A311a
Understanding User Needs For DMS Systems Based on NTCIP 1203 Standard

STANDARDS ITS TRAINING

STUDENT SUPPLEMENT

RITA Intelligent Transportation Systems Joint Program Office

A311a: Understanding User Needs for DMS Systems Based on NTCIP 1203 Standard

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PURPOSE

This participant supplement provides additional information for the Professional Capacity Building (PCB) Module A311a, Understanding User Needs for DMS Systems Based on NTCIP 1203 Standard.

Module A311a will provide participants with information on how to identify the appropriate use of the NTCIP 1203 standard and acquire a DMS system based on what the user is seeking to accomplish with support from tools and resources such as a Protocol Requirements List (PRL) in following a systems engineering (SE) process.

This module helps the user understand the scope of the DMS standard and its versions. It also assists in identifying the uses and associated needs of DMS systems. This module is to be placed in the context of the SE process as well as in the acquisition curriculum path with I101, A101, A102, and A201 being the prerequisites and A311b-Specifying Requirements for DMS Systems Based on NTCIP 1203 Standard following this module.

NTCIP 1203 History

- NTCIP v01 was published in 1999
- NTCIP 1203 Amendment 1 was approved in 2001
    - Clarified object definitions and MarkUp Language for Transportation Information (MULTI) tags
    - Added memory type for blank messages
    - Responded to questions from actual implementations
- NTCIP 1203 v02
    - Adds new functionality (additional support for colors and graphics)
    - Uses a systems engineering approach
    - NTCIP 1203 v02 was first accepted as a recommended standard in 2007
    - A minor revision was developed in 2010 and accepted
- NTCIP 1203 v03 (recommended standard)
    - In balloting 2011
    - Adds test procedures

DMS Characteristics

DMS Types

There are many types of DMS and they can be characterized in many ways. One way is by the capabilities the DMS offers for handling messages. This characterization places a DMS into one of three major categories:

1. Blank-out Sign (BOS) – this type of DMS can only show one fixed message or nothing.
2. Changeable Message Sign (CMS) – this type of DMS can display one of two or more predefined messages or be blank.
3. Variable Message Sign (VMS) – this type of DMS is one in which the message to be displayed can be created after the sign is installed in the field. It can also have predefined messages in its library of stored messages. By policy and/or system design the management system may restrict the rights of selected operators to ensure that only authorized personnel can modify or create messages "on-the-fly."

DMS Technologies

DMS can also be characterized by the technology that is used in the sign. The technologies used can include any combination of the following technologies:

a) Fiber optic
b) Light emitting diode (LED)
c) Flip disk or shutter
d) Lamp matrix
e) Drum (rotating, multifaceted cylinder)

DMS Display Matrix Configuration

Finally, DMS can be characterized by the type of display layout employed by the sign, as follows:

a) No matrix (i.e., it is not a pixel matrix sign)
b) Matrix sign
c) Full matrix
d) Line matrix
e) Character matrix

NOTE—Typically, matrix signs are VMS and VMS are matrix signs, but this is not always true; for example, the term VMS would also include: 7-segment displays, electronic ink displays, etc.

Summary of User Needs supported by NTCIP 1203 v02
PRL – NTCIP 1203 v2
User Needs Only

UN Section Number	User Need (UN)	FR Section Number	Functional Requirement (FR)	Conformance	Support / Project Requirement	Additional Project Requirements
2.3.2	DMS Characteristics			M	Yes	
2.3.2.1	DMS Type			M	Yes	
2.3.2.1.1 (BOS)	BOS			O.1 (1)	Yes / No	
2.3.2.1.2 (CMS)	CMS			O.1 (1)	Yes / No	
2.3.2.1.3 (VMS)	VMS			O.1 (1)	Yes / No	
2.3.2.2	DMS Technology			M	Yes	NOTE—Certain combinations of the following technologies might not be supported by any product.
2.3.2.2.1 (Fiber)	Fiber			O	Yes / No	
2.3.2.2.2 (LED)	LED			O	Yes / No	
2.3.2.2.3 (Flip/Shutter)	Flip/Shutter			O	Yes / No	
2.3.2.2.4 (Lamp)	Lamp			O	Yes / No	
2.3.2.2.5 (Drum)	Drum			O	Yes / No	

UN Section Number	User Need (UN)	FR Section Number	Functional Requirement (FR)	Conformance	Support / Project Requirement	Additional Project Requirements
2.3.2.3	DMS Display Matrix Configuration			M	Yes	The DMS shall be ___ millimeters wide (0..65535) and ___ millimeters high (0..65535), inclusive of borders. The Sign's Border shall be at least ___ millimeters wide (0..65535) and ___ 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 ___ 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 ___ characters wide and ___ characters high with each character being ___ pixels wide (0..255), ___ pixels high (0..255).

UN Section Number	User Need (UN)	FR Section Number	Functional Requirement (FR)	Conformance	Support / Project Requirement	Additional Project Requirements
2.3.2.4 (Beacons)	DMS Display Support of Beacons			O	Yes / No	The DMS shall support the following Beacon configuration:_____ Select one from the following (or define your own): —None —One Beacon —Two Beacons with Sync'ed Flash —Two Beacons with Opposing Flash —Four Beacons with Sync'ed Flash —Four Beacons with Alternate Row Flash —Four Beacons with Alternate Column Flash —Four Beacons with Alternate Diagonal Flash —Four Beacons with No Sync'ed Flash —One Beacon Strobe —Two Beacon Strobe —Four Beacon Strobe
2.4.2	Operational Environment			M	Yes	
2.4.2.1	Live Data Exchange			M	Yes	
2.4.2.2	Logged Data Exchange			O	Yes / No	
2.4.2.3	Exceptional Condition Reporting			X	No	Exception Reporting is not yet supported by NTCIP.
2.5	Features			M	Yes	
2.5.1	Manage the DMS Configuration			M	Yes	

UN Section Number	User Need (UN)	FR Section Number	Functional Requirement (FR)	Conformance	Support / Project Requirement	Additional Project Requirements
2.5.1.1	Determine the DMS Identity			M	Yes	
2.5.1.2	Determine Sign Display Capabilities			O	Yes / No	
2.5.1.3 (Fonts)	Manage Fonts			VMS:O	Yes / No / NA	
2.5.1.4 (Graphics)	Manage Graphics			VMS:O	Yes / No / NA	
2.5.1.5	Manage Automatic Brightness			AutoBright:O	Yes / No / NA	
2.5.1.6	Configure Speed Limit			O	Yes / No	
2.5.1.7	Configure Low Fuel Threshold			O	Yes / No	
2.5.2	Control the DMS			M	Yes	
2.5.2.1	Control a DMS from More than One Location			M	Yes	
2.5.2.2	Remotely Reset the Sign Controller			O	Yes / No	
2.5.2.3	Control the Sign Face			M	Yes	
2.5.2.3.1	Activate and Display a Message			M	Yes	
2.5.2.3.2	Prioritize Messages			M	Yes	
2.5.2.3.3	Define a Message			VMS:M	Yes / NA	
2.5.2.3.4	Blank a Sign			M	Yes	
2.5.2.3.5	Schedule Messages for Display			O	Yes / No	
2.5.2.3.6	Change Message Display based on an Internal Event			O	Yes / No	

UN Section Number	User Need (UN)	FR Section Number	Functional Requirement (FR)	Conformance	Support / Project Requirement	Additional Project Requirements
2.5.2.4	Control External Devices			O	Yes / No	NOTE—The OIDs for the objects associated with this User Need were moved from the Experimental node, as defined in NTCIP 1203:1997 (v01), to a Global objects-located node, as defined in NTCIP 1201:2005 (v02). Place a checkmark beside the major versions that the DMS is NOT required to support: NTCIP 1203:1997 (version v01)____ NTCIP 1201:2005 (v02) AND NTCIP 1201 v03 ____
2.5.2.5	Control the Brightness Output			Lamp OR LED OR Fiber:M	Yes / NA	
2.5.2.6	Perform Preventative Maintenance			Fiber OR Flip/Shutter:O	Yes / No / NA	
2.5.3	Monitor the Status of the DMS			M	Yes	
2.5.3.1	Perform Diagnostics			M	Yes	
2.5.3.1.1	Determine Sign Error Conditions—High-Level Diagnostics			M	Yes	
2.5.3.1.2	Monitor Sign Subsystem Failures—Mid-Level Diagnostics			M	Yes	
2.5.3.1.3	Monitor Subsystem Failure Details—Low-Level Diagnostics			O	Yes / No	
2.5.3.1.4	Monitor Message Errors			M	Yes	

UN Section Number	User Need (UN)	FR Section Number	Functional Requirement (FR)	Conformance	Support / Project Requirement	Additional Project Requirements
2.5.3.1.5 (Environment)	Monitor Sign Environment			O	Yes / No	
2.5.3.1.6	Monitor the Sign Control Source			M	Yes	
2.5.3.1.7	Monitor Attached Speed Detectors			O	Yes / No	
2.5.3.1.8 (Door)	Monitor Door Status			O	Yes / No	
2.5.3.1.9 (ControllerOp)	Monitor Controller Software Operations			O	Yes / No	
2.5.3.1.10	Monitor Automatic Blanking of Sign			O	Yes / No	
2.5.3.1.11	Monitor Power Source			O	Yes / No	
2.5.3.1.12	Monitor Power Voltage			O	Yes / No	
2.5.3.1.13	Monitor Fuel Level			O	Yes / No	
2.5.3.1.14	Monitor Engine RPM			O	Yes / No	
2.5.3.2	Monitor the Current Message			M	Yes	

UN Section Number	User Need (UN)	FR Section Number	Functional Requirement (FR)	Conformance	Support / Project Requirement	Additional Project Requirements
2.5.4	Provide for multi-version interoperability of the DMS to NTCIP 1203:1997 (version v01)			O	Yes / No	NOTE—These object definitions have been revised to address interoperability issues in NTCIP 1203:1997 (version v01). The associated objects were deprecated and replaced by newer objects that have a wider scope or that have been changed to ease implementation. Pay close attention to the implementation and interoperability of these objects. Place a checkmark below, if the DMS is NOT required to support the major version that is checked. NTCIP 1203:1997 (version v01)____

Glossary

The following is a Glossary of Terms that is used throughout the module:

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.
Beacon	A device that directs light in one direction and flashes (Similar to a one-section traffic intersection signal head). The device is intended to increase a driver's attention to a message. The color is undefined (see also Strobe Lights).
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.
Dialogs	A sequence of information or message exchanges.
Dynamic Message Sign	Any sign system that can change the message presented to the viewer, such as VMS, CMS, and BOS. It includes the following major components: sign face, sign housing, controller, and, if present, the controller cabinet.
Informative	Information that identifies a document, introduce its content and explain its background, its development and its relationship with other documents; or information that provide additional information intended to assist the understanding or use of the document (see normative).

Term	Definition
Interchangeability	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.
Interoperability	The ability of two or more systems or components to exchange information and use the information that has been exchanged.
Normative	Information that describes the scope of the document and which set out provisions (ISO). Normative elements are considered to be a prescriptive part of the standard (see informative).
Protocol Requirements List (PRL)	A table mapping user needs with its associated requirements. 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.
Requirement	A condition or capability needed by a user to solve a problem or achieve an objective.
Requirements Traceability Matrix (RTM)	A table that links the requirements to the corresponding dialogs and objects.
Specification	A document that specifies in a complete, precise, and 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	An interdisciplinary approach and means to enable the realization of successful systems. (INCOSE) An interdisciplinary collaborative approach to derive, evolve, and verify a lifecycle balanced system solution, which satisfies customer expectations and meets public acceptability. (IEEE)
User Needs	The business or operational problem (opportunity) that is to be fulfilled to justify procurement or use. NOTE—While this is termed a “user need” within the NTCIP community, it reflects needs of all stakeholders.

References

Dynamic Message Signs

- **NTCIP 1203 Version v3.04, National Transportation Communications for ITS Protocol, Object Definitions for Dynamic Message Signs (DMS)**, AASHTO/ITE/NEMA, v03.04, September 2011.
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- **NTCIP 9001 Version v04, National Transportation Communications for ITS Protocol, The NTCIP Guide**, AASHTO/ITE/NEMA, July 2009.
- **NEMA Standards Publication TS 4-2005, Hardware Standards for Dynamic Message Signs (DMS) With NTCIP Requirements,** NEMA, 2005.
- **DMS Procurement Workshop,** U.S. Department of Transportation, Federal Highway Administration, December 28, 2006. Available online at: http://www.ops.fhwa.dot.gov/int_its_deployment/standards_imp/dmswkshp.htm. Accessed March 23, 2011.
- **ITS Standards Fact Sheets - NTCIP 1203 - Object Definitions for Dynamic Message Signs (DMS),** Research and Innovative Technology Administration, U.S. DOT 2010. Available online at: http://www.standards.its.dot.gov/fact_sheet.asp?f=23. Accessed March 23, 2011.

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- **Systems Engineering Guidebook for Intelligent Transportation Systems Version 3.0,** United States Department of Transportation, November 2009.
- **Building Quality Intelligent Transportation Systems Through Systems Engineering prepared for Intelligent Transportation Systems**, Joint Program Office, U.S. Department of Transportation by Mitretek Systems, Inc., FHWA-OP-02-046, April 2002. Available online at: http://ntl.bts.gov/lib/jpodocs/repts_te/13620.html. Accessed March 23, 2011.
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