



W E L C O M E



U.S. Department of Transportation
Office of the Assistant Secretary for
Research and Technology

Welcome



**Ken Leonard, Director
ITS Joint Program Office
Ken.Leonard@dot.gov**

United States Department of Transportation
OFFICE OF THE ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY
**Intelligent Transportation Systems
Joint Program Office**

About DOT | Briefing Room | Our Activities
About OST-R | Press Room | Programs | OST-R Publications | Library | Contact Us
Search

ITS Professional Capacity Building Program / Advancing ITS Education

About ▾ ITS Training ▾ Knowledge Exchange ▾ Technology Transfer ▾ ITS in Academics ▾ Media Library



WHAT'S NEW

- New Web-Based Training from ITS Joint Program Office
 - Connected Vehicle Reference Implementation Architecture Training now available
- New NHI Course
 - Systems Engineering for Signal Systems Including Adaptive Control (NHI-133123)
- New ITS Case Study Available
 - National ITS Architecture
- Added to T3 Archive
 - Learn from the Experts: Open Data Policy Guidelines for Transit - Maximizing Real Time and Schedule Data-Legalities, Evolutions, Customer Perspectives, Challenges, and Economic Opportunities - Part II
Presented on August 7, 2014
 - Saving Lives and Keeping Traffic Moving: Quantifying the Outcomes of Traffic Incident Management (TIM) Programs
Presented on July 31, 2014

Welcome to ITS Professional Capacity Building

The ITS PCB Program is the U.S. Department of Transportation's leading program for delivering ITS training and learning resources to the nation's ITS workforce.

FREE TRAINING



The ITS PCB Program and partners offer many free ITS training courses.

- Web and Blended Courses from CITE
- ITS Standards Training
- Upcoming T3 Webinars

wwwpcb.its.dot.gov

A311a: Understanding User Needs for DMS Systems based on NTCIP 1203 Standard v03



Source: Caltrans

Instructor



**Raman K. Patel
Ph.D., P.E.**

President
RK Patel Associates, Inc.
New York City, NY, USA

Learning Objectives

Review the **structure** of the DMS standard

Identify specific DMS operational needs

Describe the **purpose** of the Protocol Requirements List (PRL) matrix and benefits

Discuss how to **prepare a project level PRL** with user needs and their associated requirements



Learning Objective 1

Review the **structure** of the
DMS standard



How This Standard Fits into the Family of NTCIP Standards

What Is a Dynamic Message Sign?

Dynamic Message Sign (DMS) is any sign system that can change the message presented to the viewer.

--NTCIP 1203 v03 Standard



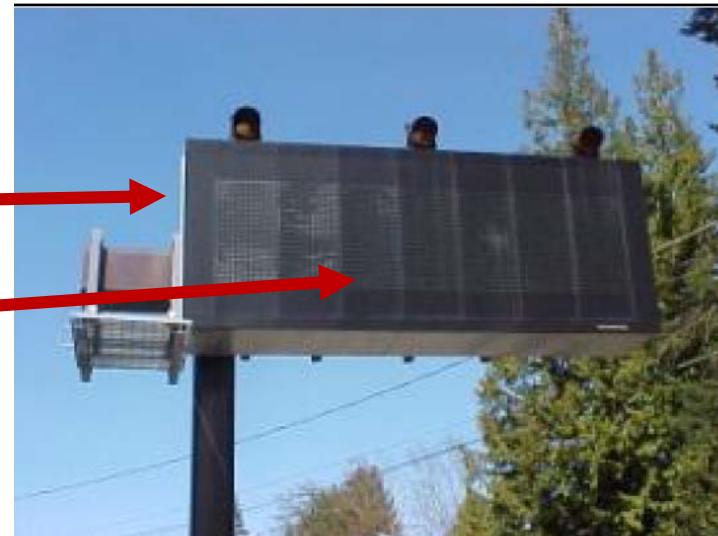
Source: FDOT



How This Standard Fits into the Family of NTCIP Standards

Major Components of a DMS System

Sign Housing

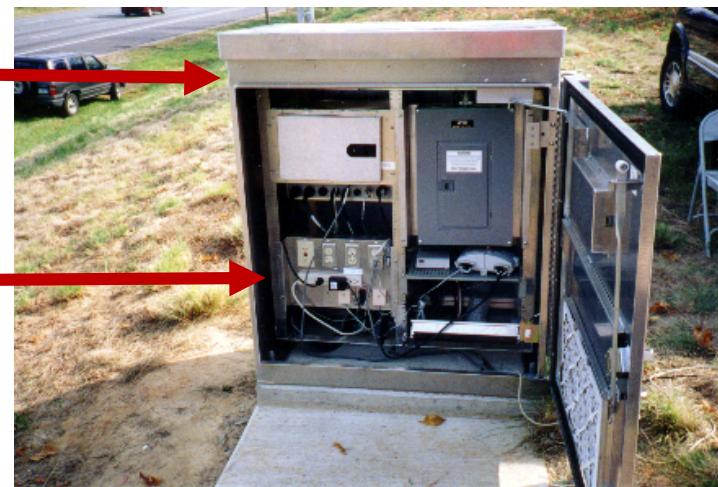


Sign Face



Cabinet

(Located close to the sign)



Controller

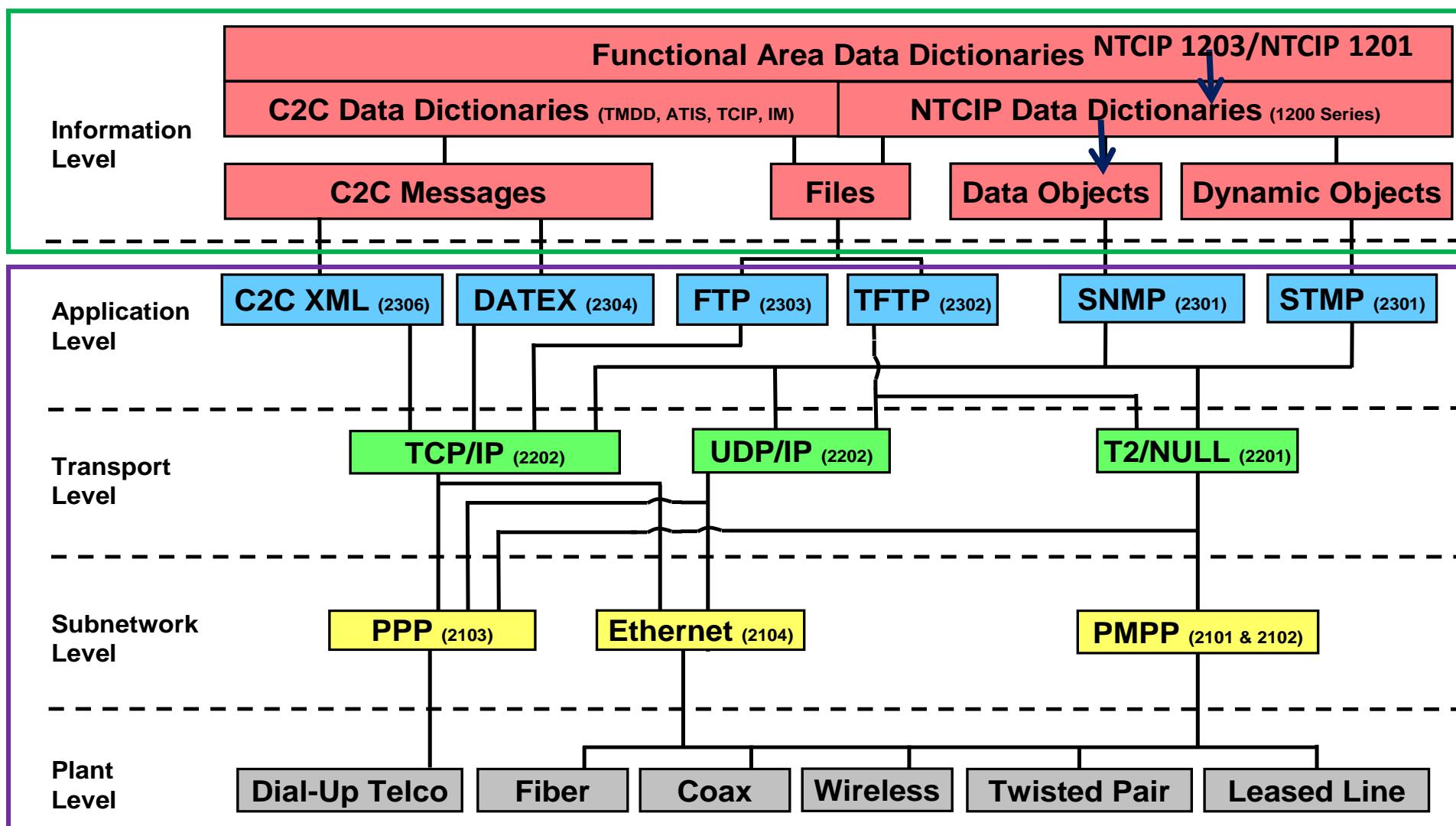


Source: ITE OET-DMS



How This Standard Fits into the Family of NTCIP Standards

NTCIP Framework



Types of DMS and Technologies

DMS Characteristics Supported by the Standard

DMS Types

Capabilities the DMS offers for handling messages

**DMS
Technology**

The **technology** that is used in the sign

**DMS Display
Matrix
Configuration**

The type of display **layout** employed by the sign

EXAMPLE



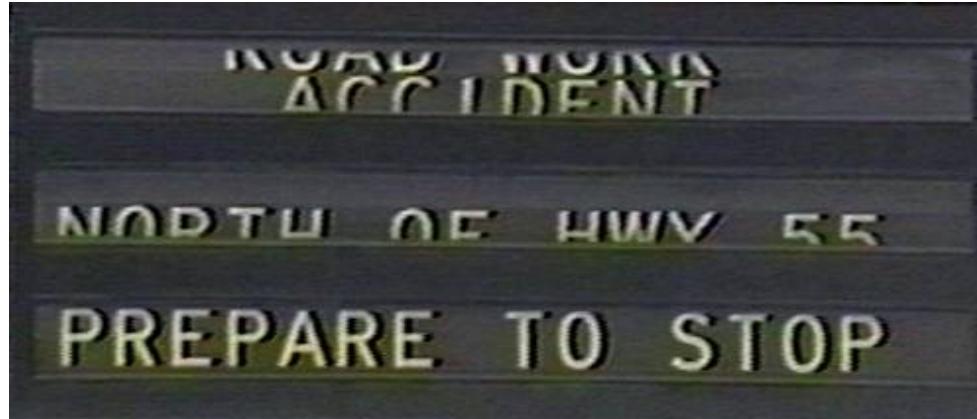
Types of DMS and Technologies Examples

Blank-out Sign (BOS) One Message/Nothing



Source: ITE OET DMS-Patel

Changeable Message Sign (CMS), Predefined Messages



Source: ITE OET DMS-Patel

Variable Message Sign (VMS) Real-time Messages





Types of DMS and Technologies Examples

DMS Display Technologies

- Fiber Optic
- Light Emitting Diode (LED)
- Flip Disk or Shutter
- Lamp Matrix
- Drum
(rotating, multifaceted cylinder)

Standard Supports all Display Technologies and Types-Matrix



Source: WSDOT



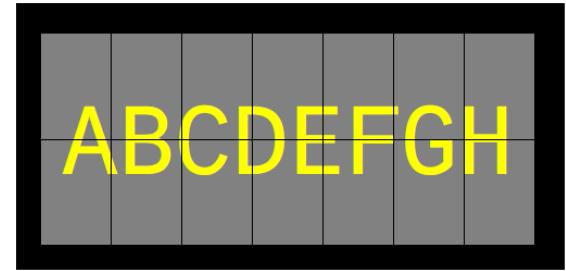
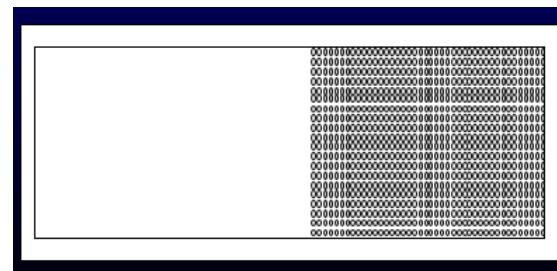
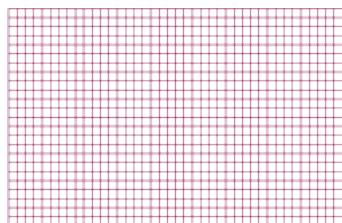
Source: Caltrans D



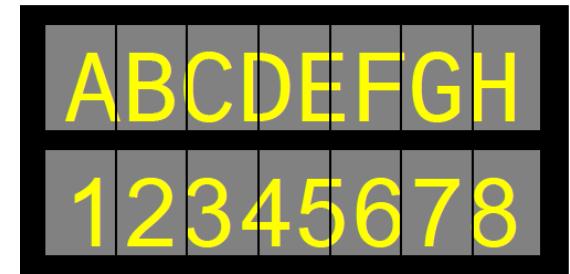
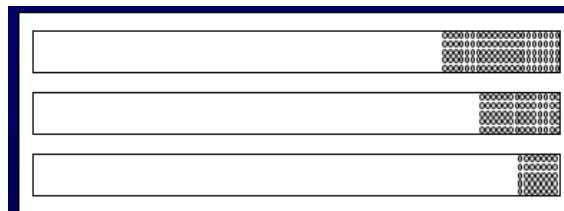
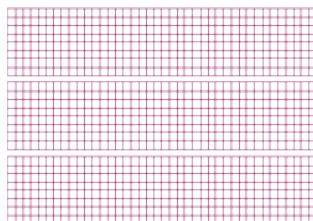
Types of DMS and Technologies Examples

Display Surface Matrix Configurations

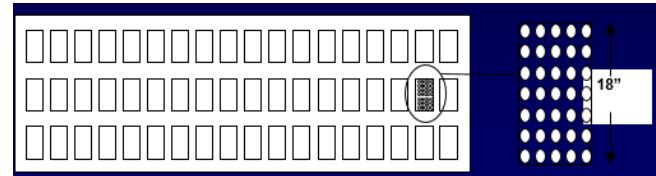
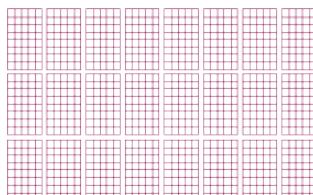
Full matrix



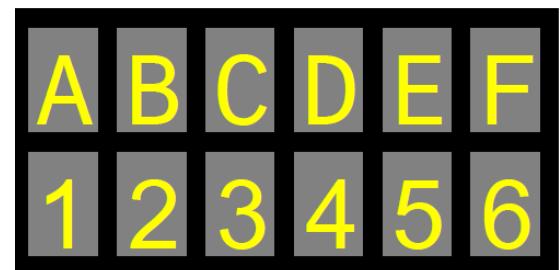
Line matrix



Character matrix



Source: ITE OET DMS



Source: WSDOT DMS Manual

Types of DMS and Technologies

How Messages are Organized and Displayed

First Line Identifies **Problem**

Second Line Identifies **Location**

Third Line Identifies
Action

Source: WSDOT



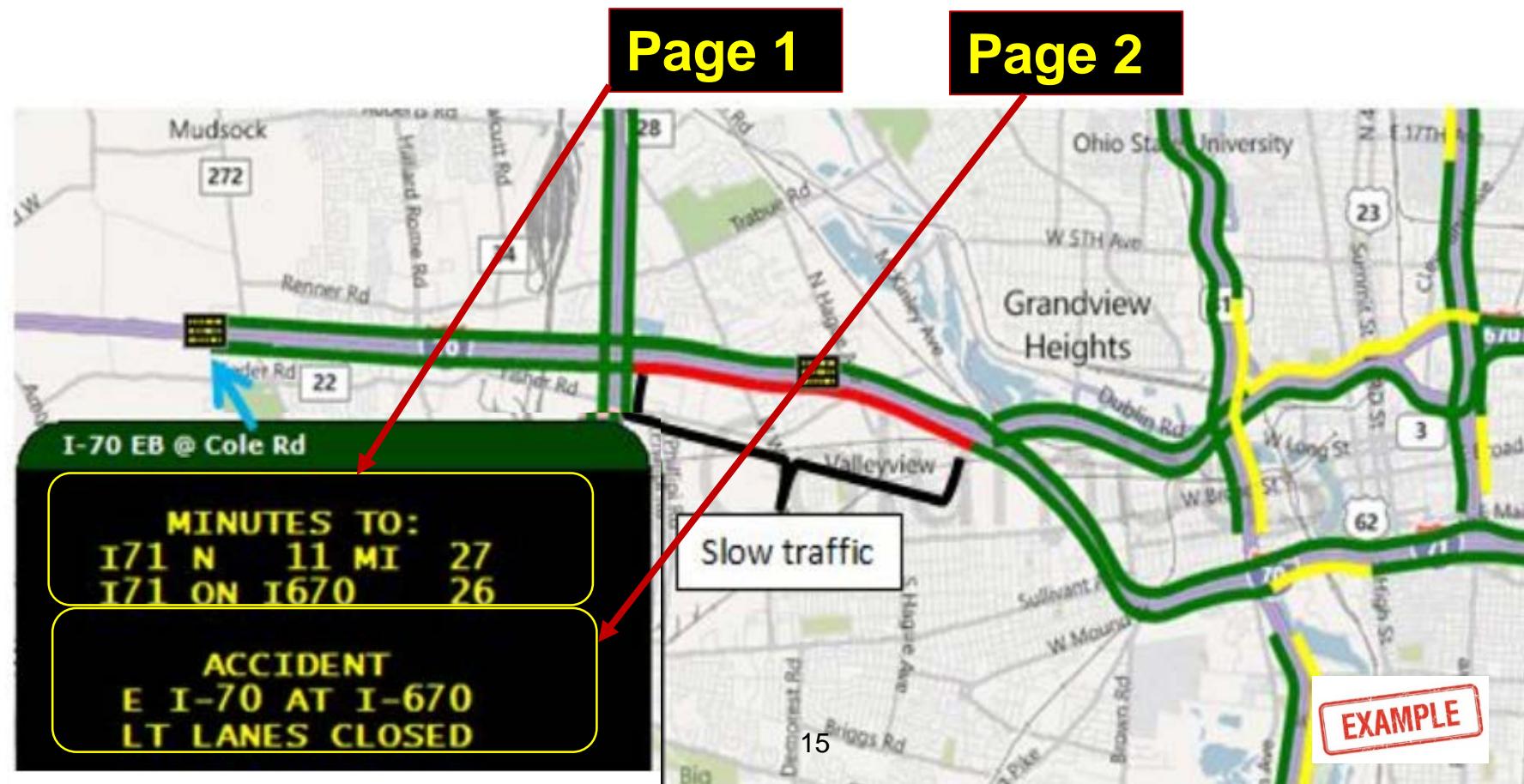
Warnings on VMS boards gave drivers a chance to use alternate routes, helping to minimize the backup on northbound I-5.



Types of DMS and Technologies

For Longer Messages, a Page is Added

Page is defined as the information that can fit on a sign at one time, together with its message attributes.

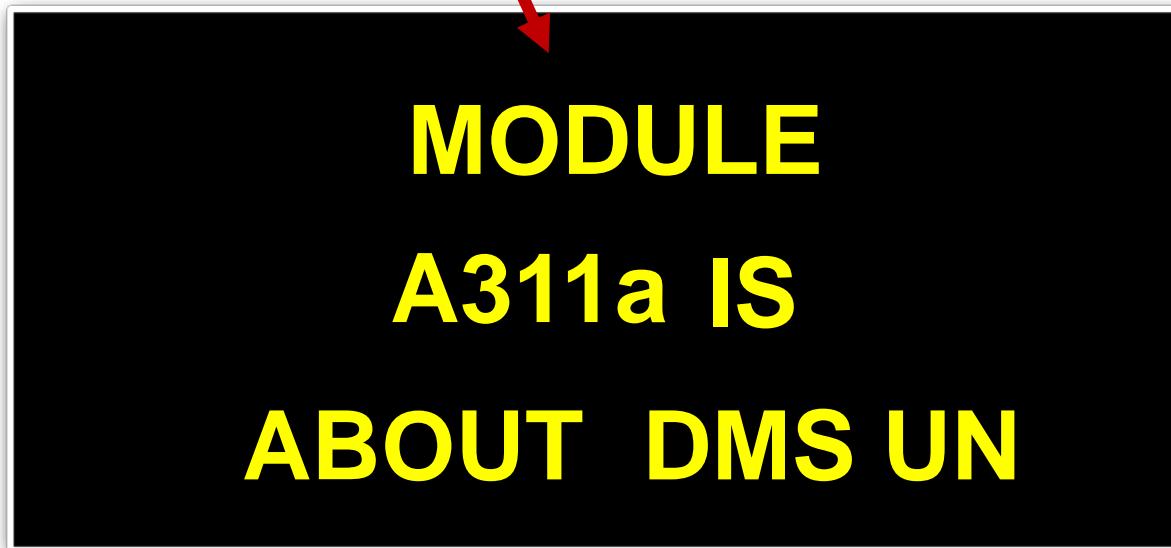


Types of DMS and Technologies

How a Message “Appears” on the Surface

Markup Language for Transportation Information (MULTI)
is similar to HTML where text is transmitted,

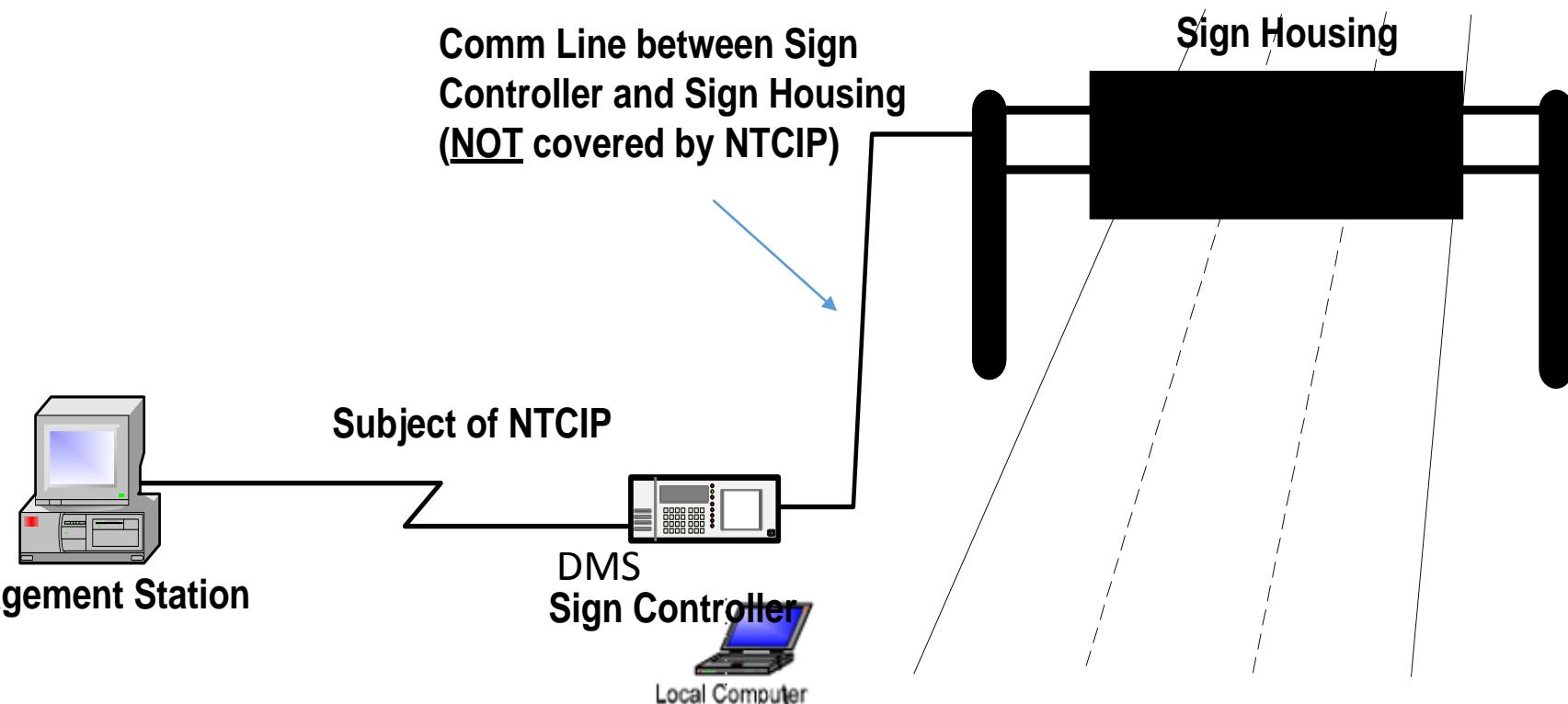
and [tags define how the text appears-
displayed]



EXAMPLE

Structure of Standard (Sections)

Reference Architecture for DMS



Structure of Standard (Sections)

NTCIP 1203 v03 Documentation Organization (Part 1)

Section 1 General

Section 2 Concept of Operations-User Needs

Section 3 Functional Requirements (Includes Protocol Requirements List-PRL)

Section 4 Dialogs

Section 5 Management Information Base (MIB)

Section 6 Markup Language for Transportation Information-MULTI



Structure of Standard (Sections)

NTCIP 1203 v03 Documentation Organization (cont.)

Part 1

Annex A	Requirements Traceability Matrix (RTM)
Annex B	Object Tree
Annex D	Documentation of Revisions
Annex E	Frequently Asked Questions
Annex F	ASCII Table and Description
Annex G	Simple Network Management Protocol (SNMP) Interface

Part 2

Annex C Test Procedures

Structure of Standard (Sections)

What Is New in NTCIP 1203 v03 DMS Standard?

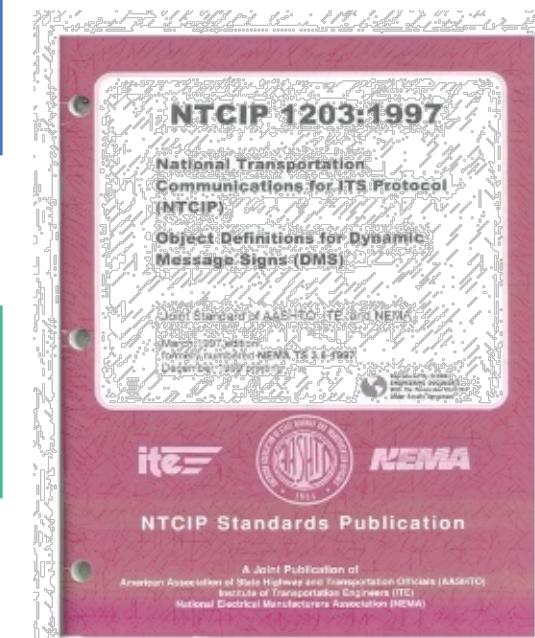
v01 was published in 1997
Amended in 2001, Non-SEP based

Lessons Learned

v02 was published in 2007
Added new functionality, SEP-based

Lessons Learned

v03.03 was published in 2011
Annexes A, B, D-H Information Data
Annex C: Added Test Procedures



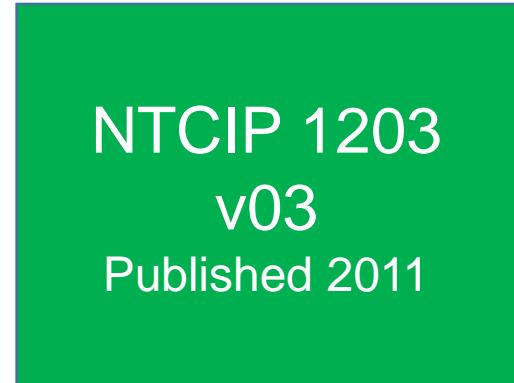


Structure of Standard (Sections)

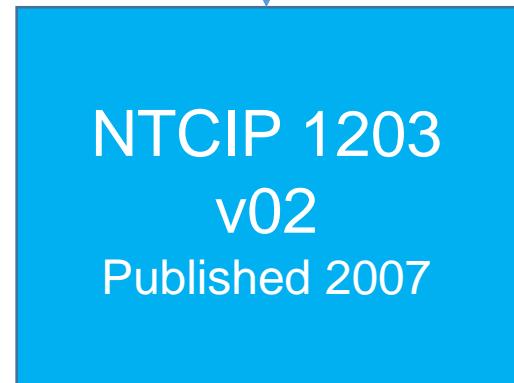
What Is New in v03

- v03 added Test Procedures (Annex C)
- Made minor corrections (see Annex D)
- Published in Two Parts

Both versions are SEP based; provide User Needs/Requirements/Dialogs and PRL/RTM.



Fully Compatible to v02





Standard Structure (Sections)

What are user Needs?

- Standardized statements that describe what a DMS should do—features/functions
- Every user need has an **Unique ID**, provides a Major Desired Capability (**MDC**), has a **rationale** and it is **solution-free**

Standard Structure (Sections)

Illustration of a DMS User Need

2.5.2.3.4 Blank a Sign

Unique ID-Title

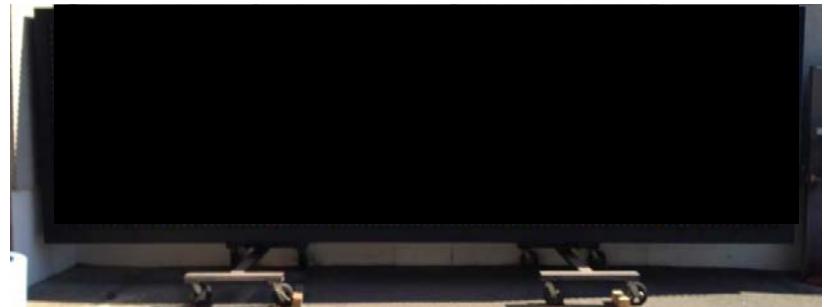
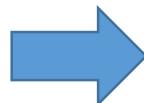
This feature enables the operator (or logic within the management station) to **remove any messages** displayed on a sign (causing the sign to appear blank).

MDC

Rationale



Source: Caltrans





Standard Structure (Sections)

DMS User Needs Organization

NTCIP 1203 v03

2.4 Architectural Needs

- 2.4.1 Fundamental Needs
- 2.4.2 Operational Environment
 - 2.4.2.1 Live Data Exchange
 - 2.4.2.2 Logged Data Exchange

2.5 User Needs/Features

- 2.5.1 Manage the DMS Configuration
- 2.5.2 Control the DMS
- 2.5.3 Monitor the Status of the DMS



Communications
Interface



A C T I V I T Y





Question

Which of the following is a FALSE statement?

Answer Choices

- a) DMS Standard Contains SNMP Interface
- b) DMS Standard Lacks Testing Documentation
- c) DMS Standard Supports all Types of DMSs and Technologies
- d) DMS Standard Includes Protocol Requirements List (PRL)

Review of Answers



- a) DMS Standard Contains SNMP interface

True statement. v03 provides SNMP interface in Annex G.



- b) DMS Standard Lacks Testing Documentation

False statement. v03 provides test procedures in Annex C.



- c) DMS Standard Supports all Types of DMSs and Technologies

True statement. Standard is independent of types of signs and technologies. It supports all.



- d) DMS Standard Includes Protocol Requirements List (PRL)

True statement. v03 includes PRL in Section 3.

Learning Objectives

Review the **structure** of the DMS standard

Identify specific DMS operational needs



Learning Objective 2

Identify specific DMS
operational needs



What Are You Trying to Do with a DMS System?

Concept of Operations (ConOPs)

- Communicates user needs and expectations for the proposed DMS system
- Provides an operational context of a DMS system

Fundamental Needs Driving DMS Deployment

*“The provision of **timely and reliable information** to the traveling public improves **public safety and convenience** by providing advance notification of items that may be of interest (e.g., downstream **road conditions** or the **arrival of a transit vehicle**). DMS are typically dispersed along interstate highways, arterial roadways, and at transit stops.”*

-NTCIP 1203 v03



What Are You Trying to Do with a DMS System?

Example of ConOPs from Indiana DOT

“DMS provides dynamic operational information to motorists, including incident, traffic, and road condition information, emergency alerts, travel time information, and other advisories.”



“Motorists can use this information to select an alternate route or divert, delay, or even cancel their trip to avoid traffic delays.”

What Are You Trying to Do with a DMS System?

Who Benefits from the Use of DMSs

Public Sector

- Achieve ITS objectives
- Safe and Efficient Mobility-Capacity
- Real-time Messages to Public

Road Users

- Obtain Visual Traffic Information
- Make Informed decisions

Private Sector

- Larger DMS Installed-base

What Are You Trying to Do with a DMS System?

Operations Staff Use DMS System to Improve Operations

**TMC Provides
Real-time Traffic
Information**



Source: Courtesy Munjal Joshi: NYCDOT TMC

**Traveling Public
Makes Decisions
Based on Real-time Information**

**Advisory
Information**

**Regulatory
Information**

**Special Events
Information**

**Resulting in
Improved:**

- ✓ Traffic Flow
- ✓ Road Safety
- ✓ Environment
- ✓ Mobility Management

What Are You Trying to Do with a DMS System?

Convey Advisory Information to the Traveling Public

Road Closures



Source: www.dot.ny.gov

Traffic Condition



Source: IN DOT



What Are You Trying to Do with a DMS System?

Convey Advisory Information to the Traveling Public

Weather Warnings



Source: ntl.bts.gov

Curve Warning



Source: ODOT

Safety Benefits



What Are You Trying to Do with a DMS System?

Convey Advisory Information to the Traveling Public: Estimated Travel Times



Source: NYSDOT



What Are You Trying to Do with a DMS System?

Convey Advisory Information to the Traveling Public: Transit Vehicle Arrival Times



Source: FHWA-PCB





What Are You Trying to Do with a DMS System?

Convey Advisory Information to the Traveling Public: HOV Lane Access Requirements





What Are You Trying to Do with a DMS System?

Convey Regulatory Information to the Traveling Public

- Mandatory detour information/evacuation
- Speed limits
- Variable Speed



Source: WSDOT ATDM



Source: FHWA



Source: FDOT



What Are You Trying to Do with a DMS System?

Convey Special Event Information to the Traveling Public

- High Value Information
- Require Urgent Attention



Source: NJ Turnpike Auth.

Source: ntl.bts.gov

Source: ntl.bts.gov

What Are You Trying to Do with a DMS System?

Activate a Flashing Beacon to Draw Attention of Motorists

- Traffic Alert-Message Activation



Source: ITE



Source: Iowa DOT



Source: ops.fhwa.dot.gov

- Change in Condition



Source: WSDOT



What Are You Trying to Do with a DMS System?

Manage Information from Multiple Facilities, Owning Centers

- Traffic Management Centers; Roadside, Moveable or Vehicle-based
- Transit platforms: Train Stations, Bus Depots
- Parking facility



Texas A&M Transportation Institute



Source: VDOT-Fairfax

Support for Configuring/Monitoring and Controlling a Sign

Support Operational Environment with Communications Interface

Management Station



Architectural
(Communications)
Needs

Sign Controller



DMS Operation (Features):
Configure
Control
Monitor



Source: NYC DOT



Support for Configuring/Monitoring and Controlling a Sign

Support Operational Environment with Live Data Exchange

Connection Always ON:

Need to allow a management station to issue request for status and issue control commands to a DMS.



Source: NYCDOT

Request for Status Information

Response

Control Command

Response

What
Message Currently is
Displayed

NEW MESSAGE
EXIT 42
CLOSED TILL 6 PM



Support for Configuring/Monitoring and Controlling a Sign

Support Operational Environment with Logged-Data

When Connection is Broken or Using Dial-UP Connection:

Logged-Data is retrieved at later time when a broken connection is restored.



Source: NYCDOT

45



Source: ITE OET DMS



Support for Configuring/Monitoring and Controlling a Sign

Summary of Operational Needs Supported by the Standard?

1. Manage the DMS Configuration
2. Control the DMS
3. Monitor the Status of the DMS
4. Perform Diagnostics to the DMS System such as pixel testing

SUPPLEMENT

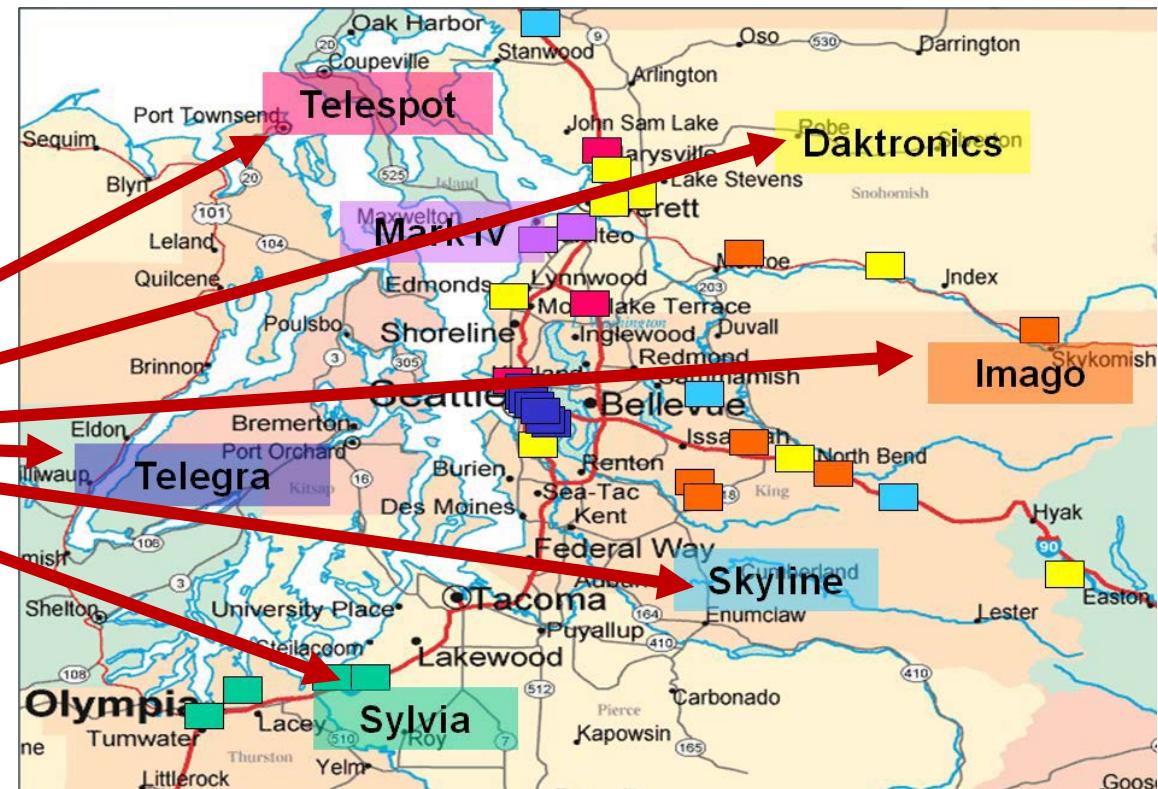


Support for Configuring/Monitoring and Controlling a Sign

Managing the DMS Configuration

Determine the DMS Identity

DMS Type
Make
Location
Id



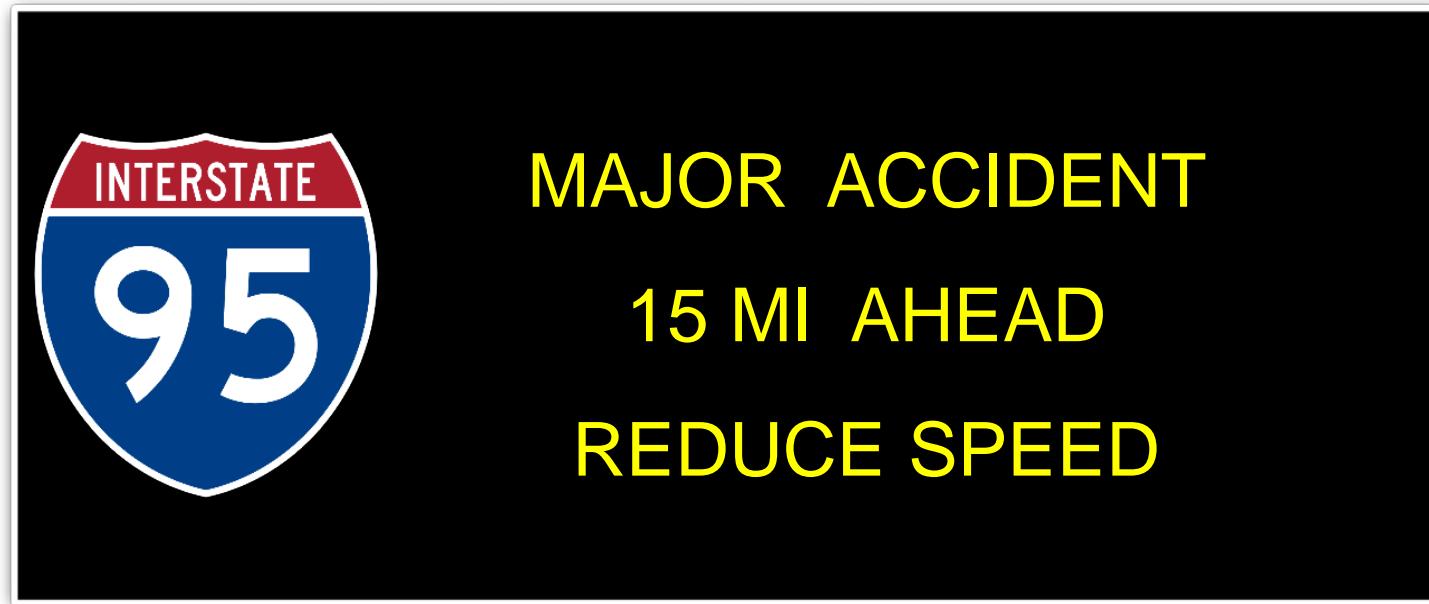
Source: WSDOT



Support for Configuring/Monitoring and Controlling a Sign

Managing the DMS Configuration (cont.)

- Manage Graphics
- Manage Fonts (color, height, width)

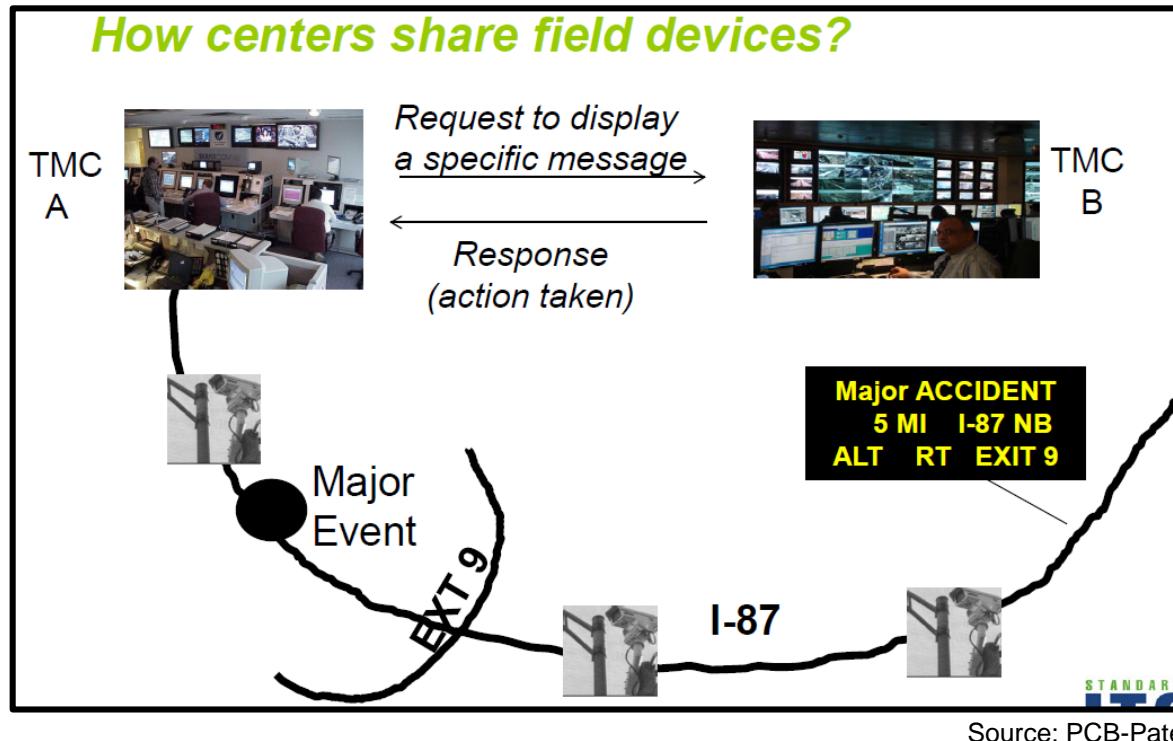


- Manage Brightness-LED (changing lighting conditions)
- Determine Sign Display Capabilities



Support for Configuring/Monitoring and Controlling a Sign

Controlling the DMS



- Control the Sign Face
- Control External Devices
- Control the Brightness Outputs
- Remotely Reset the Sign Controller
- DMS Control by Multiple Locations Centers



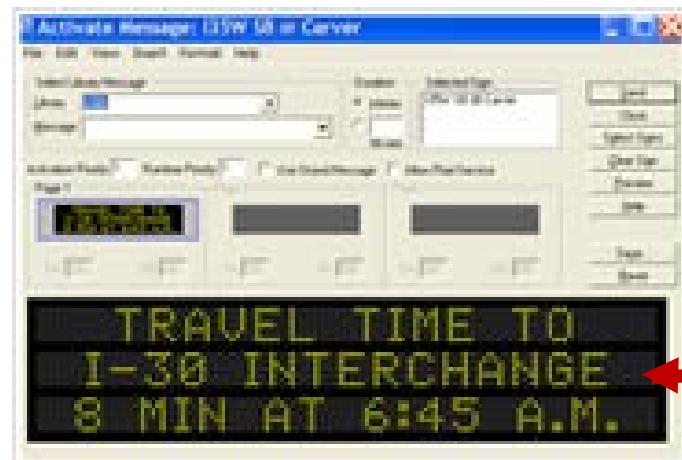
Support for Configuring/Monitoring and Controlling a Sign

Monitoring the Status of the DMS

TMC



Source: NYCDOT



Source Credit: Skyline

DMS Controller



Monitor the Current Message

TMC Work Station Display Confirms the Message



Support for Configuring/Monitoring and Controlling a Sign

Performing Diagnostics to the DMS System

Test the Operational Status of System Components

- Determine Sign Error Conditions (High-Level Diagnostics)
- Monitor Message Errors
- Monitor Sign Environment



Source: Oregon DOT



Module/Driver Failure

Source: WSDOT

Support for Configuring/Monitoring and Controlling a Sign

Performing Diagnostics to the DMS System (cont.)

Test the operational status of system components

- Monitor Door Status
- Monitor Controller Software Operations
- Monitor Power Source
- Monitor Power Voltage
- Pixel Status



Source: ITE OET DMS



Source: ITE OET DMS



Support for Configuring/Monitoring and Controlling a Sign

What if a User Need is NOT Found in NTCIP 1203 v03?

- The standard allows for extensions
- Proprietary extensions are not desired
- Interoperability rests on standardized user needs; may be broken if a proprietary solution is imposed

Caution! Certain Automatic Actions are NOT supported



Examples of DMS Operational Uses

Transportation Operations that Use DMSs

- Freeway Management
- Travel Information
- Incident Management
- Work Zone Management
- Traffic Control
- Parking Management



Source: www.roadtraffic-technology.com



Examples of DMS Operational Uses

Transportation Operations that Use DMS (cont.)

- Route Diversion
- Evacuation
- Public Service & Safety
- Road Weather Information System



Warnings on VMS boards gave drivers a chance to use alternate routes, helping to minimize the backup on northbound I-5.

Source: WSDOT TMC



Examples of DMS Operational Uses

Key Outcomes from ITS Deployments (DMS)

- Improved Traffic Flow
- Coordinated Incident Management
- Reduced Travel Time
- Work Zones-Safety
- Speed Limits Enforcement



Source: FHWA OP



Source: City of Scottsdale

A C T I V I T Y





Question

Which of the following is NOT a DMS operational need?

Answer Choices

- a) Management station remotely configures a DMS sign
- b) Management station monitors and controls a DMS sign
- c) Management station activates the beacon during an incident
- d) Management requests current traffic flow data from the DMS controller



Review of Answers



- a) Management station remotely configures a DMS sign

True. This is a major DMS operational need. Management station configures a sign-type, location, direction, manufacture etc.



- b) Management station monitors and controls a DMS sign

True. Management station remotely manages messages in real-time.



- c) Management station activates the beacon during an incident

True. A beacon is activated to flash mode to make motorists aware of the current, perhaps urgent, message.



- d) Management requests current traffic flow data from the DMS controller

False. DMS is a display device; it does not collect data such as traffic flow data.



Learning Objectives

Review the **structure** of the DMS standard

Identify specific DMS operational needs

Describe the **purpose** of the Protocol Requirements List (PRL) matrix and benefits

Learning Objective 3

Describe the **purpose** of the
Protocol Requirements List (PRL)
matrix and benefits





What Is a PRL?

Protocol Requirements List (PRL) is a Table, a Matrix

- Provides the standardized **relationship** between user needs and their requirements
- As a **template** with fixed columns and multiple rows it guides users and DMS manufacturers/suppliers

USER NEED SECTION NUMBER	USER NEED	FR SECTION NUMBER	FUNCTIONAL REQUIREMENT	CONFORMANCE	SUPPORT / PROJECT REQUIREMENT	ADDITIONAL PROJECT REQUIREMENTS
2.5	Features			M	Yes	

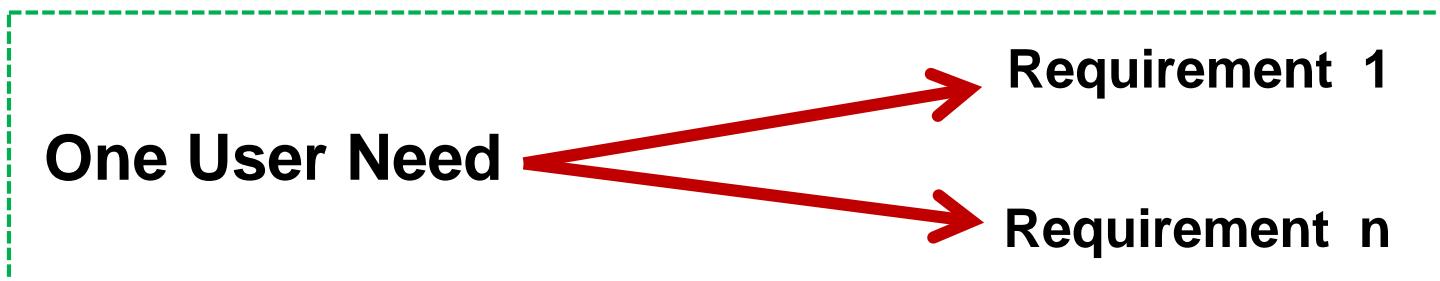


What Is a PRL?

Standardized Relationship Provided by the Standard

Agency selects

Templates Links to
Associated Requirements





What Is a PRL?

Provides Guidance

(Section 3.3, Page 31, Part 1)

- PRL template **guides agency** to select project user needs
- PRL then presents associated requirements to fulfill user needs

USER NEED SECTION NUMBER	USER NEED	FR SECTION NUMBER	FUNCTIONAL REQUIREMENT	CONFORMANCE	SUPPORT / PROJECT REQUIREMENT	ADDITIONAL PROJECT REQUIREMENTS
2.5	Features:			M	Yes	

Agency completes the **rows** by entering selected user needs with associated requirements.



Parts of PRL Provided in the Standard (Section 3.3)

User Need

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			0	Yes / No	

1st line is the headings of the PRL Table (**We cannot Modify Columns**)

2nd line, an example of a user need, with section number-2.5.1.2 and its title

Section number 2.5.1.2, (page 25), find the user need; and determine if it is desired for your project implementation

SUPPLEMENT



Parts of PRL Provided in the Standard (Section 3.3)

Determine if a User Need is Required

2.5.1.2 Determine Sign Display Capabilities

This feature allows the operator to retrieve the necessary information to produce a rendering of a suggested or active message. This feature also allows the system to ensure that a message can be displayed on the DMS. The feature allows the operator to determine the detailed physical limitations of the DMS as well as details regarding the current fonts and any graphics that are stored.

May be desired to provide a graphical rendering of how a DMS sign face may look like

May not be desired if a blank out sign (BOS) is procured

Parts of PRL Provided in the Standard (Section 3.3)

Completing a Project PRL-Functional Requirements

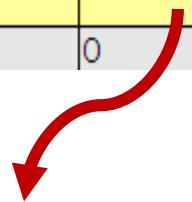
UN Section Number	User Need (UN)	FR Section Number	Functional Requirement (FR)	Conformance	Support / Project Requirement	Additional Project Requirements
2.5.2.3.1	Activate and Display a Message			M	Yes	
		3.5.2.3.1	Activate a Message	M	Yes	
		3.5.2.3.3.5	Retrieve Message	M	Yes	
		3.5.2.3.6	Activate a Message with Status	Drum:M	Yes / NA	

- Third/Fourth columns lists FR section number and title as described in Section 3.5 of the standard

Parts of PRL Provided in the Standard (Section 3.3)

Conformance Column

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		



- Identifies if the user need (or requirement) is Mandatory (M) or Optional (O)
- Certain basic user needs are considered **Mandatory** by the standard that must be selected **YES**

Example: *DMS Matrix Configuration*, must be selected (M)

Parts of PRL Provided in the Standard (Section 3.3)

Conformance Column (cont.)

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).	

The designation **O.2 (1)** means:

- This user need is optional (indicated by the 'O')
- The user need is one of several under the higher-level User Need (2.3.2.3 – DMS Display Matrix Configuration) (indicated by **group '.2'**)
- One of the user needs selected under the higher-level user need must be selected (indicated by the (1))



Parts of PRL Provided in the Standard (Section 3.3)

Conformance Column (cont.)

See page 32 of Standard for details

UN Section Number	User Need (UN)	FR Section Number	Functional Requirement (FR)	Conformance	Support / Project Requirement	Additional Project Requirements
2.5.1.3 (Fonts)	Manage Fonts			VMS:O	Yes / No / NA	

Predicate - <predicate>: Indicates whether this user need is mandatory, optional or applicable, and is dependent on a condition or another feature is supported



- E.g., for **Manage Fonts**, VMS:O indicates if the DMS is a variable message sign, the user need is optional
- Other conditions or features include type of DMS (**BOS, CMS; requires no font management**)-NA





Parts of PRL Provided in the Standard (Section 3.3)

Support/Project Requirement Column

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		0		Yes / No	

Agency/Specifier circles Yes, No or NA to indicate the agency's user needs for the proposed implementation.

- If the Conformance statement for the User Need is Mandatory, you must circle Yes.
- If the Conformance statement is not applicable for your implementation, circle (write) NA.

Parts of PRL Provided in the Standard (Section 3.3)

Additional Project Requirements-Last Column

- Provides additional notes or requirements (implementation)

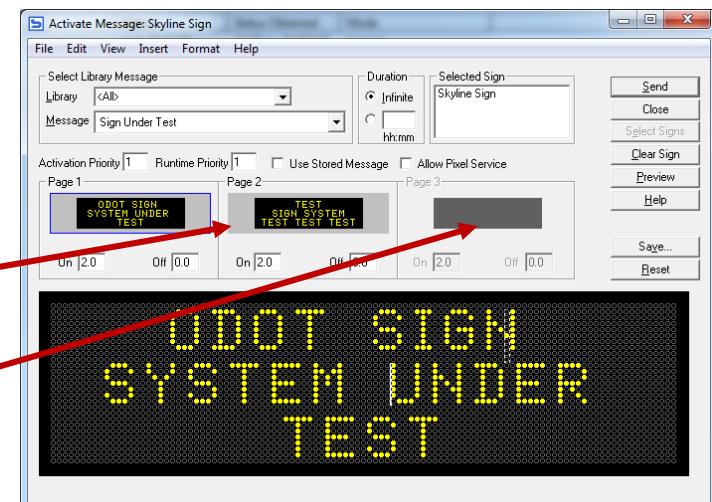
User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		H.2.1	Determine Device Component Information	M	Yes	
		H.2.4	Determine Supported Standards	M	Yes	
2.5.1.2	Determine Sign Display Capabilities		O	Yes / No		
	3.5.1.2.1.1 Determine the Size of the Sign Face		M	Yes		
	3.5.1.2.3.1 Determine Maximum Number of Pages		VMS:M	Yes / NA	The DMS shall support at least _____ (1..255) pages for a single message.	

3.5.1.2.3.1 Determine Maximum Number of Pages

The DMS shall allow a management station to determine the maximum number of pages that can be included in a single message.

How many pages? 1 or 2

Do you really need 3? Costs



Parts of PRL Provided in the Standard (Section 3.3)

Agency Prepares a Customized Project PRL by selecting YES for Support

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
2.5	Features			M	Yes	
2.5.1	Manage the DMS Configuration			M	Yes	
2.5.1.1	Determine the DMS Identity			M	Yes	
	3.5.1.1.1	Determine Sign Type and Technology		M	Yes	
	H.2.1	Determine Device Component Information		M	Yes	
	H.2.4	Determine Supported Standards		M	Yes	
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	
2.5.3.1.5 (Environment)	Monitor Sign Environment			O	Yes / No	
	3.5.3.1.4.7	Monitor Sign Housing Temperatures		M	Yes	
	3.5.3.1.4.8	Monitor Sign Housing Humidity		O	Yes / No	
	3.5.3.1.4.9	Monitor Control Cabinet Temperatures		O	Yes / No	
	3.5.3.1.4.10	Monitor Control Cabinet Humidity		O	Yes / No	
	3.5.3.1.7	Monitor Ambient Environment		Temp:M	Yes / NA	



Benefits of PRL to Stakeholders

Agency Perspective (Project PRL)

- “Communicates” the scope of the desired DMS communication interface
- Makes it easier to specify what the interface is to do (customize)
- “Spells out” conformance requirements
- Acts as a “checklist” to validate the built system
- Aids in achieving interoperability

Did they build **RIGHT** system?





Benefits of PRL to Stakeholders

Vendors/System Developers Perspective

- Everyone is “*connected*” on the same page
- Eliminates “*ambiguity*”- reduces risks
- Vendors “*confirms*” DMS functionality + offer optional features

With a **completed PRL**, your agency, your vendors, system developers, **all parties** know what is expected from the DMS implementation.



A C T I V I T Y



Question

Which of the following is NOT a correct statement?

Answer Choices

- a) PRL is used to ensure conformance to the standard
- b) PRL only identifies mandatory user needs/requirements
- c) PRL is used as a validation checklist
- d) PRL may be used to provide additional notes

Review of Answers



- a) PRL is used to ensure conformance to the standard

True. The statement is valid; we do use PRL to ensure Conformance to the standard.



- b) PRL only identifies Mandatory user needs/requirements

False. The statement is invalid; PRL also allows agency to select optional user needs and associated requirements, in addition to mandatory ones.



- c) PRL is used as a validation checklist

True. PRL helps in validating user needs-Right system being built.



- d) PRL may be used to provide additional notes

True, Last column of a PRL allows users to make special comments if required.

Learning Objectives

Review the **structure** of the DMS standard

Identify specific DMS operational needs

Describe the **purpose** of the Protocol Requirements List (PRL) matrix and benefits

Discuss how to **prepare a project level PRL** with user needs and their associated requirements



Learning Objective 4

Discuss how to **prepare a project level PRL** with user needs and their associated requirements

How PRL Fits into the DMS Specification

Procurement Contract Specifications

1

2

3

Hardware Specifications

Functional Req.
Performance Req.
Structural Req.
Mechanical Req.
Electrical Req.
Environmental Req.

Software Specifications

Functional Req.
Performance Req.

Communications Interface Specifications

User Needs
Functional Req.
Project PRL, RTM
Testing Documentation

Contractual requirements during:

- ✓ System development
- ✓ Testing
- ✓ Deployment/integration
- ✓ Operations/maintenance
- ✓ Project management

**DMS INTERFACE
SPECIFICATION
PRL**



Review Steps (Tailoring) to Select User Needs and Associated Requirements

Key Points for Completing a Project PRL

PRL must be consistent with the hardware specification

Example: Temperature gauge, LED or Fiber Optic signs

PRL must be based on the NTCIP 1203 v03 with SNMP Interface

Include Need-based specific DMS parameters-NOT All YOU Can GET! Not a Wish list

Your DMS Specification Must have a fully completed PRL

Completing a Project PRL-User Needs

USER NEED SECTION NUMBER	USER NEED	FR SECTION NUMBER	FUNCTIONAL REQUIREMENT	CONFORMANCE	SUPPORT / PROJECT REQUIREMENT	ADDITIONAL PROJECT REQUIREMENTS
2.5.3.1.5 (Environment)	Monitor Sign Environment			O	Yes / No	
		3.5.3.1.4.7	Monitor Sign Housing Temperatures	M	Yes	
		3.5.3.1.4.8	Monitor Sign Housing Humidity	O	Yes / No	
		3.5.3.1.4.9	Monitor Control Cabinet Temperatures	O	Yes / No	
		3.5.3.1.4.10	Monitor Control Cabinet Humidity	O	Yes / No	
		3.5.3.1.7	Monitor Ambient Environment	Temp.M	Yes / NA	





Review Steps (Tailoring) to Select User Needs and Associated Requirements

Conformance Versus Compliance

- **Conformance:** Meets a specified standard
 - To claim "Conformance" to NTCIP 1203 v03, the vendor shall minimally satisfy the mandatory requirements selected (YES)
 - Vendors that provide additional features beyond the completed PRL are still conformant as long as they conform with the requirements of NTCIP 1203 v03 and its normative references
- **Compliance:** Meets an agency specification

Complete Project PRL with Entries (Populating Table)

Fill-in PRL with User Needs/Requirements

USER NEED SECTION NUMBER	USER NEED	FR SECTION NUMBER	FUNCTIONAL REQUIREMENT	CONFORMANCE	SUPPORT / PROJECT REQUIREMENT	ADDITIONAL PROJECT REQUIREMENTS
2.5.3.1.5 (Environment)	Monitor Sign Environment			O	Yes / No	
		3.5.3.1.4.7	Monitor Sign Housing Temperatures	M	Yes	
		3.5.3.1.4.8	Monitor Sign Housing Humidity	O	Yes / No	
		3.5.3.1.4.9	Monitor Control Cabinet Temperatures	O	Yes / No	
		3.5.3.1.4.10	Monitor Control Cabinet Humidity	O	Yes / No	
		3.5.3.1.7	Monitor Ambient Environment	Temp:M	Yes / NA	

- Use the Support/Project Requirement column to indicate if the user need is required for the implementation
- If the YES is selected, the requirements associated with that user need are also selected

Commonly Used DMS User Needs in PRL

Fill-in PRL with User Needs/Requirements

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
2.4.2	Operational Environment			M	Yes	
2.4.2.1	Live Data Exchange			M	Yes	
	3.4.1.1	Retrieve Data		M	Yes	
	3.4.1.2	Deliver Data		M	Yes	
	3.4.1.3	Explore Data		M	Yes	
	3.4.4.1	Determine Current Access Settings		M	Yes	
	3.4.4.2	Configure Access		M	Yes	The DMS shall support at least _____ access levels in addition to the administrator.

DMS Specification **MUST Select [YES]** these User Needs and associated Requirements; **First Step to Achieving Interoperability.**

2.5	Features		M	Yes	
2.5.1	Manage the DMS Configuration		M	Yes	
2.5.1.1	Determine the DMS Identity		M	Yes	
	3.5.1.1.1	Determine Sign Type and Technology	M	Yes	

EXAMPLE

Commonly Used DMS User Needs in PRL

Fill-in PRL with User Needs/Requirements

USER NEED SECTION NUMBER	USER NEED	FR SECTION NUMBER	FUNCTIONAL REQUIREMENT	CONFORMANCE	SUPPORT / PROJECT REQUIREMENT	ADDITIONAL PROJECT REQUIREMENTS
--------------------------	-----------	-------------------	------------------------	-------------	-------------------------------	---------------------------------

2.5.2.3	Control the Sign Face		M	Yes		
2.5.2.3.1	Activate and Display a Message		M	Yes		
		3.5.2.3.1	Activate a Message	M	Yes	
		3.5.2.3.3.5	Retrieve Message	M	Yes	

Specification Must selects YES.

2.5.3.1.8 (Door)	Monitor Door Status		O	Yes	No	
		3.5.3.1.3.10	Monitor Door Status	M	Yes	

Specification selects YES, if Door status is monitored.

EXAMPLE

Commonly Used DMS User Needs in PRL

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
2.5.2	Control the DMS			M	Yes	
2.5.2.1	Control a DMS from More than One Location			M	Yes	
		3.5.2.1	Manage Control Source	M	Yes	
		3.6.4 †	Supplemental Requirements for Control Modes	M	Yes	

2.5.2.1 Control a DMS from More than One Location

This feature addresses the need for DMS to be controlled both remotely (e.g., from one or more central computers) and locally (e.g., from the controller directly or from a laptop computer connected to the controller).

In summary, PRL has all your user needs and associated requirements-all in **ONE place-together with solid relationship**

A C T I V I T Y



Question

Which of the following is a FALSE statement related to a DMS specification?

Answer Choices

- a) DMS specification includes a PRL
- b) Conformance requires only meeting mandatory user needs
- c) Compliance requires only mandatory user needs
- d) Vendor must use the project PRL

Review of Answers



- a) DMS specification includes a PRL

True. The statement is true; PRL must be in every DMS specification.



- b) Conformance requires only mandatory user needs

True. The statement is true; only Mandatory user needs must be met to conform to the DMS standard.



- c) Compliance requires only meeting mandatory user needs

False. The vendor must meet mandatory and selected optional user needs for compliance to specification.



- d) Vendor must use the project PRL

True. The statement is true; the vendor must use agency PRL.

Module Summary

Review the **structure** of the DMS standard

Identify specific DMS operational needs

Describe the **purpose** of the Protocol Requirements List (PRL) matrix and benefits

Discuss how to **prepare a project level PRL** with user needs and their associated requirements

We Have Now Completed A311a in the DMS Curriculum



Module A311a: Understanding **User Needs** for DMS Systems based on NTCIP 1203 Standard v03

Module A311b: Specifying **Requirements** for DMS Systems based on NTCIP 1203 Standard v03

Module T311: Applying Your **Test Plan** to the NTCIP 1203 v03 DMS Standard

Next Course Module

Module A311b: Specifying Requirements for NTCIP 1203 v03 DMS Standard

Concepts taught in next module (Learning Objectives):

- 1) Briefly review the structure of the DMS Standard
- 2) Explain the purpose of requirements traceability matrix (RTM) and its benefits
- 3) Prepare a project-level RTM with standard supplied requirements and design content (concepts)
- 4) Prepare a DMS specification (check list)

Thank you for completing this module.

Feedback

Please use the Feedback link below to provide us with your thoughts and comments about the value of the training.

Thank you!

