 =1)
			Required_Legend	per specification	2 (No legend)

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)

SAMPLE Test Procedure Specification – DMS

The Test Case/Test Procedure below are excerpted from NTCIP 1203 v03, which includes Test Cases and Test Procedures.

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		
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)	
Test Case Results			
Tested By:		**Date Tested:**	**Pass / Fail**
Test Case Notes:			

SAMPLE Test Case Specification – TSS

The Test Case Specification below was created for this webinar, as NTCIP 1209, TSS, does not include Test Cases or Test Procedures.

Test Case Specification Identifier
TCS-1209

Purpose
These test cases are to be used to verify conformance of the TSS (Transportation Sensor System) with NTCIP 1209 v02. They specify the input and output parameters for use with the Test Procedures TPS-1209.

Test Items
These test cases will provide details of the tests to be performed to verify conformance of the TSS with NTCIP 1205 v01. The Test Item is to consist of a Transportation Sensor System. The Test Procedure steps that support each Test Case are mapped in the table in Appendix A.

Input Specifications
The individual input specifications for each test case are given in Appendix A.

Output Specifications
The individual output specifications for each test case are given in Appendix A.

Environmental Needs
No additional needs exist beyond those defined in the Test Plan.

Special Procedural Requirements
No special procedural requirements exist.

Intercase Dependencies
No intercase dependencies exist.

Appendix A:

Test Case Number	Test Case Name	Test Procedure	Object(s) Under Test	Variables	Result
TC1205-001	Restart TSS	TP1205-001	sensorSystemStatus.0, sensorSystemReset.0	Command = 'restart'	sensorSystemStatus.0 = oK
TC1205-002	Reinitialize TSS	TP1205-001	sensorSystemStatus.0, sensorSystemReset.0	Command = 'reinitializeUserSettings'	sensorSystemStatus.0 = oK
TC1205-003	Restore TSS	TP1205-001	sensorSystemStatus.0, sensorSystemReset.0	Command = 'restoreFactoryDefaults'	sensorSystemStatus.0 = oK
TC1205-004	Retune TSS	TP1205-001	sensorSystemStatus.0, sensorSystemReset.0	Command = 'retune'	sensorSystemStatus.0 = oK
TC1205-005	Re-sync TSS	TP1205-001	sensorSystemStatus.0, sensorSystemReset.0	Command = 'resyncSamplingPeriods'	sensorSystemStatus.0 = oK
TC1205-006	Run Short Diagnostics	TP1205-001	sensorSystemStatus.0, sensorSystemReset.0	Command = 'shortDiagnostics'	sensorSystemStatus.0 = oK
TC1205-007	Run Long Diagnostics	TP1205-001	sensorSystemStatus.0, sensorSystemReset.0	Command = 'fullDiagnostics'	sensorSystemStatus.0 = oK

SAMPLE Test Procedure Specification - TSS

The Test Procedure below was created for this webinar, as NTCIP 1209, TSS, does not include Test Cases or Test Procedures.

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:	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 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
Test Procedure Result:			Pass / Fail
Test Procedure Notes:			

SAMPLE Test Case Specification – CCTV

The Test Case Specification below was created for this webinar, as NTCIP 1205, CCTV, does not include Test Cases or Test Procedures.

Test Case Specification Identifier
TCS-1205

Purpose
These test cases are to be used to verify conformance of the CCTV (closed circuit TV) camera with NTCIP 1205 v01. They specify the input and output parameters for use with the NTCIP 1205 v01 Test Procedures.

Test Items
These test cases will provide details of the tests to be performed to verify conformance of the camera with NTCIP 1205 v01. The items selected for testing are in accordance with the Test Design Specifications TDS-1205. The Test Procedure steps that support each Test Case are mapped in the table in Appendix A.

Input Specifications
The individual input specifications for each test case are given in Appendix A.

Output Specifications
The individual output specifications for each test case are given in Appendix A.

Environmental Needs
No additional needs exist beyond those defined in the Test Plan.

Special Procedural Requirements
No special procedural requirements exist.

Intercase Dependencies
No intercase dependencies exist.

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
TC1205-002	Zoom absolute - maximum wide	TP1205-003 Steps 11-17	positionZoomLens.0	Mode = 2 (absolute) Speed_Wide_Fast = -128 Offset = 0	Camera should zoom to its widest angle setting at its maximum speed
TC1205-003	Zoom absolute - half-way	TP1205-003 Steps 18-24	positionZoomLens.0	Mode = 2 (absolute) Speed_Tele_Fast = 127 Offset = (rangeZoomLimit.0)/2	Camera should zoom halfway to its maximum setting at its maximum speed
TC1205-004	Zoom delta	TP1205-003 Steps 25-30	positionZoomLens.0	Mode = 1 (delta) Speed_Tele_Mid = 50 Offset = (rangeZoomLimit.0)/10	Camera should zoom 1/10th toward its maximum zoom at midspeed with each delta command
TC1205-005	Zoom continuous	TP1205-003 Steps 31-33	positionZoomLens.0	Mode = 3 (continuous) Speed_Wide_Slow = -30 Offset = 0	Camera should zoom wide at a slow speed
TC1205-006	Zoom stop	TP1205-003 Steps 34-38	positionZoomLens.0	Mode = 0 (stop) Speed = 0 Offset = 0	Camera should stop
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	TP1205-003	positionZoomLens.0;	Mode = 3 (continuous)	Camera begins

Test Case Number	Test Case Name	Test Procedure Steps	Object(s) Under Test	Variables	Result
	duration than timeoutZoom.0	Steps 40-46	timeoutZoom.0	Speed_Tele_Slow = 10 Offset = rangeZoomLimit.0	zooming toward its maximum telephoto setting, but stops after Zoom_Timeout seconds

SAMPLE Test Procedure Specification - CCTV

The Test Procedure below was created for this webinar, as NTCIP 1205, CCTV, does not include Test Cases or Test Procedures.

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
11.	**Set** positionZoomLens.0 to Mode: 2 (absolute) Speed: Speed_Wide_Fast Position or Offset: 0	Pass / Fail
12.	Delay for 10 seconds	
13.	**Verify** that the camera zoomed to its absolute wide position.	Pass / Fail
14.	**Get** positionZoomLens.0	Pass / Fail
15.	**Verify** that the **Response Value** equals Mode: 02 Speed: Speed_Wide_Fast Position or Offset: 00 00	Pass / Fail
16.	**Get** positionQueryZoom.0	Pass / Fail
17.	**Verify** that the **Response Value** equals 0. A **Response**	Pass / Fail /

	Error of noSuchName indicates that positionQueryZoom.0 is unsupported.	Pass Unsupported
18.	**Set** positionZoomLens.0 to Mode: 2 (absolute) Speed: Speed_Wide_Fast Position or Offset: Zoom_Limit / 2	Pass / Fail
19.	Delay for 5 seconds	
20.	**Verify** that the camera is zoomed in half way	Pass / Fail
21.	**Get** positionZoom.0	Pass / Fail
22.	**Verify** that the **Response Value** equals Zoom_Limit_Hex / 2	Pass / Fail
23.	**Get** positionQueryZoom.0	Pass / Fail
24.	**Verify** that the **Response Value** equals Zoom_Limit / 2. A **Response Value** of 0 indicates that positionQueryZoom.0 is unsupported.	Pass / Fail / Pass Unsupported
25.	For each value N, from 1 to 5, perform steps 26 through 30.	
26.	**Set** positionZoomLens.0 to Mode: 1 (delta) Speed: Speed_Tele_Mid Position or Offset: Zoom_Limit / 10	Pass / Fail
27.	Delay for 2 seconds	
28.	**Verify** that the camera zooms in by some amount	Pass / Fail
29.	**Get** positionQueryZoom.0	Pass / Fail
30.	**Verify** that the **Response Value** has been incremented by Zoom_Limit / 10 from the previous value of this step, where the initial value (N=1) is Zoom_Limit / 2. A **Response Error** of noSuchName indicates that positionQueryZoom.0 is unsupported.	Pass / Fail / Pass Unsupported
31.	**Set** positionZoomLens.0 to Mode: 3 (continuous) Speed: Speed_Wide_Slow Position or Offset: 0	Pass / Fail
32.	Delay for 5 seconds	
33.	**Verify** that the camera zooms out continuously	Pass / Fail
34.	**Set** positionZoomLens.0 to Mode: 3 (continuous) Speed: Speed_Tele_Slow Position or Offset: 0	Pass / Fail
35.	Delay for 5 seconds	
36.	**Verify** that the camera begins zooming in continuously.	Pass / Fail
37.	While the camera is still zooming, **Set** positionZoomLens.0 to Mode: 0 (stopMovement) Speed: 0 Position or Offset: 0	Pass / Fail
38.	**Verify** that the camera stops zooming.	Pass / Fail
39.	**IF** Zoom_Limit equals 65535, GOTO Step 42 - the camera allows all levels of zoom.	
40.	**Set** positionZoomLens.0 to Mode: 2 (absolute) Speed: Speed_Tele_Fast Position or Offset: 65535	Pass / Fail
41.	**Verify** that the RESPONSE ERROR is badValue.	Pass / Fail
42.	**Set** positionZoomLens.0 to Mode: 2 (absolute)	Pass / Fail

	Speed: Speed_Wide_Fast Position or Offset: 0	
43.	**Verify** that the camera zooms to its widest angle.	Pass / Fail
44.	**Set** timeoutZoom.0 to Zoom_Timeout.	Pass / Fail
45.	**Set** positionZoomLens.0 to Mode: 2 (absolute), Speed: Speed_Tele_Slow Position or Offset: Zoom_Limit	Pass / Fail
46.	**Verify** that the lens begins slowly zooming in, then stops after two seconds.	Pass / Fail
Test Procedure Result:		Pass / Fail
Test Procedure Notes:		

Terminology/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 for 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.
Device Under Test (DUT)	NTCIP device that is the object of testing.
Dialogs	A sequence of information or message exchanges.
Environmental Sensor Station (ESS)	A location that includes a remote processor unit (RPU) connected to one or more sensors for the collection of environmental or meteorological data. It may also include a pavement treatment system (PTS). NOTE-The acronym ESS may also be used in the plural.
Feature	A behavior of the device.
Interchangeable	A condition which exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves, or adjoining items, except for adjustment, and without selection for fit and performance. NOTE-See National Telecommunications and Information Administration, U.S. Department of Commerce
Interoperable	The ability of two or more systems or components to exchange information and use the information that has been exchanged. NOTE-See NTCIP 8004 v02.
Management Station	The computer system with which the device communicates. Typically, the management station commands and monitors the device.

Term	Definition
Protocol Requirements List (PRL)	A table mapping user needs with its associated requirements, along with whether the requirement is mandatory for conformance to the standard. This table allows procurement personnel to specify the desired features of a DMS or can be used by a manufacturer to document the features supported by their implementation.
Remote Processor Unit (RPU)	A field processor that collects data from sensors and can communicate the collected data to other computers; the processor may also process the collected data and/or control equipment.
Requirement	A condition or capability to which a system shall conform.
Requirements Traceability	The ability to follow or study the logical progression among the needs, requirements, and design details in a step-by-step fashion.
Requirements to Test Cases Traceability Matrix (RTCTM)	A table that defines the traceability from a requirement to the associated test case.
Requirements Traceability Matrix (RTM)	A table that links the requirements to the corresponding dialogs and objects.
Sensor	A device that is capable of detecting a condition and reporting the result to an RPU.
Specification	A document that specifies, in a complete, precise, verifiable manner, the requirements, design, behavior, or other characteristics of a system or component, and, often, the procedures for determining whether these provisions have been satisfied.
Systems Engineering Process (SEP)	Interdisciplinary collaborative approaches to derive, evolve, and verify a life-cycle balanced system solution, which satisfies customer expectations and meets public acceptability. (IEEE)
Test Case Specification (TCS)	A document that specifies the actual inputs, predicted results, and set of execution conditions for a test. It also identifies constraints on the test procedures resulting from use of that specific test case. NOTE—See IEEE 829 for a more detailed discussion of test cases.
Test Design Specification (TDS)	Per IEEE 829, "A document specifying the details of the test approach for a ... feature or combination of ... features and identifying the associated tests." For testing NTCIP conformance, this document includes the completed PRL and Requirements to Test Cases Traceability Matrix.

Term	Definition
Test Plan	A document that prescribes the scope, approach, resources, and schedule of the testing activities. It identifies the items to be tested, the features to be tested, the testing tasks to be performed, the personnel responsible for each task, and the risks associated with the plan.
Test Procedure Specification (TPS)	A document that specifies a sequence of actions for the execution of a test. The test procedures test the implementation of the requirement. Test procedures are separated from test design as they are intended to be followed step by step and should not have extraneous detail.
Validation	A quality control process that determines if a product fulfills its intended purpose.
Verification	A quality control process that determines if a product meets specified requirements.

References

ITS

- Standards website: http://www.standards.its.dot.gov/ - includes a variety of information about ITS standards and the systems engineering process.

- NTCIP Website: http://www.ntcip.org - includes links to NTCIP standards, guides and other relevant information to the NTCIP standards.

- NTCIP 9001 – NTCIP Guide

- NTCIP 9012 – NTCIP Testing Guide for Users

IEEE

- IEEE Website: http://www.ieee.org - includes all sorts of information about IEEE standards.

- IEEE Std 829-1998, Standard for Software Test Documentation

FHWA

- FHWA Systems Engineering Website: http://www.fhwa.dot.gov/cadiv/segb/

- Systems Engineering Guidebook for Intelligent Transportation Systems Version 3.0 (The "V" Systems Engineering Model): http://ops.fhwa.dot.gov/publications/seitsguide/seguide.pdf