T312: Applying Your Test Plan to a Transportation Sensor System (TSS) Based on the NTCIP 1209 Standard v02

Table of Contents

1. Introduction/Purpose

This module assists user agencies in their efforts to create test documentation specific to their transportation sensor system (TSS) needs based on the National Transportation Communications for Intelligent Transportation Systems Protocol (NTCIP) 1209 v02 Standard. At a time when connectivity and data sharing are essential, the NTCIP 1209 Standard provides a rich data set for communicating TSS information. While NTCIP standards for actuated signal control (ASC) and ramp metering control (RMC) supply some limited sensor data communications indirectly through those systems, NTCIP 1209 provides the means to configure, control, monitor, and collect data from TSSs directly. Used both publicly and commercially, TSS information enables transportation system managers and operators to improve traffic flow and public safety in a variety of ways. Prior to developing test documentation specific to their TSS needs, users are expected to be knowledgeable about the NTCIP 1209 v02 Standard and testing methodologies. The agency is also expected to have developed its own user needs and requirements related to the NTCIP 1209 Standard.

This module is based on the Institute of Electrical and Electronics Engineers (IEEE 829) architecture for testing. It reviews both sample test documentation created prior to testing and sample test documentation produced after performing the tests. It also guides agencies in verifying that delivered products comply with their NTCIP specifications.

2. Outlines for TSS Communication Test Reporting
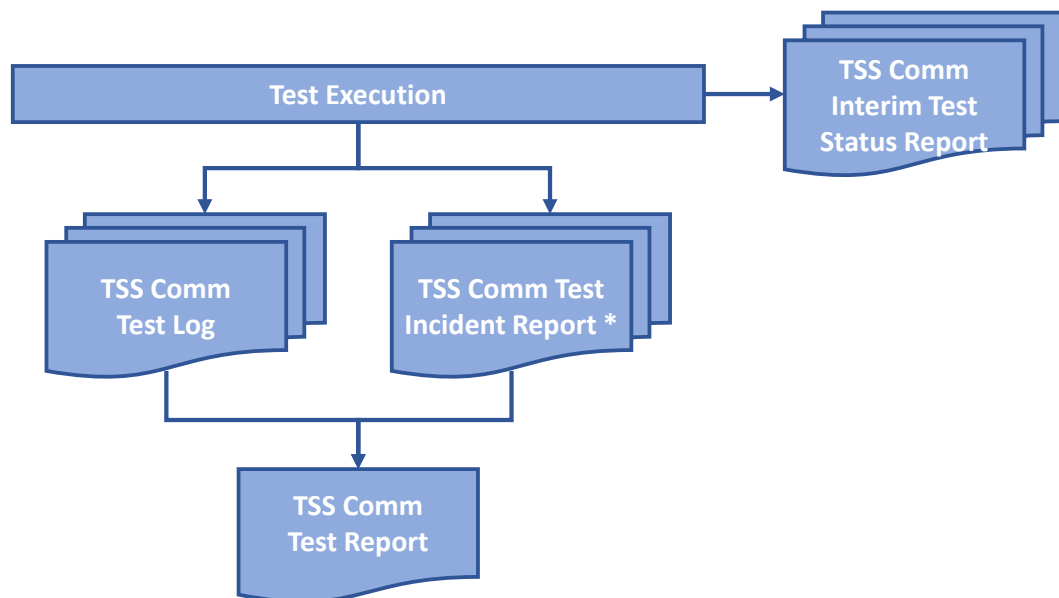
* IEEE 829-2008 allows "anomaly report" to be replaced by problem, test incident, defect, trouble, issue, or error report.

TSS Communications Test Log

TSS Communications Test Incident Report

TSS Communications Interim Test Status Report

TSS Communications Test Report

3. Reference to Other Standards

- Institute of Electrical and Electronics Engineers, *IEEE Std 829-2008 IEEE Standard for Software and System Test Documentation*. IEEE, 2008. http://standards.ieee.org/findstds/standard/829-2008.html

- NTCIP Joint Committee, *National Transportation Communications for ITS Protocol Object Definitions for Transportation Sensor Systems (TSS) Version 02*. NTCIP Joint Committee. NTCIP JC Recommended Standard in process of publication. http://www.ntcip.org/library/documents/

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.
Arming Enable	A selected state of an arming input bit or arming pin of the TSS that can be used to modify its operation.
Arming Input Bit	An external event that is reported to the TSS using this protocol and used to modify its operation.
Arming Pin	A physical input to the TSS that can be monitored and used to modify its operation.
ASC	Actuated Signal Control
Class	A subdivision of collected historical sample data.

Term	Definition
Compatibility	A condition that exists when two or more systems or components perform their required functions while sharing the same environment.
Compliance	A condition that exists when an item meets all of the requirements of an agency specification.
Conformance	A condition that exists when an item meets all of the mandatory requirements as defined by the 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.
ConOps	Concept of Operations
Delay	A feature that allows the detection output from a TSS detector to be deferred for a user set time period.
Deprecated	In the context of a MIB, "deprecated" is an object STATUS value that indicates the object is valid in limited circumstances and may have been replaced by another.
DST	Daylight Saving Time
Extension	A feature that allows the detection output from a TSS detector to be lengthened for a user set time period.
Fail-Safe Mode	Capable of compensating automatically and safely for a failure, as a mechanism or power source.
Feature	A service provided by or behavior of the TSS.
Firmware Version	A manufacturer-specified description for identifying the software currently embedded in the TSS.
Hardware Version	A manufacturer-specified description for identifying the electronic components that comprise the TSS.
ICD	Interface Control Document
Interchangeability	A condition that 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. (National Telecommunications and Information Administration, U.S. Department of Commerce)
Interoperability	The ability of two or more systems or components to exchange information and use the information that has been exchanged.

Term	Definition
Live Data	A specific operational network configuration between the management station and the TSS through which the information exchange can be performed without the need for initiating and terminating a physical network connection between the management station and TSS. From a network perspective, this configuration is an "always on" connection, in which the management station has access to the "current" information available in the TSS.
Management Information Base (MIB)	A structured collection or database of related managed objects defined using Abstract Syntax Notation One (ASN.1).
Management Station	A remote computer (e.g., Traffic Management Center), local computer (e.g., laptop), or local controller (e.g., Traffic Controller).
MVI	Multi-Version Interoperability (backward compatibility)
Near Real-Time Data	Data that depict an event as it existed at the current time less the processing time. The data vary from real-time data because they depend on the type and speed of transmission. These data are useable for identifying changes in traffic flows.
NTCIP	National Transportation Communications for Intelligent Transportation Systems (ITS) Protocol
Normalized	Process of reducing sample data to a common denominator to accommodate comparison of the measured data.
Occupancy	A measurement of vehicle presence within a zone of detection, expressed in seconds of time a given point or area is occupied by a vehicle.
Output	The condition of an on/off status generated by a change of state.
Output Mode	There are two common output modes: presence and pulse. In the presence output mode, a detection of a vehicle is output constantly while the vehicle is in the zone. In the pulse output mode, a detection is output for 125 milliseconds (± 25 milliseconds) and then the zone is retuned.
PRL	Protocol Requirements List
Protocol	A specific set of rules, procedures, and conventions defining the format and timing of data transmissions between devices that are accepted and used to understand each other.
Protocol Version	A standardized description for identifying the version of the TSS standard to which the TSS is designed to conform.
Requirement	A condition or capability to which a system must conform, either derived directly from the user needs, or stated in a contract, standard, specification, or other formally imposed document. A desired feature, property, or behavior of a system.

Term	Definition
Requirements Traceability	The ability to follow or study the logical progression among the needs, requirements, and design details in a step-by-step fashion.
RTC	Real Time Clock
RTM	Requirements Traceability Matrix
Sample Period	Duration of time in seconds when data for the zone are being collected.
Sensitivity	The ability of the TSS to react to incoming signals, expressed as the minimum input signal required to produce an output signal.
Sensitivity Mode	A characteristic of the loop detector being used. It is defined as either $\Delta L/L$, $\Delta L/\sqrt{L}$, or ΔL.
Sensor	A physical device used for sensing traffic.
SEP	Systems Engineering Process
SNMP	Simple Network Management Protocol
SRS	Software Requirements Specification
Transportation Sensor System (TSS)	Any system capable of sensing and communicating near real-time traffic parameters using NTCIP.
User	A person who will utilize the system that is developed.
User Need	The business or operational problem (opportunity) that must be fulfilled in order to justify purchase or use. While this is termed a "user need" within the NTCIP community, it reflects needs of all stakeholders.
Virtual Zone	A logical combination of one or more zones to create a new zone with its own conditioning and arming enables. Combining zones into a single zone can be used to provide one output from many zones. It can also be used to alias a zone, so that the same zone can provide multiple outputs, each with different conditioning parameters, sample periods, and/or trigger usage.
Volume	The number of vehicles crossing a section of road per unit time at a selected period.
Zone	An area in which traffic parameters can be measured and/or traffic data can be generated.
Zone Options	Special settings for controlling the behavior of zones.

5. References

- Institute of Transportation Engineers
  http://www.ite.org/standards/

- ITS PCB Training
  http://www.pcb.its.dot.gov/

- United States Department of Transportation Federal Highway Administration. *Systems Engineering Guidebook for Intelligent Transportation Systems Version 3.0*. November 2009.
  http://www.fhwa.dot.gov/cadiv/segb/

- United States Department of Transportation Federal Highway Administration. *Traffic Detector Handbook: Third Edition—Volume I*. October 2006.
  http://www.fhwa.dot.gov/publications/research/operations/its/06108/

6. Study Questions

1) Which of the following is a TRUE statement?

   a) There is usually one Level Test Case per Level Test Design

   b) Always use the word "Level" in test document names

   c) Anomaly Reports provide a chronological record of tests

   d) A Level Test Report summarizes the results of testing

2) When bench testing the communications for a TSS, the primary objective is to:

   a) Test the TSS communications with other components

   b) Exercise as much of the NTCIP 1209 protocol as possible

   c) Test the TSS communications under real-world conditions

   d) Test the central system communications to the TSS

3) True or False: The best way to start developing your test documentation is with a Test Design.

   a) True

   b) False

4) What is the most appropriate test document in which to include a Test Traceability Matrix (TTM)?

    a) TSS Communications Test Cases

    b) TSS Communications Test Procedures

    c) TSS Communications Test Design

    d) TSS Communications Test Report

5) Which of the following is a TRUE statement?

    a) Only manufacturers need to be concerned with testing

    b) Well-written agency TSS specifications facilitate testing

    c) Good testing is easy

    d) The only thing that matters is the level test report