



W E L C O M E



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

Welcome



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A screenshot of the website for the ITS Professional Capacity Building Program. The page features a blue header with the United States Department of Transportation logo and navigation links. The main content area includes a navigation menu, a large image of people in a classroom, and several sections: 'Welcome to ITS Professional Capacity Building', 'FREE TRAINING', and 'WHAT'S NEW'. The 'WHAT'S NEW' section lists recent updates such as new web-based training and NHI courses.

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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.

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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

www.pcb.its.dot.gov



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



Instructor



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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



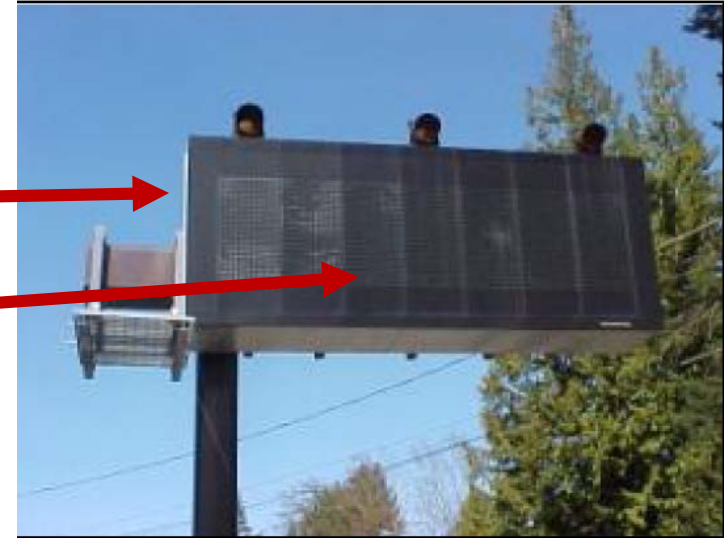
Source: FDOT

How This Standard Fits into the Family of NTCIP Standards

Major Components of a DMS System

Sign Housing

Sign Face

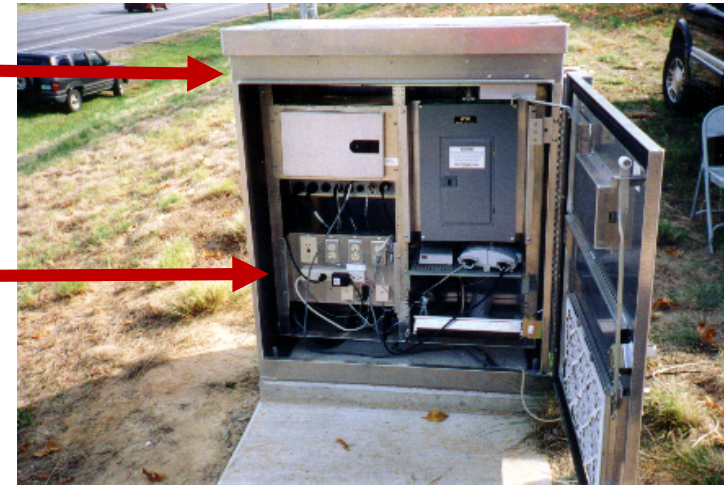


Source: WSDOT Handbook

Cabinet

(Located close to the sign)

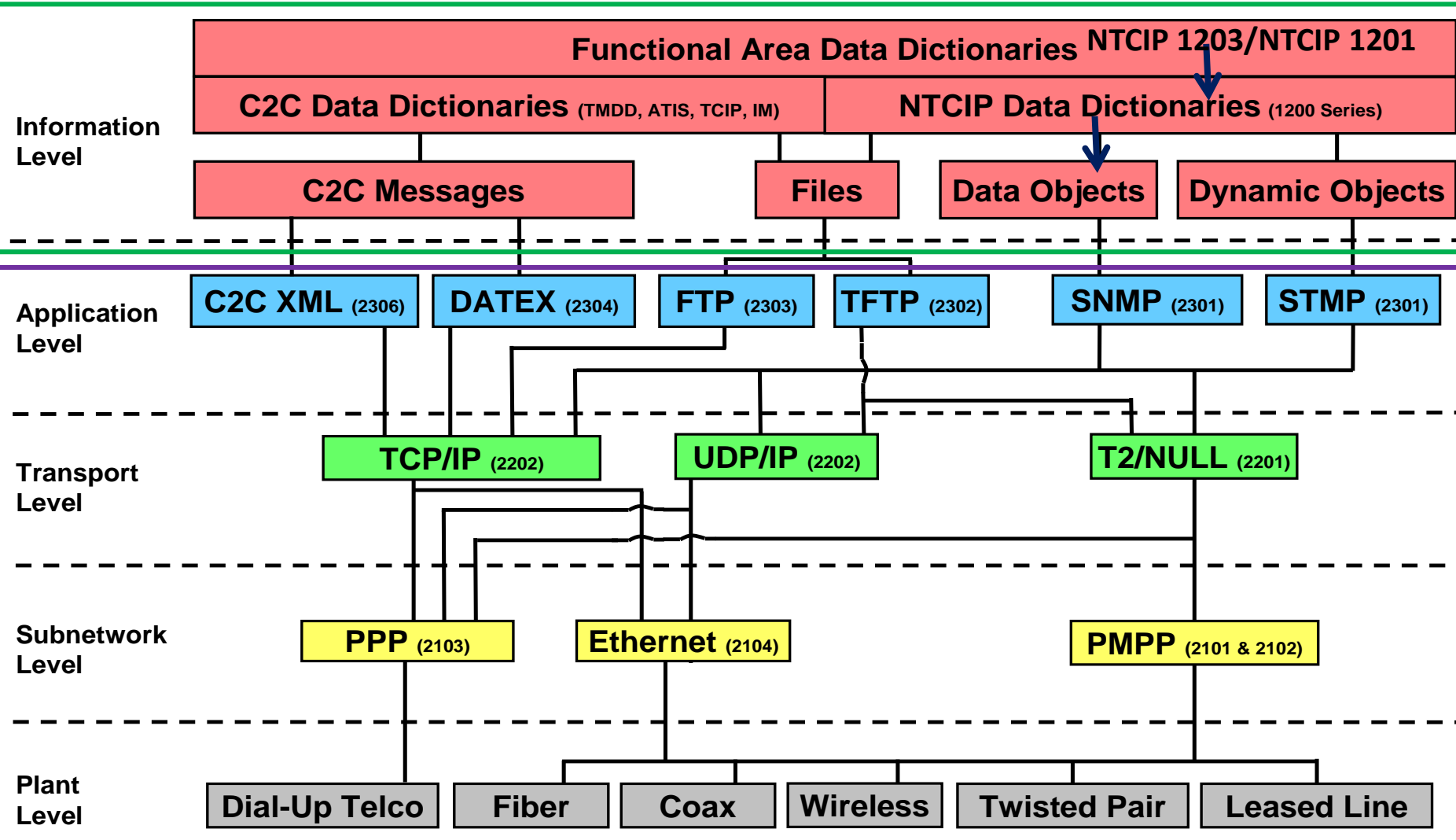
Controller



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

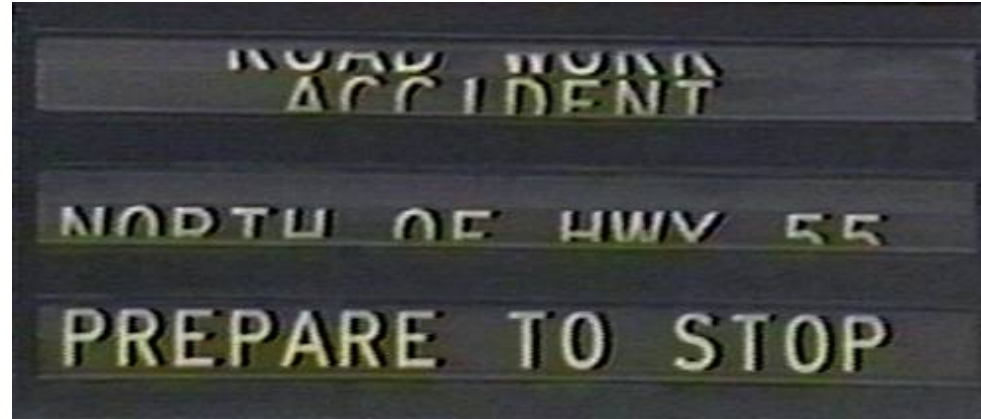
Types of DMS and Technologies Examples

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



Source: MNDOT

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

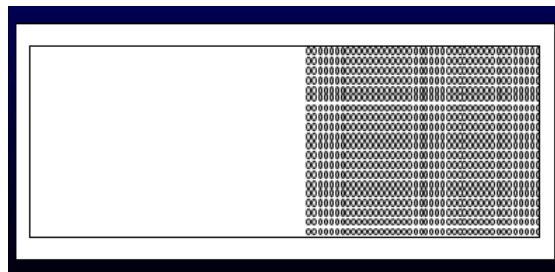
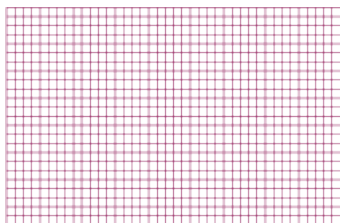


Source: Caltrans D

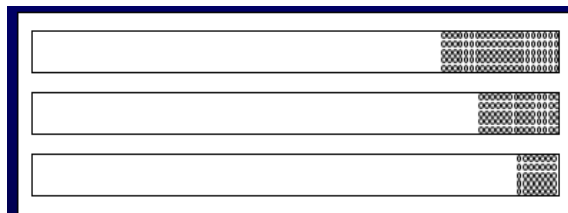
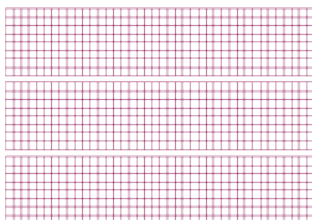
Types of DMS and Technologies Examples

Display Surface Matrix Configurations

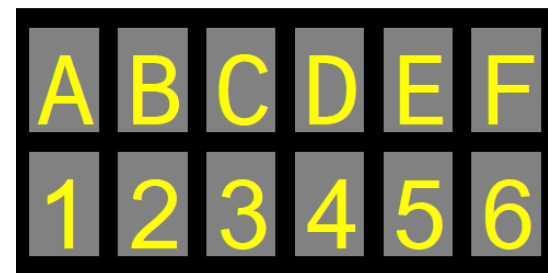
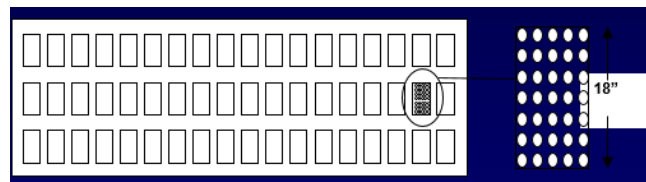
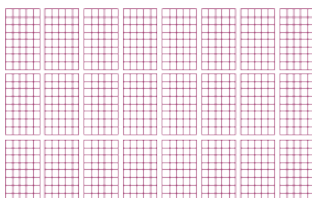
Full matrix



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**



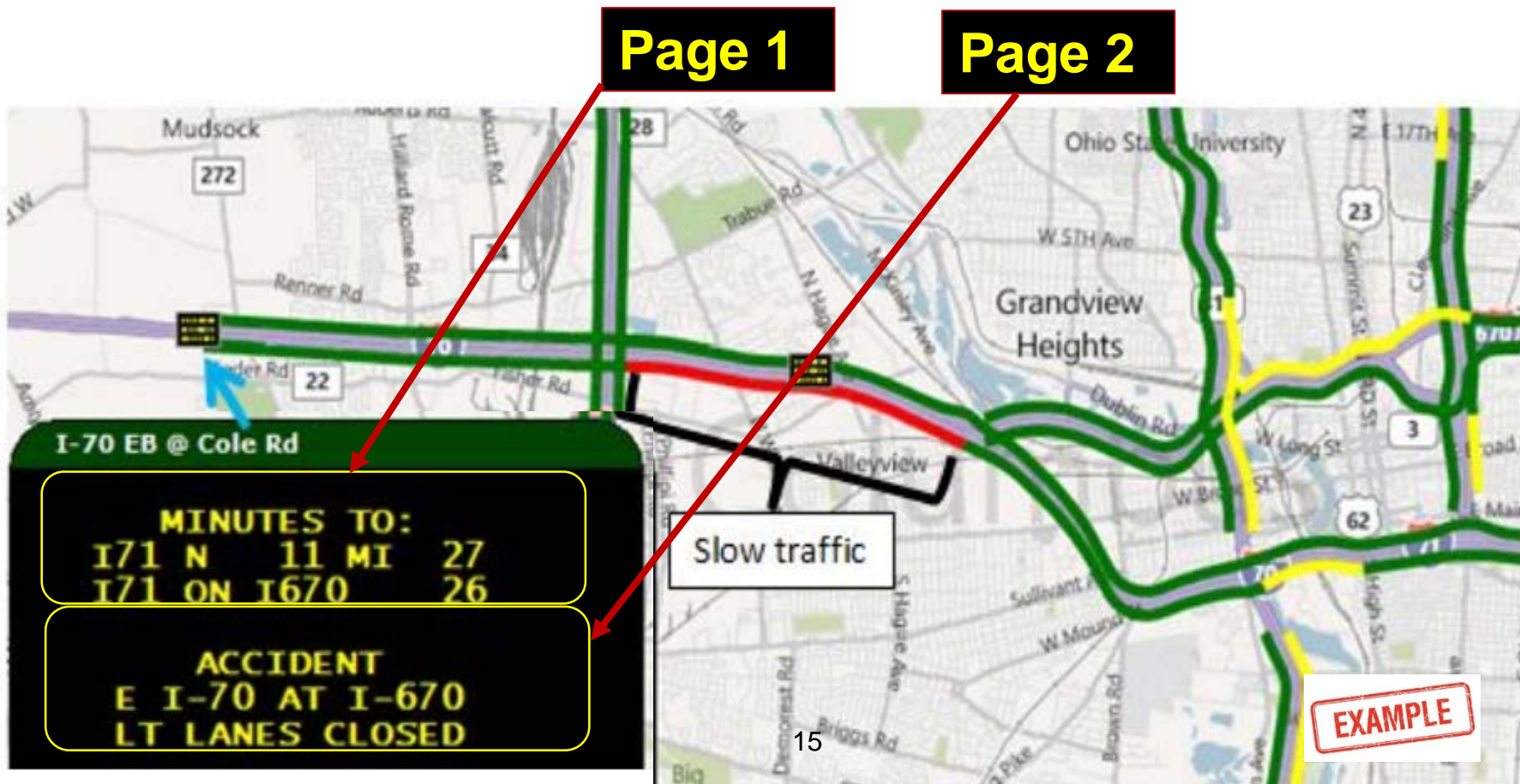
Source: WSDOT

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.



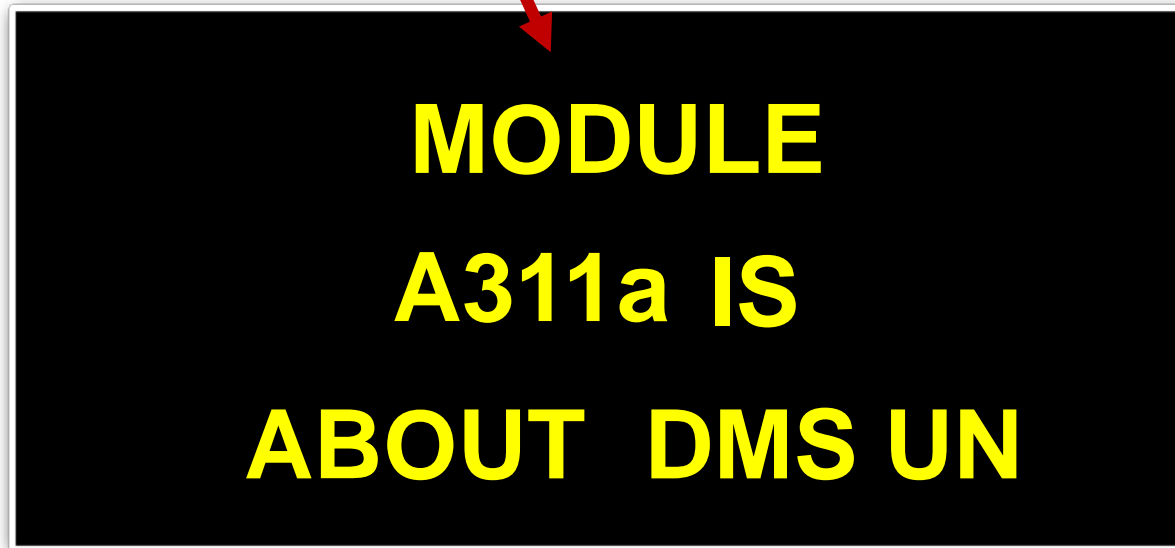
Types of DMS and Technologies

How a Message “Appears” on the Surface

Markup Language for Transportation Information (MULTI)

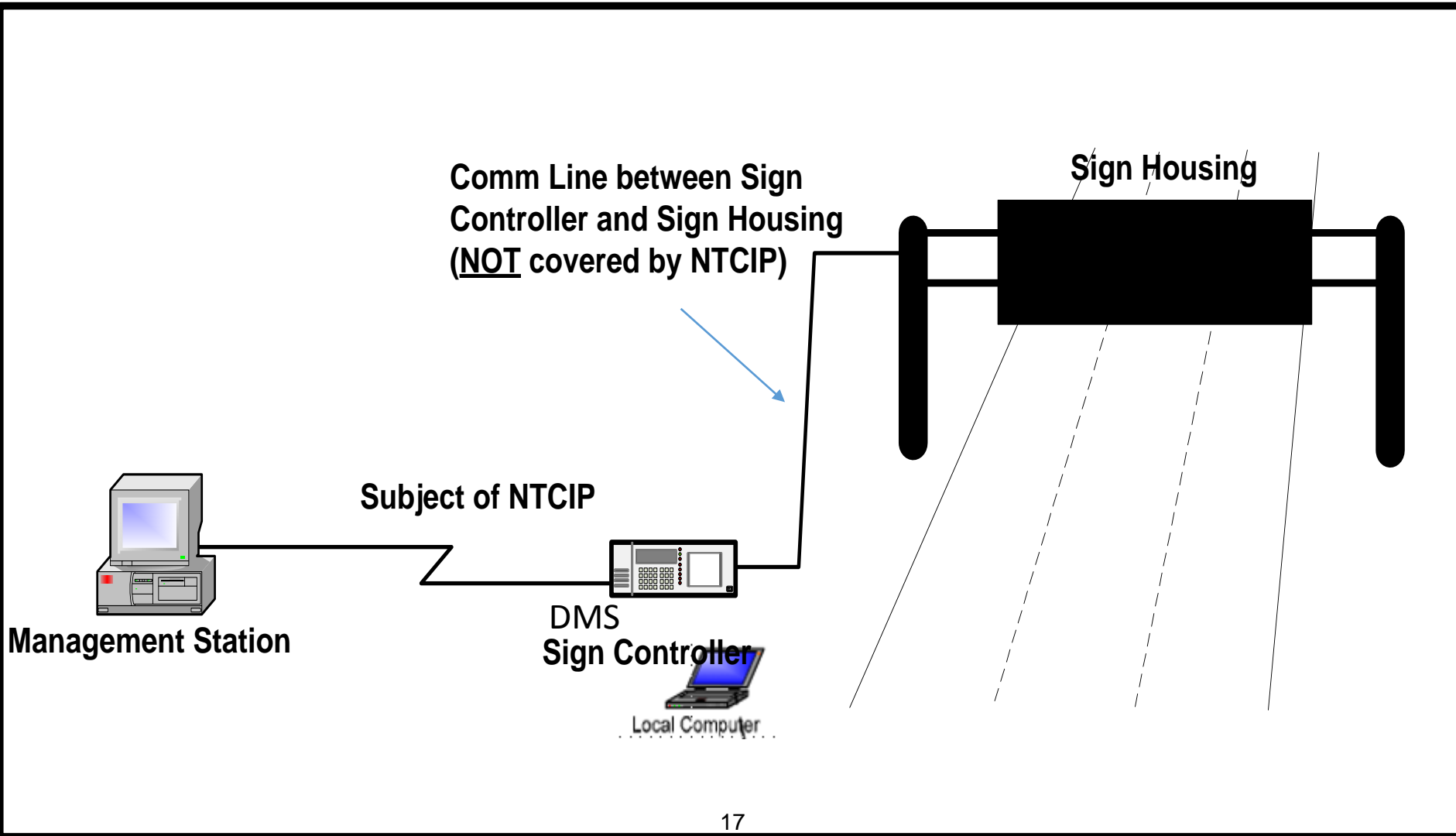
is similar to HTML where text is transmitted,

and [tags define how the text appears-
displayed]



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?

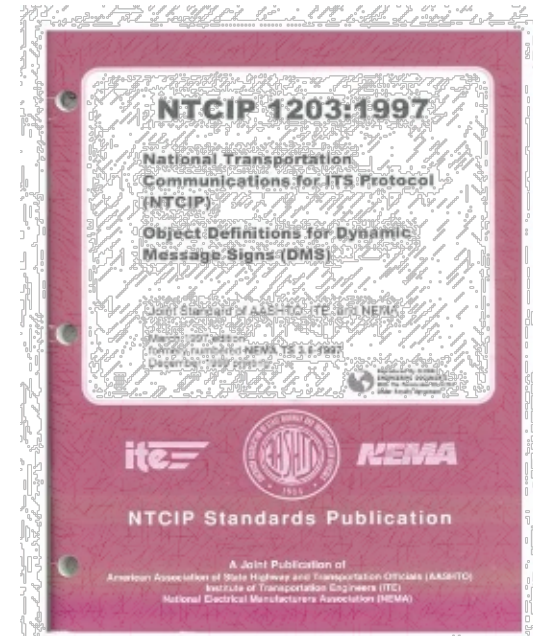
v01 was published in 1997
Amended in 2001, Non-SEP based

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

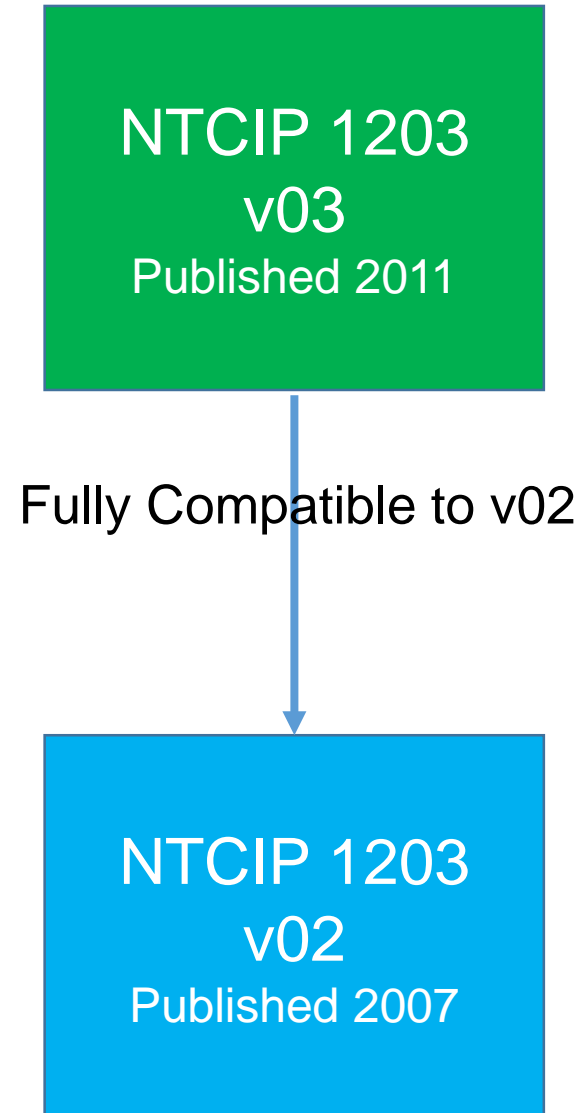


Structure of Standard (Sections)

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.





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

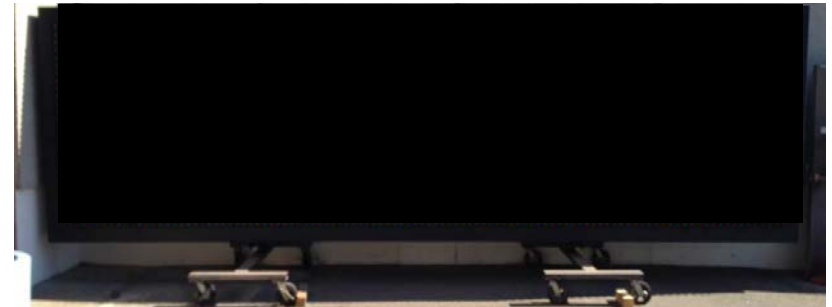
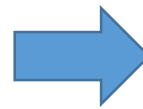
2.5.2.3.4 Blank a Sign

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

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

NTCIP 1203 v03



Communications Interface



ACTIVITY





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



What Are You Trying to Do with a DMS System?

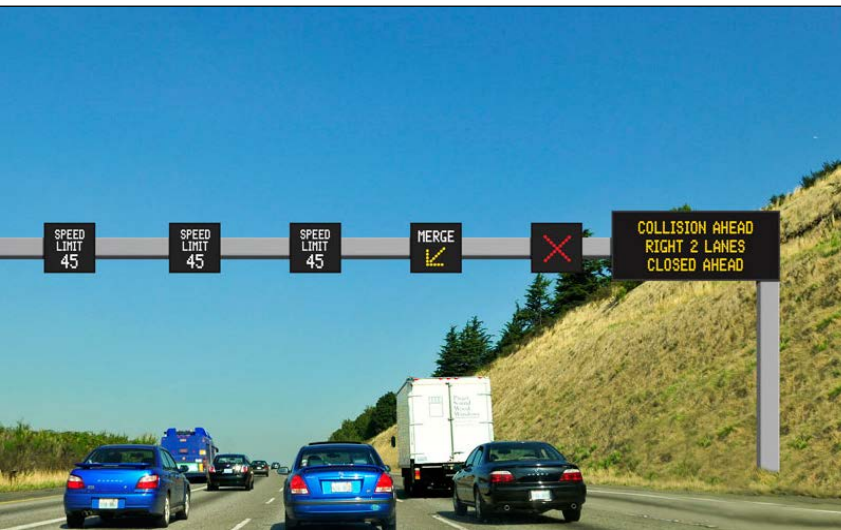
Convey Advisory Information to the Traveling Public: HOV Lane Access Requirements



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: FHWA



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
- Change in Condition



Source: ITE



Source: Iowa DOT



Source: ops.fhwa.dot.gov



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: NYCDOT

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



Source: ITE OET DMS



Support for Configuring/Monitoring and Controlling a Sign

Summary of Operational Needs Supported by the Standard?

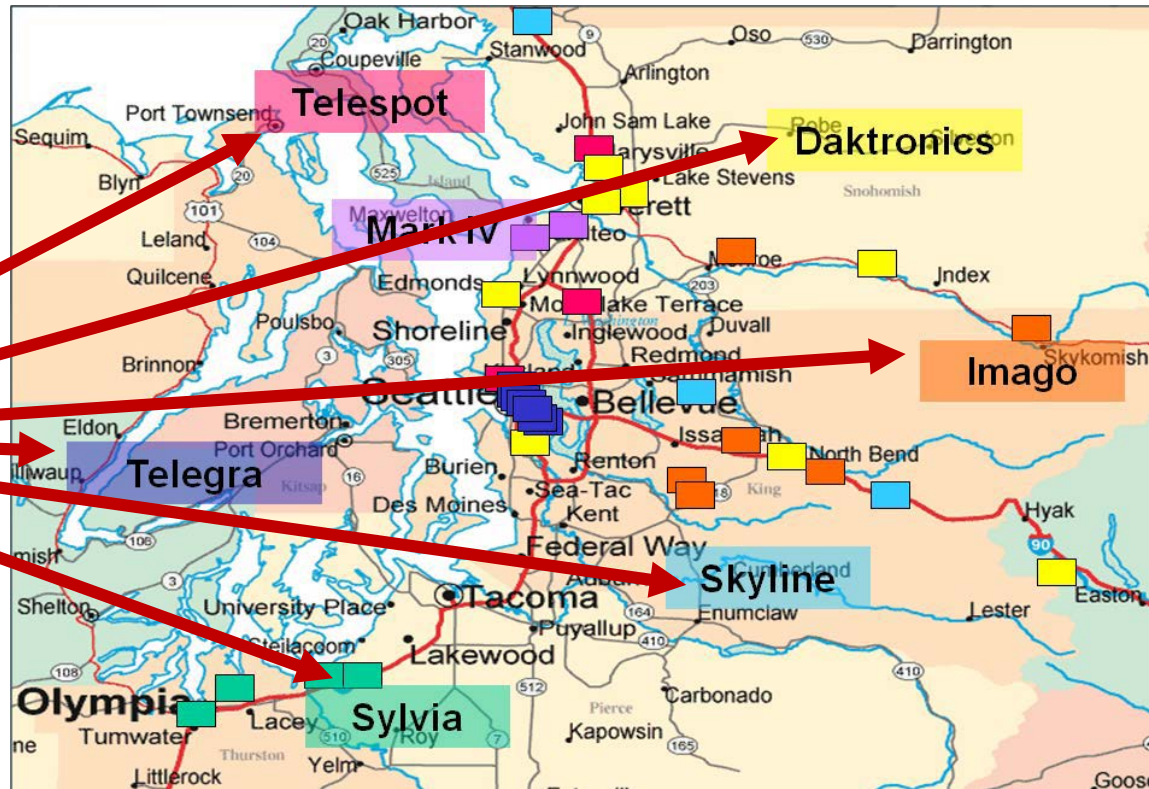
1. Manage the DMS Configuration
2. Control the DMS
3. Monitor the Status of the DMS
4. Perform Diagnostics to the DMS System such as pixel testing

SUPPLEMENT

Support for Configuring/Monitoring and Controlling a Sign

Managing the DMS Configuration

Determine the DMS Identity



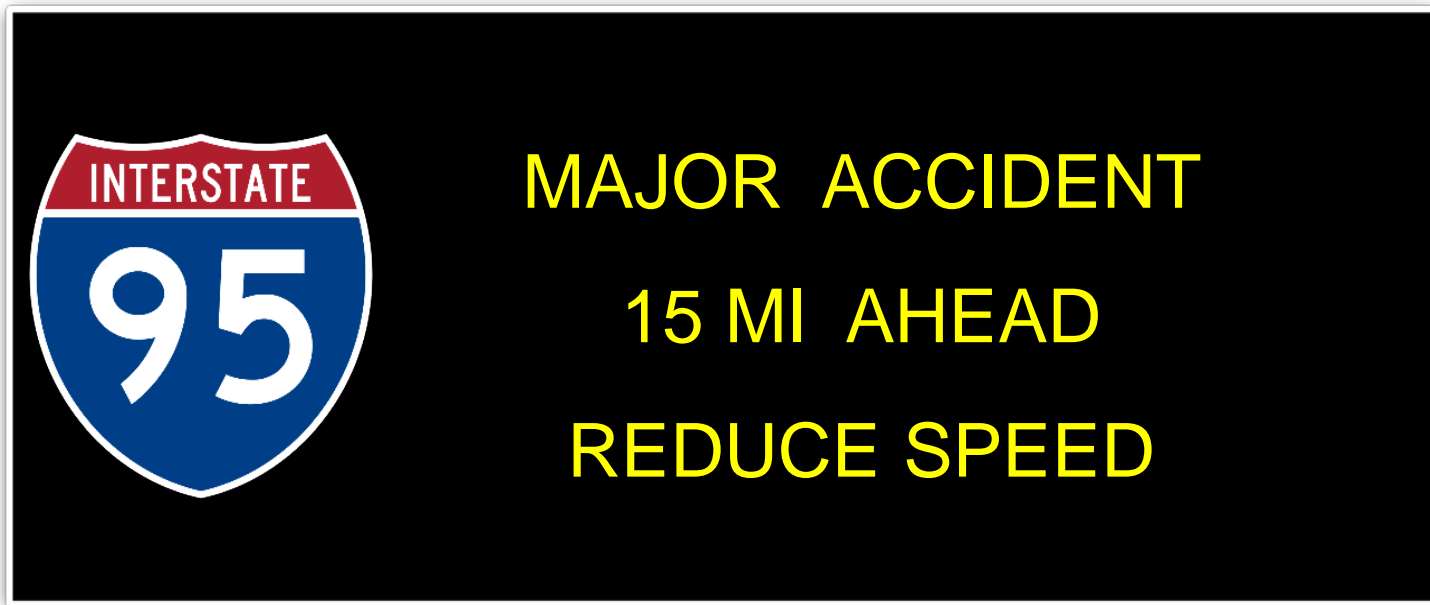
Source: WSDOT



Support for Configuring/Monitoring and Controlling a Sign

Managing the DMS Configuration (cont.)

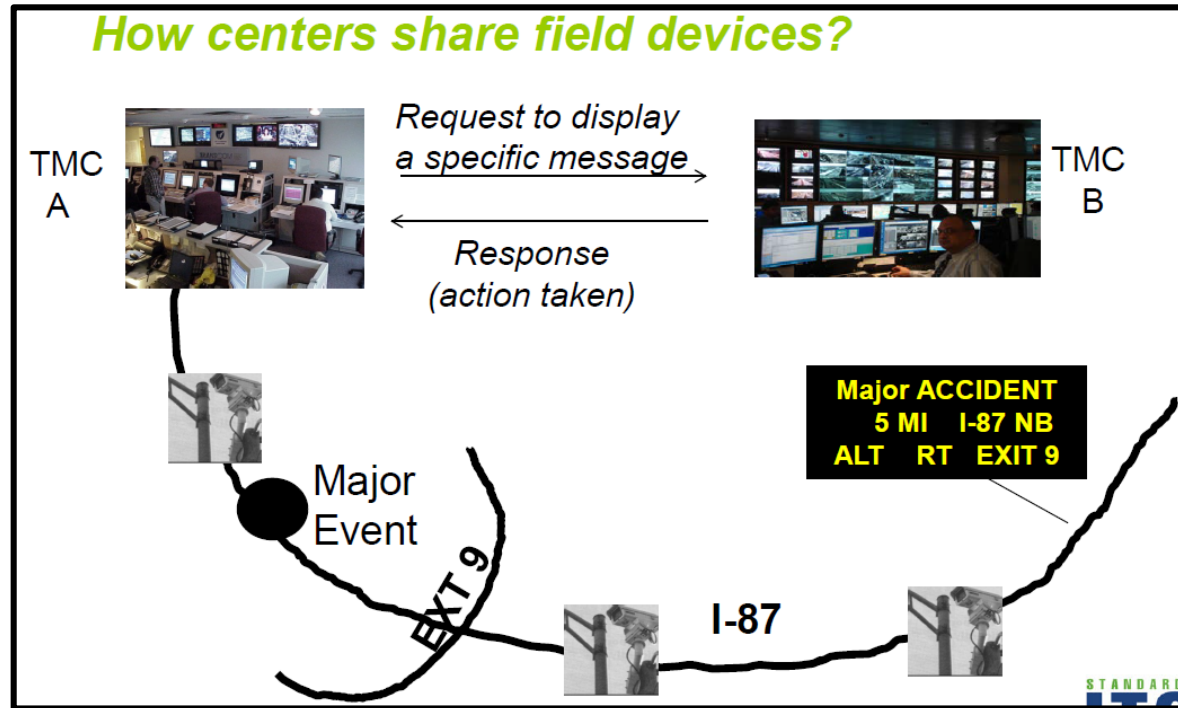
- Manage Graphics
- Manage Fonts (color, height, width)



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

Support for Configuring/Monitoring and Controlling a Sign

Controlling the DMS



Source: PCB-Patel

- 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

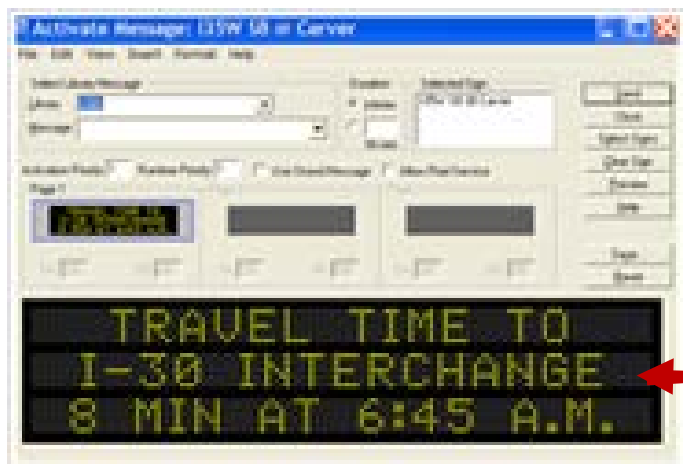


Source: NYCDOT

DMS Controller

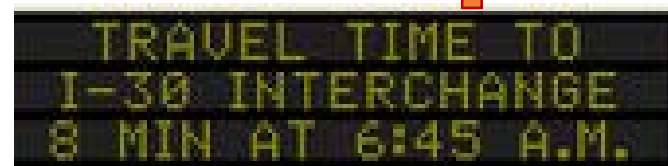


Monitor the Current Message



Source Credit: Skyline

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



WORKERS
PRESENT
AHEAD

SPEED
REDUCED
NEXT 3MI

Source: FHWA OP



Source: City of Scottsdale

ACTIVITY





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

One User Need → **Requirement 1** **Minimum**

One User Need → **Requirement 1**
→ **Requirement n**

Many User Needs → **Requirement 1**

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

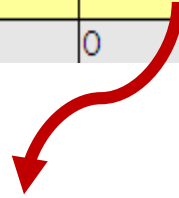
UN Section Number	User Need (UN)	FR Section Number	Functional Requirement (FR)	Conformance	Support / Project Requirement	Additional Project Requirements
2.5.2.3.1	Activate and Display a Message			M	Yes	
		3.5.2.3.1	Activate a Message	M	Yes	
		3.5.2.3.3.5	Retrieve Message	M	Yes	
		3.5.2.3.6	Activate a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

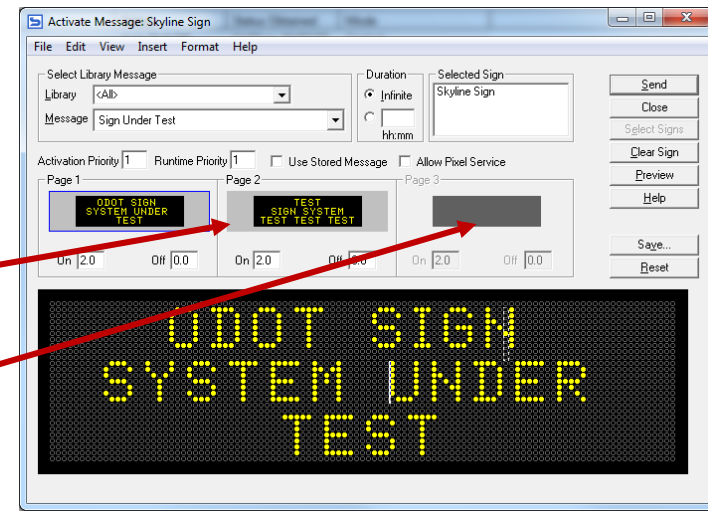
USER NEED SECTION NUMBER	USER NEED	FR SECTION NUMBER	FUNCTIONAL REQUIREMENT	CONFORMANCE	SUPPORT / PROJECT REQUIREMENT	ADDITIONAL PROJECT REQUIREMENTS
		H.2.1	Determine Device Component Information	M	Yes	
		H.2.4	Determine Supported Standards	M	Yes	
2.5.1.2	Determine Sign Display Capabilities			O	Yes / 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.



ACTIVITY



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

Hardware Specifications

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

2

Software Specifications

Functional Req.
Performance Req.

3

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			<input type="radio"/>	<input checked="" type="radio"/> Yes / No	
		3.5.3.1.4.7	Monitor Sign Housing Temperatures	M	<input type="radio"/> Yes	
		3.5.3.1.4.8	Monitor Sign Housing Humidity	<input type="radio"/>	<input type="radio"/> Yes / No	
		3.5.3.1.4.9	Monitor Control Cabinet Temperatures	<input type="radio"/>	<input type="radio"/> Yes / No	
		3.5.3.1.4.10	Monitor Control Cabinet Humidity	<input type="radio"/>	<input type="radio"/> Yes / No	
		3.5.3.1.7	Monitor Ambient Environment	Temp:M	<input type="radio"/> 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
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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	
		3.5.2.3.5	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**

EXAMPLE

ACTIVITY



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!