



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

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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

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

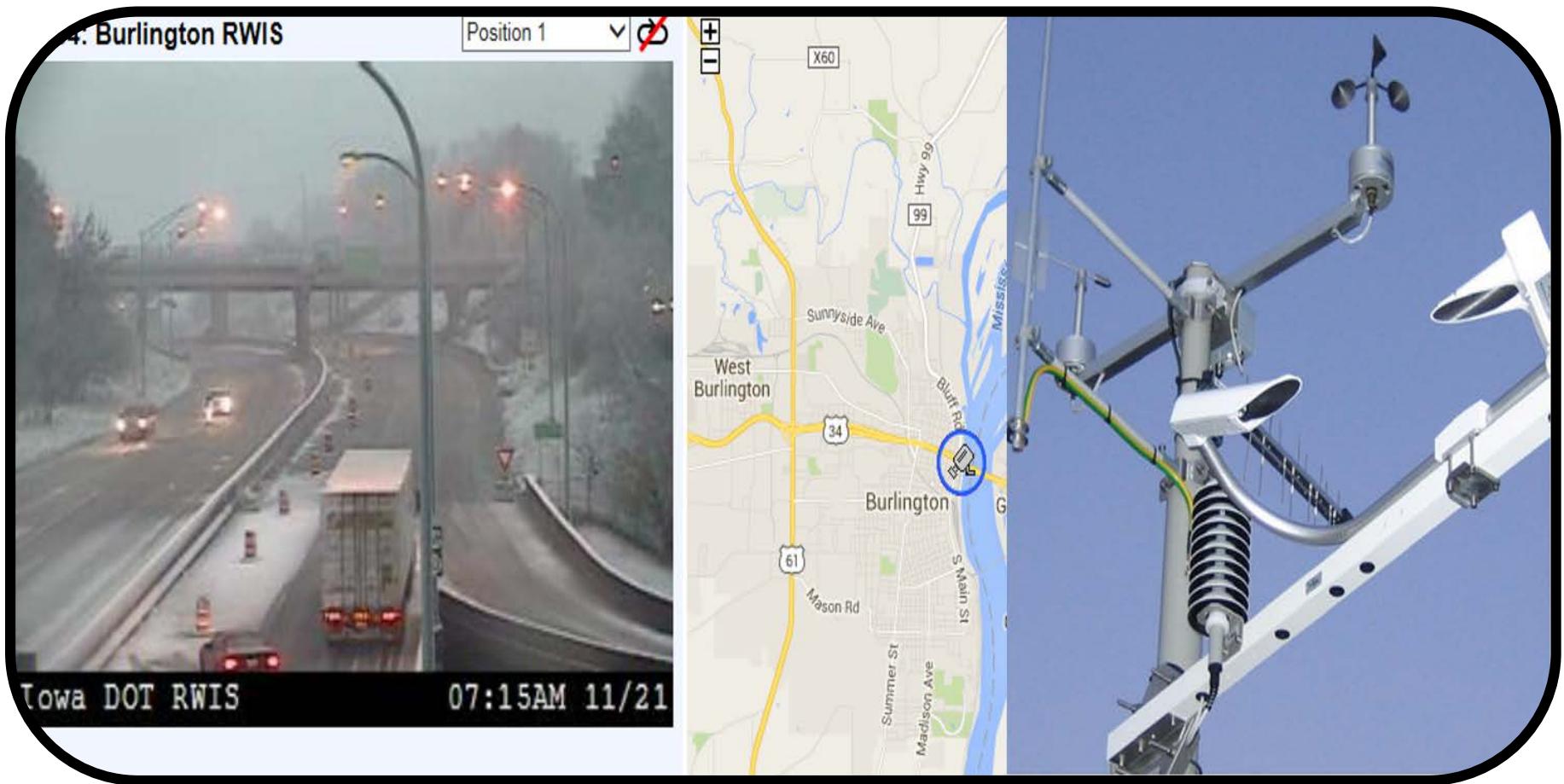
The ITS PCB Program and partners offer many free ITS training courses.

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

www.pcb.its.dot.gov

A313a:

Understanding User Needs for ESS Systems based on NTCIP 1204 v04 Standard



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 standard

Identify specific ESS operational needs

Use the **PRL** to select the user needs and
traceability to requirements

Discuss how to prepare a project level
PRL for ESS specification

Learning Objective 1

Review the **structure** of the standard

Terminology

Sensor

Sensor is a device that responds to a physical stimulus and transmits a resulting **impulse** to a remote processing unit



Source: Temperature Probe, FHWA

Terminology

Environmental Sensor Station (ESS)

Location on the Roadway/Bridge



Source: MDOT

ESS collects weather data using range of sensors



Source: FDOT Bridge Wind Speed Monitor Installation. FHWA

Terminology

Remote Processing Unit (RPU) is a Part of a Controller

- As part of a field controller, RPU **collects and transmit data** to the management station
- RPU is located close to sensors

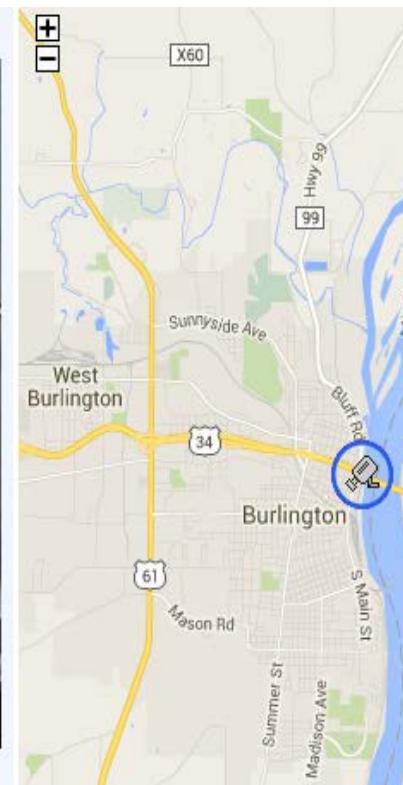
Management Station



Terminology

Road Weather Information System (RWIS)

RWIS is a **network** of ESS that relay road and weather conditions to a computer system

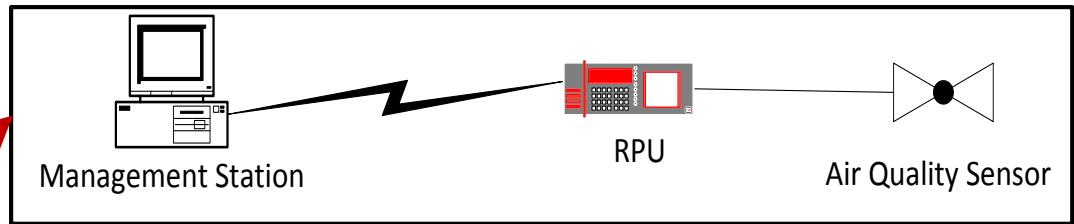


Source: Iowa DOT RWIS Camera Images

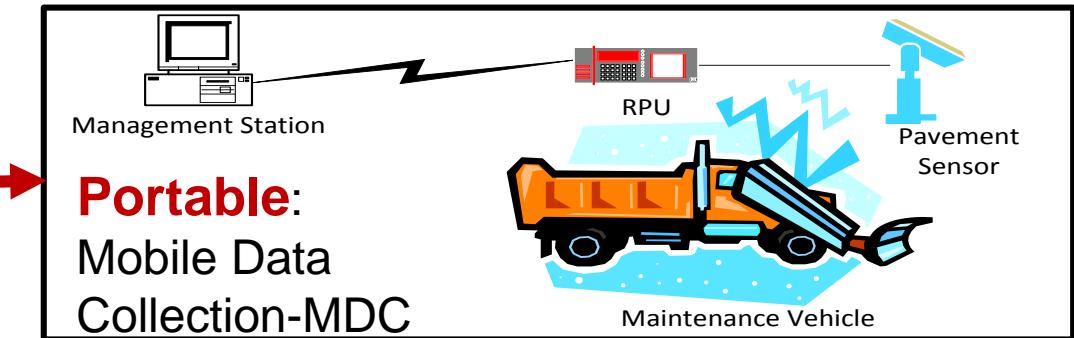
Terminology

Types of RWIS

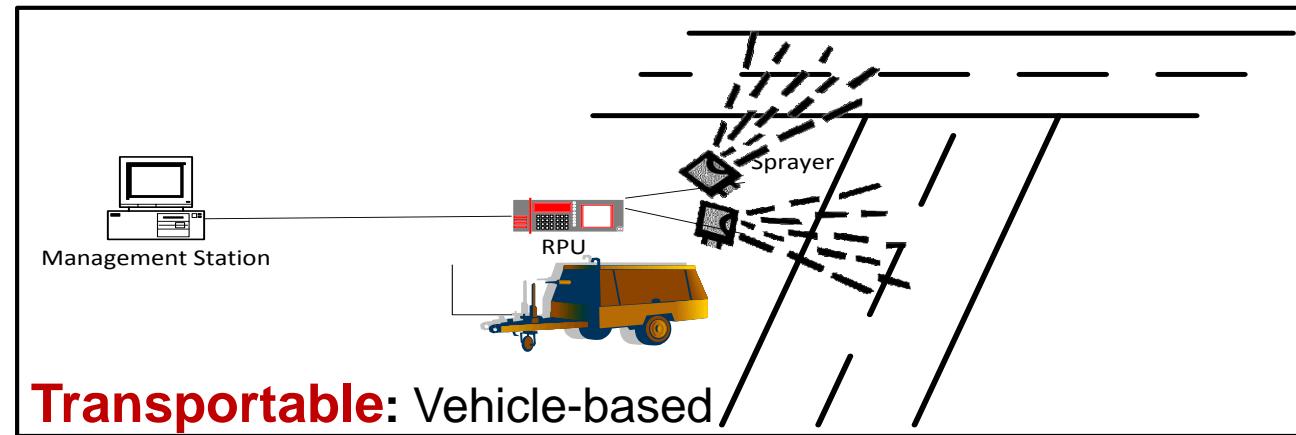
Permanent: Fixed Locations-based ESS



Portable:
Mobile Data Collection-MDC



Transportable: Vehicle-based



Terminology

Flashing Beacons



Flashing Beacons are used to **warn public** on current and anticipated flooding conditions



Example: Flashing Beacon with optional video monitoring

Terminology

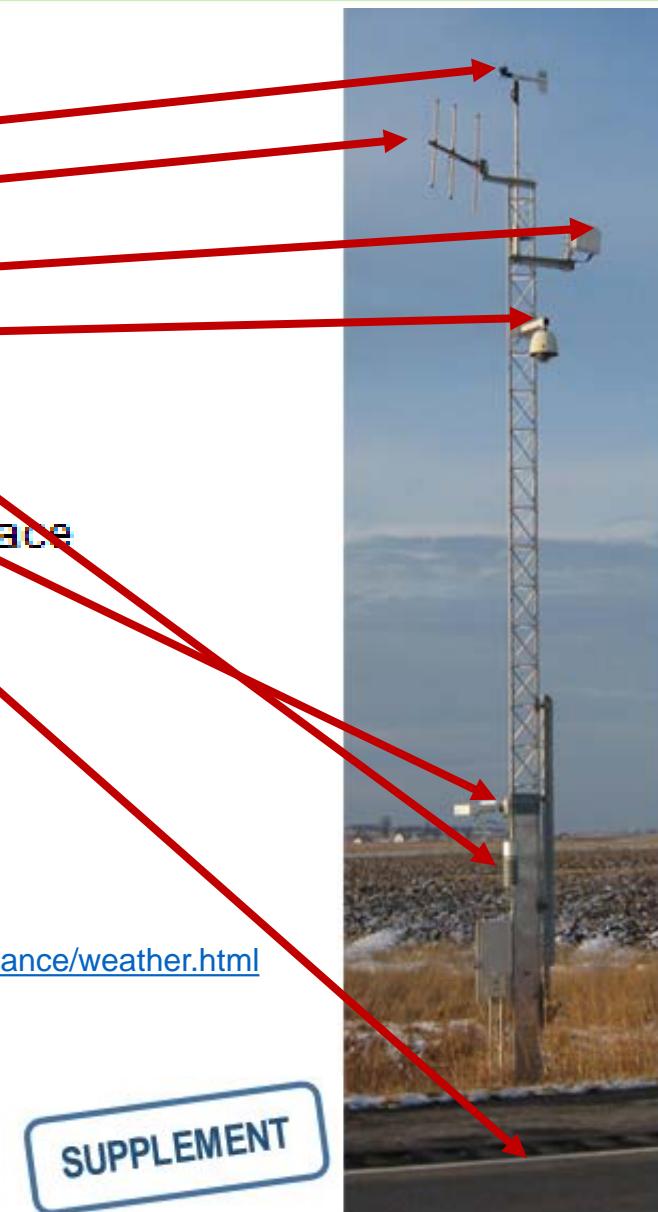
Example: IOWA DOT RWIS

1. Wind speed and direction sensor
2. Antenna for communications
3. Traffic speed and traffic count sensor
4. Pan-tilt-zoom color camera
5. Precipitation and visibility sensor
6. Air temperature and Relative Humidity sensor
7. Road surface temperature sensor and sub surface temperature sensor below pavement



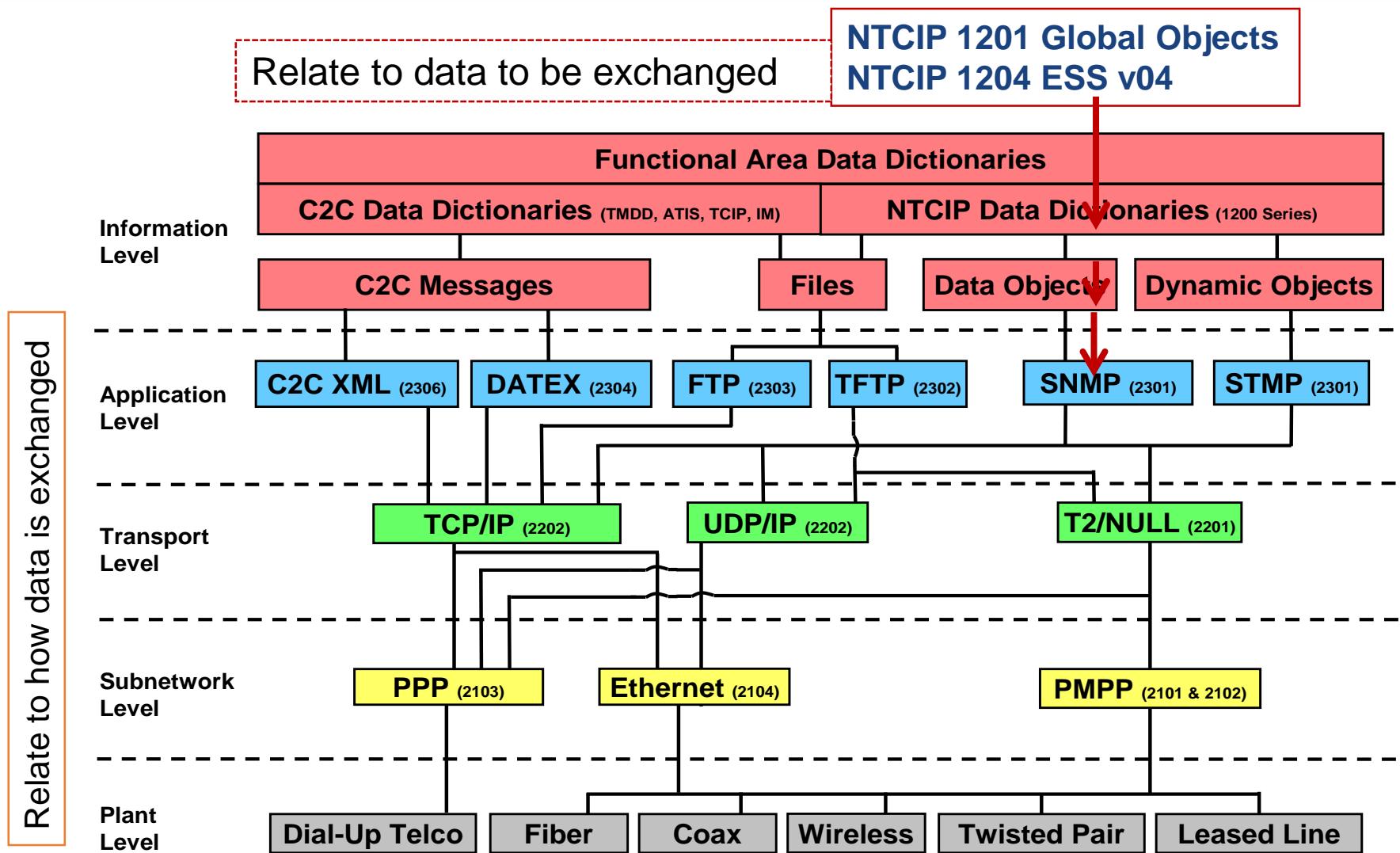
<http://www.iowadot.gov/maintenance/weather.html>

Source: Iowa DOT RWIS



SUPPLEMENT

NTCIP Framework



Source: NTCIP Guide



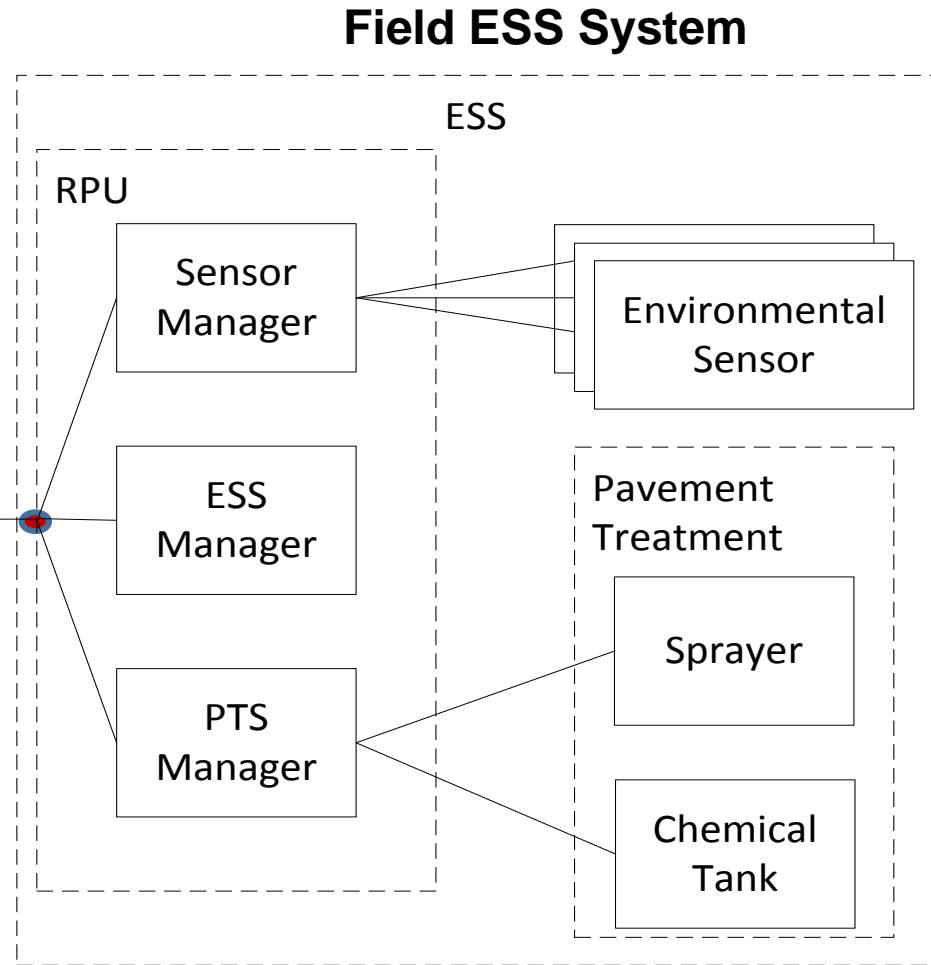
Reference Architecture for ESS

Major Components of ESS System

Central System



Subject of NTCIP
NTCIP 1204



History of NTCIP 1204 Standard

ESS Standard has Evolved to v04 in 2016

NTCIP 1204 v01

(1998), Non-SEP
(2001), Amendment-1, Reflected Actual Implementations.

NTCIP 1204 v02

(2007), SEP-based
Added new Features, e.g. de-icing.

NTCIP 1204 v03

(2009), Updated SEP content
Added test procedures, issued Errata for Annex C.

NTCIP 1204 v04

(2015), Supports newly identified user needs, such as Connected Vehicles (CV), reflects lessons learned from deployments.



Standard Organization

Structure of the Standard (NTCIP 1204 v04)

- Section 1 General
- Section 2 Concept of Operations (**Features-User Needs**)
- Section 3 Functional Requirements
- Section 3.3 Protocol Requirements List (**PRL**)
- Section 4 **Dialogs**
- Section 5 Object Definitions (Management Information Base-**MIB**)



Standard Organization

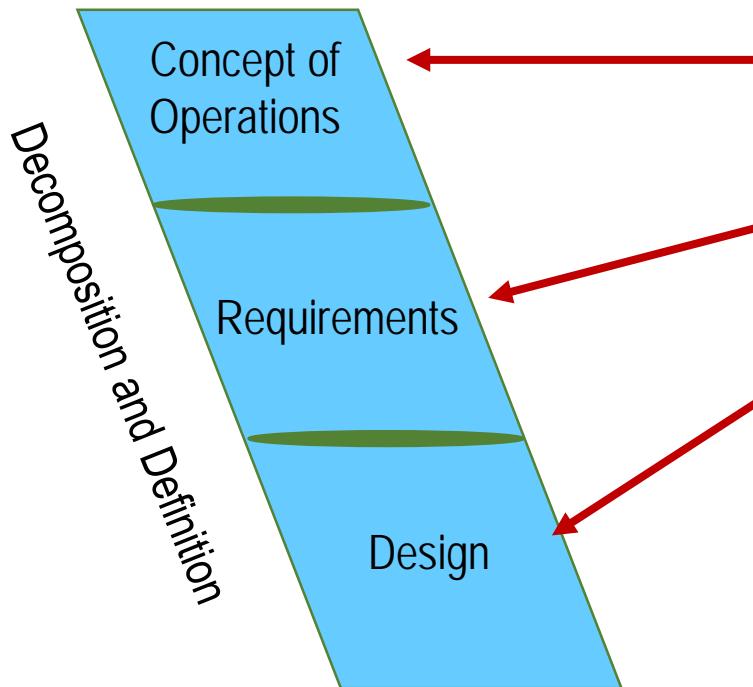
Structure of the Standard (NTCIP 1204 v04)

Annex A	Requirements Traceability Matrix (RTM)
Annex B	Object Tree
Annex C	Test Procedures
Annex D	Documentation of Revisions
Annex E	User Requests
Annex F	Generic Clauses
Annex G	Encoding of Sample Block Objects
Annex H	Controller Configuration Objects

Standard Organization

How Does the Structure Relate to the Agency ESS/RWIS Specification?

Specification Development

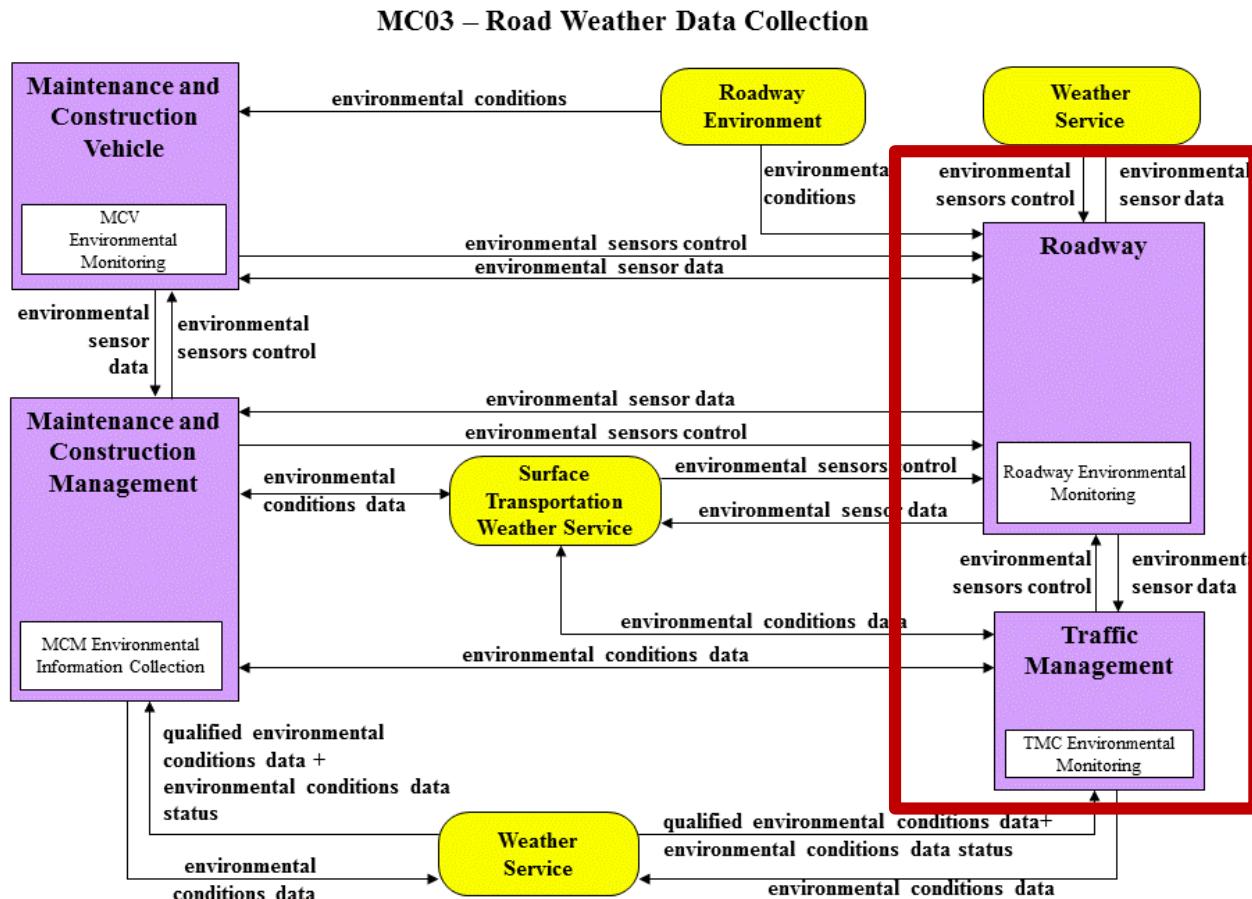


Information from the Standard

- Features-User Needs (**Section 2**)
- Requirements (Section 3)
- Design Details (Section 5)
- PRL (Section 3)
- RTM (Annex A)
- Test Procedures (Annex C)

Standard Organization

Standard Structure Supports Road Weather Data Collection Service Package



NTCIP 1204
Interface

Standard Organization

User Needs (Features) NOT Covered by v04 Standard

- Configuration details about how a device calculates the current reading **sampling periods**
- File Transfer Protocol (FTP) to transfer files such as camera snapshots across their **agency's network**



Learning Objectives

Review the **structure** of the standard

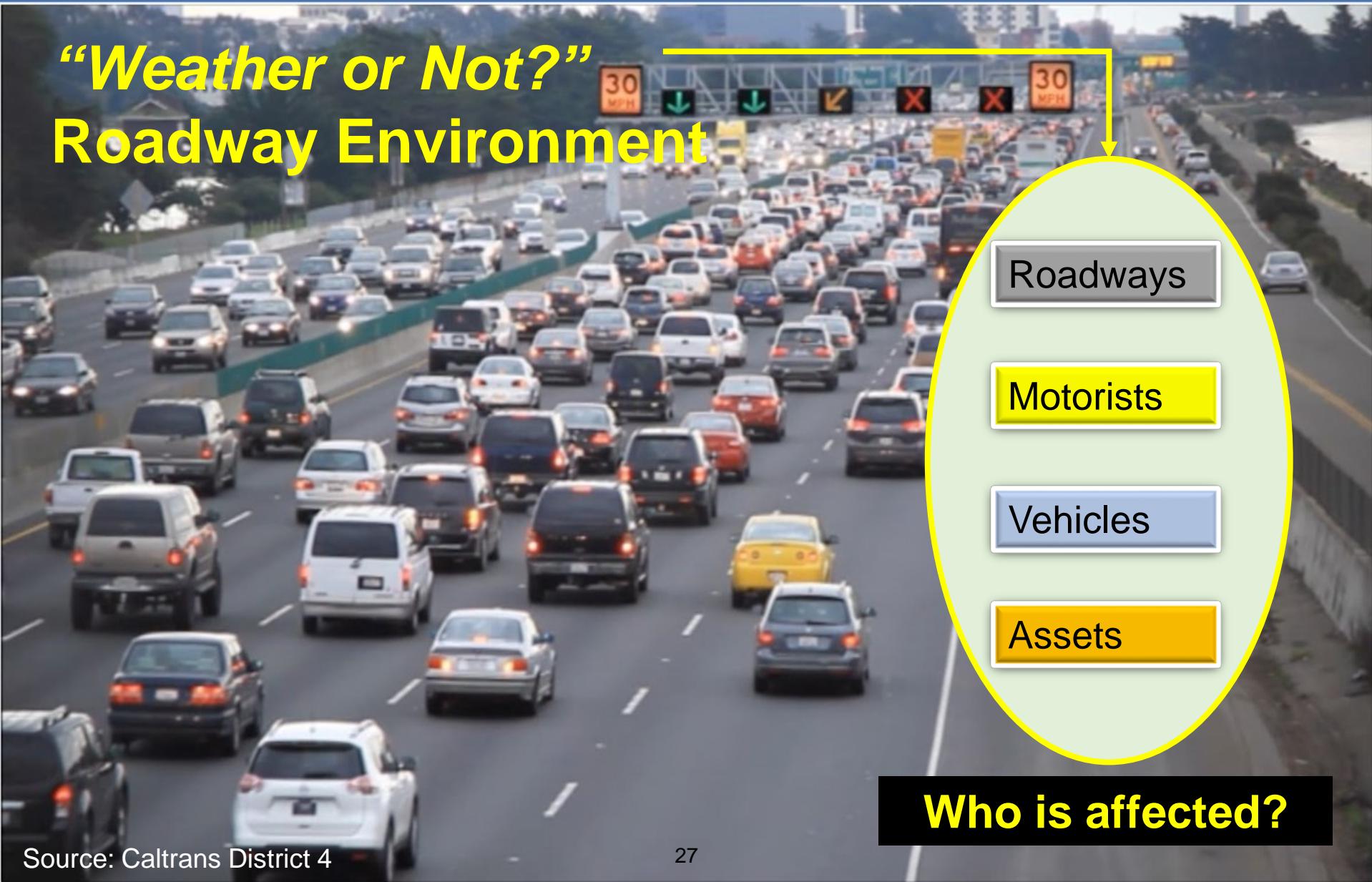
Identify specific ESS operational needs

Learning Objective 2

Identify Specific ESS
Operational Needs

What are Your Operational Objectives?

**“Weather or Not?”
Roadway Environment**



What are Your Operational Objectives?

Roadway Operational Environment Weather Variables

Automatic

- Air temperature/Humidity
- Precipitation
- Wind speed
- Fog
- Water level
- Pavement temperature
- Pavement condition
- Snow/slit



What are Your Operational Objectives?

Weather Events Adversely Impact Roadway Operations

- Rain and Flooding
- Snow and Ice
- Low Visibility
- Hurricanes
- High Winds



Source: TX DOT



Source: FHWA



Source: Iowa DOT

What are Your Operational Objectives?

Loss of Access Routes



What are Your Operational Objectives?

Loss of Access Routes

Courtesy: Michael Martinez and Ben Brumfield, CNN



BRANDON WADE/AP

What are Your Operational Objectives?

Operational Concerns for Roads-Drivers-Vehicles

Roadway Conditions

Adverse Impacts

Reduced Capacity/
Access-Throughput-Speed

Visibility Impairment

Driver Behavior-Reactions-Safety

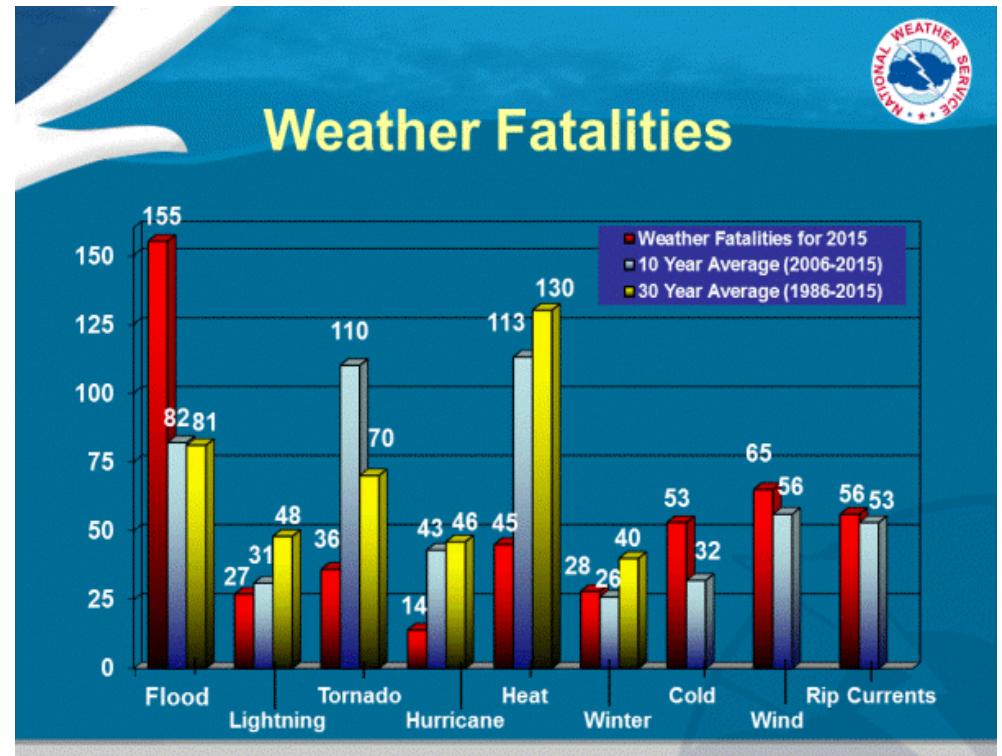
Traction, Stability
Maneuverability

Vehicle Performance,
Skidding-Crash Potential

What are Your Operational Objectives?

Measuring Adverse Impacts on Safety

- 1.5 million (23%) of annual vehicle **crashes** in 2015
- Resulting in 800,000 **Injuries**
- 7,000 fatalities (20% of total 35,092) attributed to weather related vehicle **crashes**



(Based on NHTSA and FHWA 2015 Data)

Source: NOAA, [National Weather Service](#)

What are Your Operational Objectives?

Measuring Adverse Impacts on Mobility

- Road closures reduce Capacity/Speed/ Volume
- Motorists, Traffic Signals, Vehicles-Trucks



What are Your Operational Objectives?

Measuring Adverse Impacts on Productivity

- 20% spent on winter maintenance by State DOTs
- Motorists' delays, Maintenance workers safety
- Trucking Loss-\$3.5 billion, Roadway damage (potholes, erosions)

“The Pennsylvania Department of Transportation, which had \$189.2 million budgeted for the 2013-14 winter, spent \$284 million.”-PennDOT



What are Your Operational Objectives?

Operational Need

Assess Roadway Condition with Sensors-Supplied Data

Central System Management
Station RWIS



Source: FHWA: WY TMC

Note: Wyoming DOT has 62 RWIS Operational



Source: FHWA

Sensors Detect Roadway Conditions

- Visibility impairments
- Precipitation
- High winds
- Temperature extremes
- Pavement friction-condition
- Snow-Ice-Rain....

What are Your Operational Objectives?

User Needs are Translations of Operational Needs

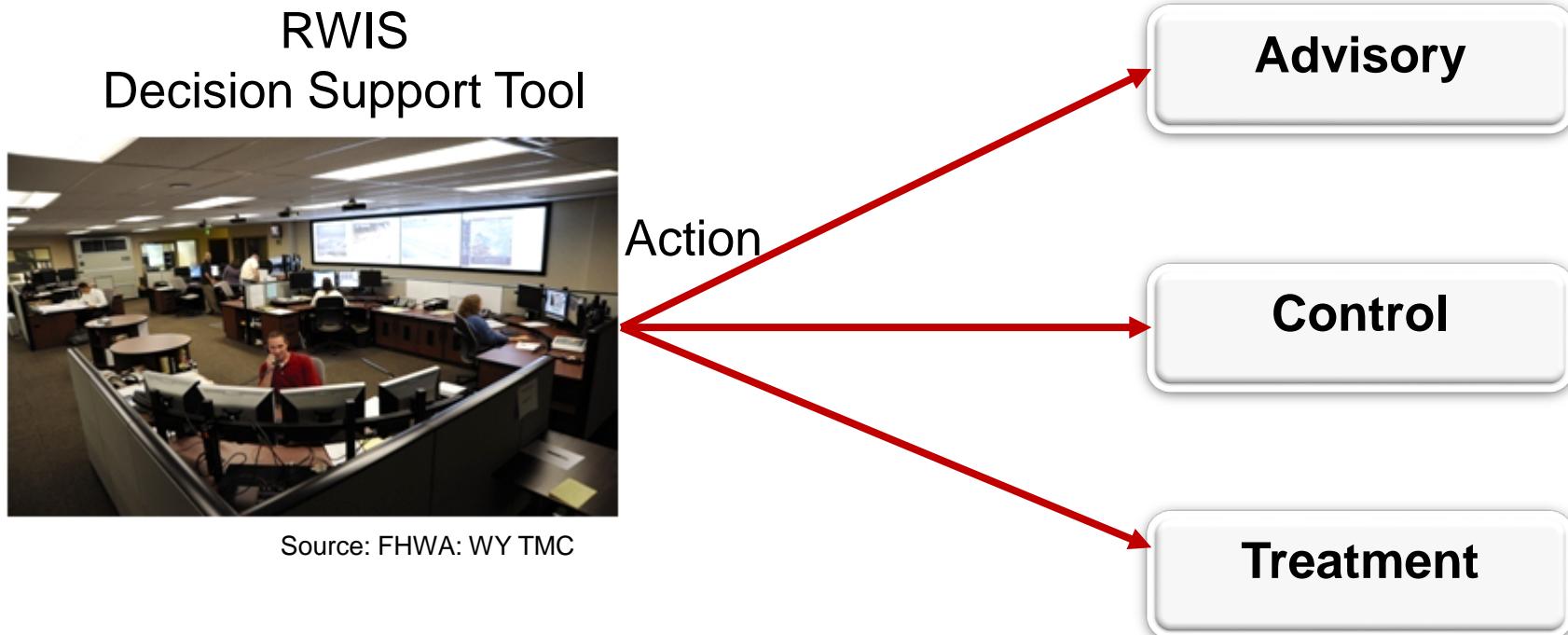
- 2.5.2.1 Monitor Weather Conditions**
(affect the transportation system)
- 2.5.2.1.2 Monitor Atmospheric Pressure**
- 2.5.2.1.3 Monitor Winds**
- 2.5.2.1.4 Monitor Air Temperature**

EXAMPLE

What are Your Operational Objectives?

Operational Need

Deploy RWIS as a Decision Support System to Take Action



What are Your Operational Objectives?

Weather Related Advisory Actions

- Display Messages on Variable Message Signs
(Covered by NTCIP 1203 Standard)
- 511
- Text Message-E Mails
- Web-services
- Media



Source: Caltrans

Electronic freeway message signs warn motorists of upcoming roadway conditions, such as low visibility.



Source: NJTPA-Daktronics



Source: Manual Joshi, NYCDOT TMC

What are Your Operational Objectives?

Weather Related Control Actions



Source: National Conference of State Legislatures



Source: Tennessee Ramp Gate-FHWA

What are Your Operational Objectives?

Roadway Treatment Actions



Figure 17A – City of New York,
NY Bridge Section Treated
with Anti-Icing System



Figure 17B – City of New York,
NY Bridge Section Treated
with Truck-Mounted Sprayer

Source: FHWA



Source: FHWA

EXAMPLE



How Does ESS Standard Support Operational Needs-Features?

Annex F.1.1: Architectural Needs Supports Operational Environment

F.1.1.1. Provide Live Data: When we always have **ON** connection

F.1.1.2 Provide Compressed Data

F.1.1.3 Provide Off-line Log Data

F.1.2 Generic Features



Source: City of Overland Park, KS

Communications to RPU in ESS Controller

How Does ESS Standard Support Operational Needs-Features?

Categories of Features Supported

ESS Manager
Features

Section 2.5.1

Sensor Manager
Features

Section 2.5.2

PTS Manager
Features

Section 2.5.3

PTS-Pavement Treatment System



How Does ESS Standard Support Operational Needs-Features?

ESS Manager Features Supported by Standard

- ESS Manager manages both a Sensor Manager and a PTS Manager
- ESS Features (2.5.1):
 - Generic Features (2.5.1.1)
 - Monitor Door Status (2.5.1.2)
 - Monitor Power (2.5.1.3)
 - Monitor Mobile Station Data (2.5.1.4)
 - Determine ESS Type (2.5.1.5)

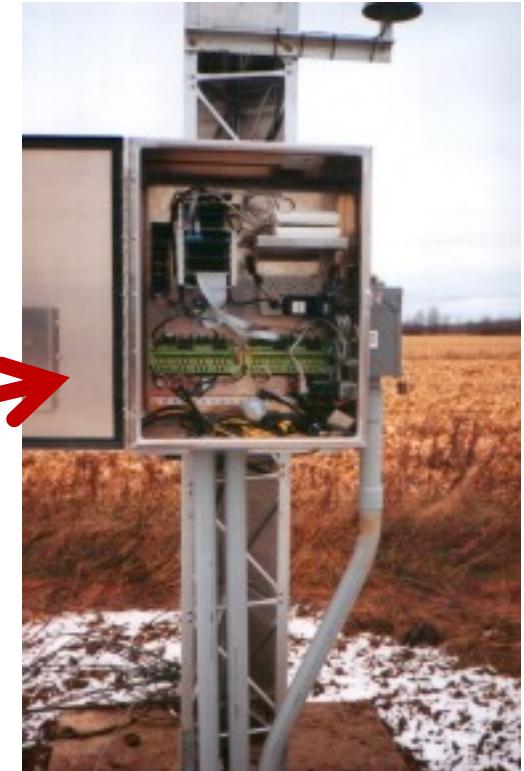
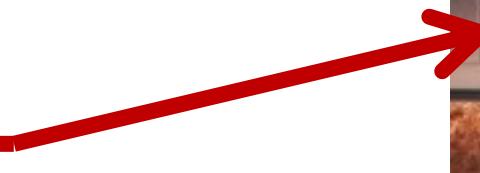
How Does ESS Standard Support Operational Needs-Features?

Example: 2.5.1.2 Monitor Door Status

“A transportation system operator may wish to inquire if any doors on the ESS equipment are open...”



Source: WYDOT TMC



Source: UDOT

EXAMPLE

Deployment Examples

Idaho DOT Statewide Deployments of Weather Stations

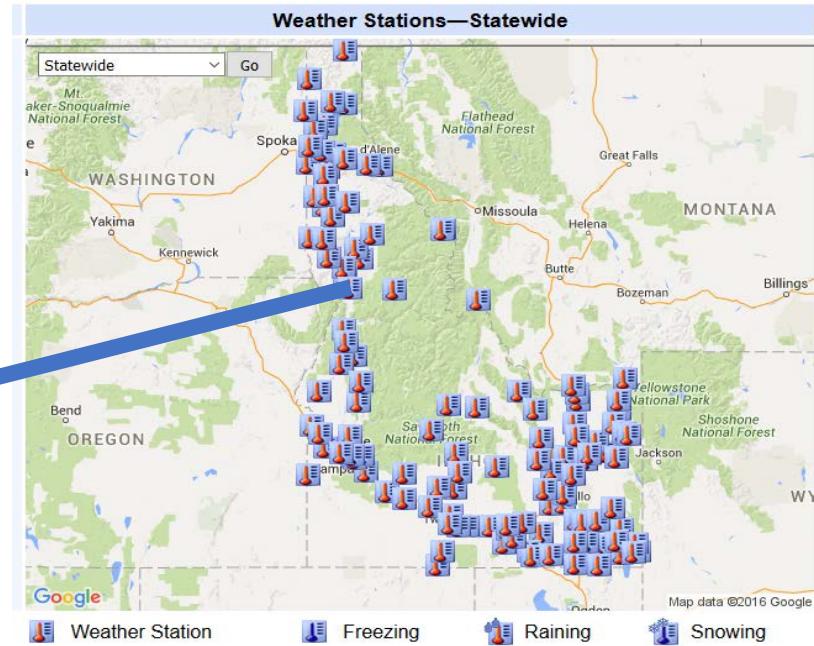


US 95: Whitebird Hill

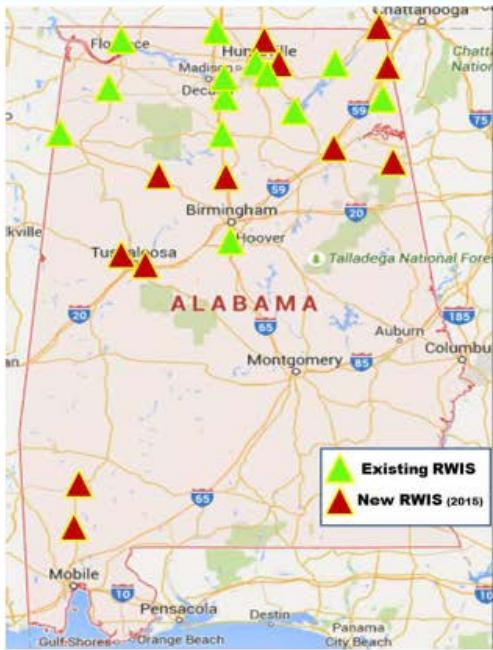
6 miles north of the White Bird area

78 °F

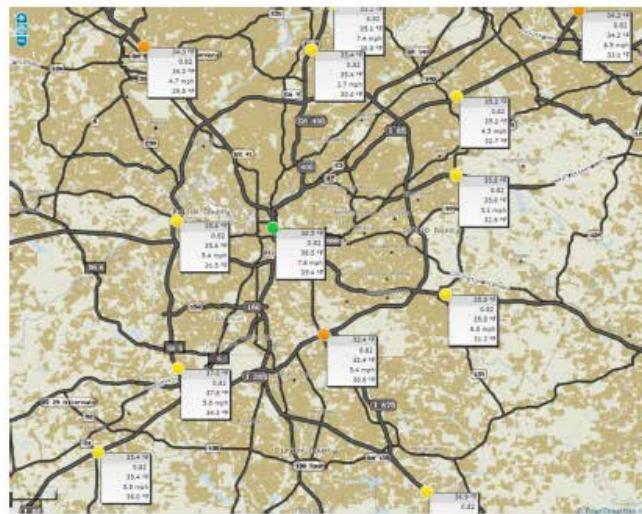
Precip (Yes/No)	No
Surface Status	Dry
Surface Friction	Good
Visibility	1.24 miles
Wind Speed (avg)	3.4 mph
Wind Speed (gust)	5.1 mph



Deployment Examples



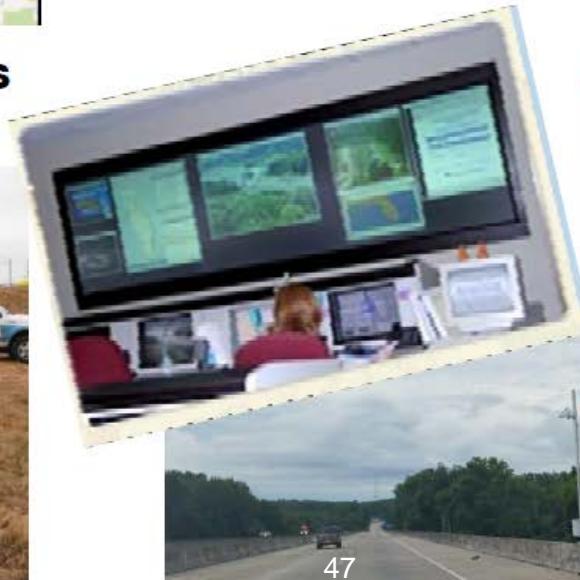
Alabama DOT 26 SITES



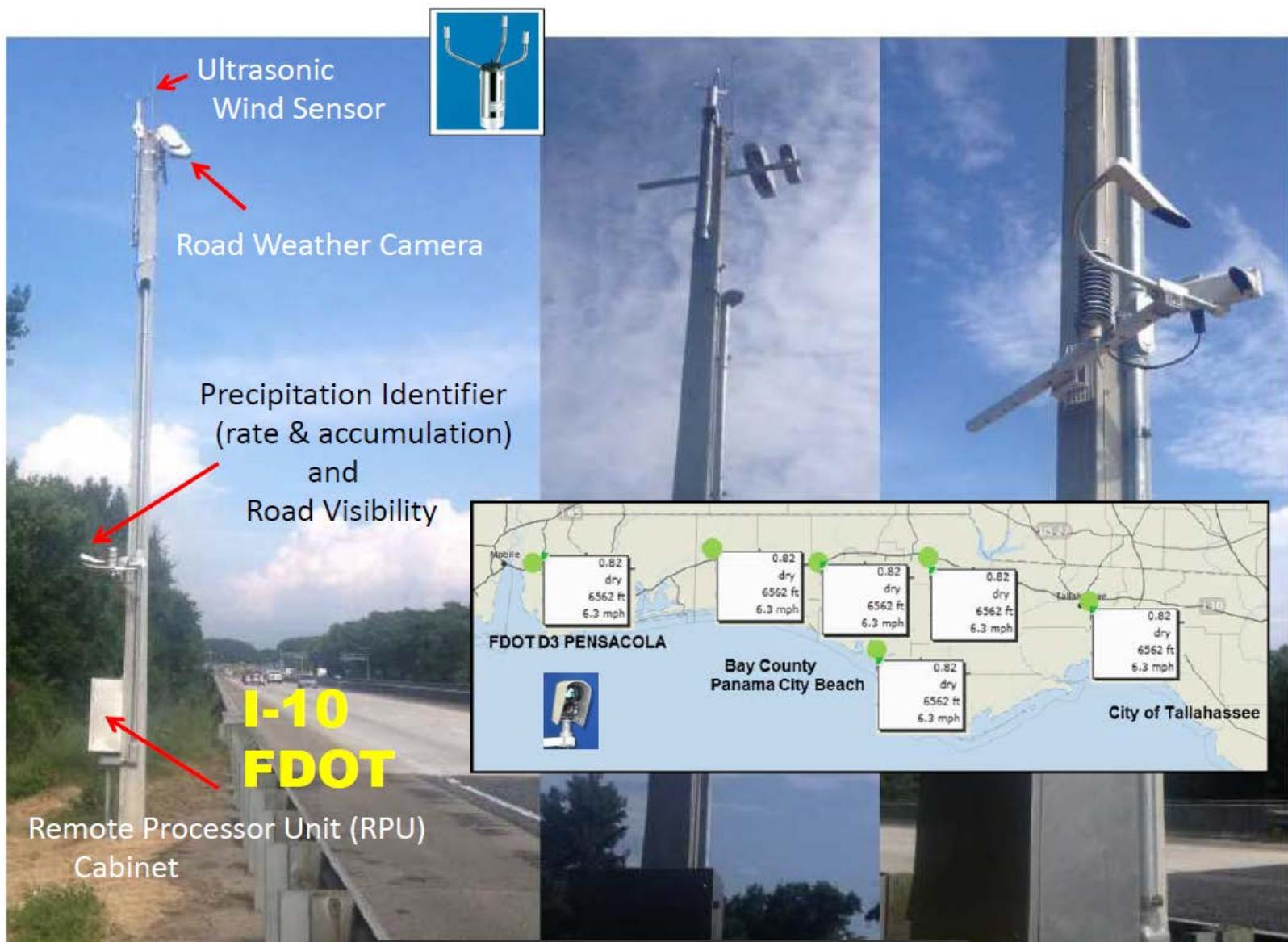
Georgia DOT 27 RWIS Sites



Florida DOT 52 Sites



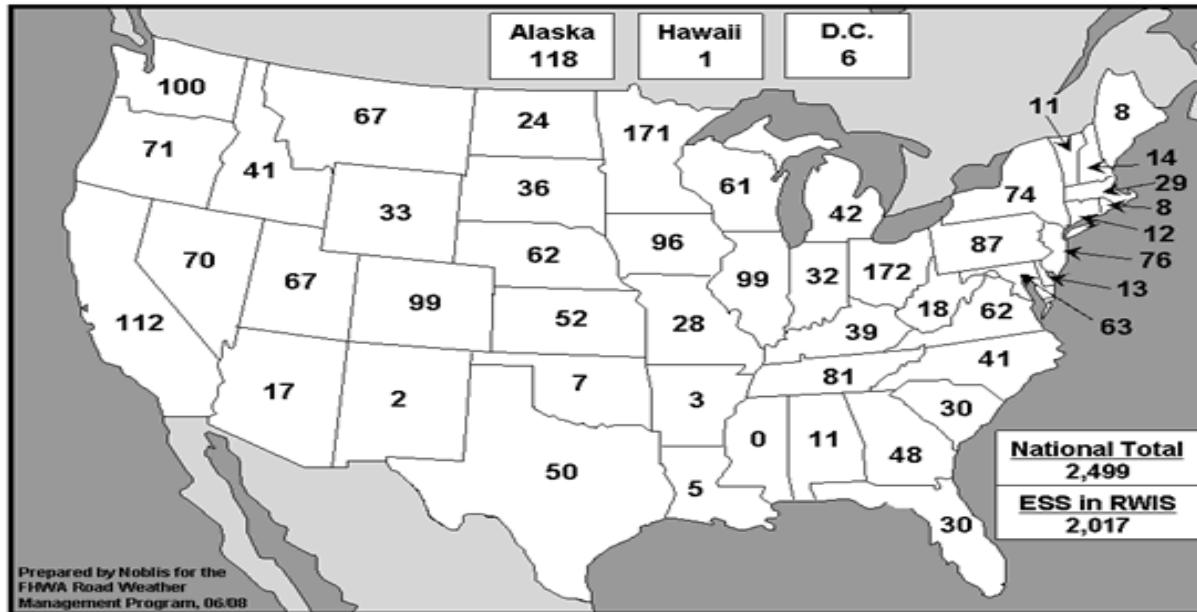
Deployment Examples



Deployment Examples

Purpose of ESS Deployments by Transportation Agencies

- Collect timely, accurate, and relevant road weather conditions data
- Manage roadways and provide roadway weather information to motorists
- Motorists make travel decisions and adjust to roadway conditions



Source: http://ops.fhwa.dot.gov/weather/mitigating_impacts/essmap.htm: FHWA 2008

Deployment Examples: ESS Manager

2.5.1.3 Monitor Power

A transportation system operator may wish to monitor the power for the ESS to ensure proper operation.



Source: UDOT

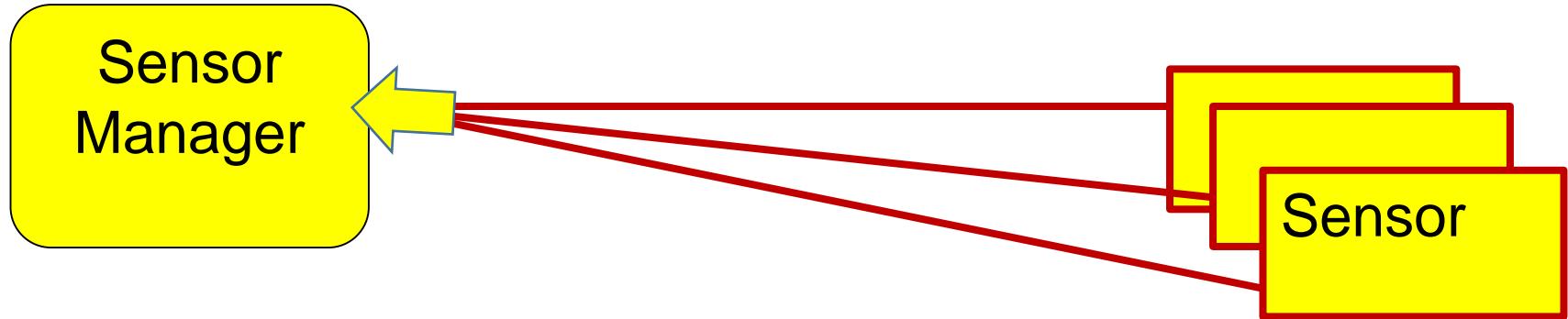
2.5.1.4 Monitor Mobile Station Data

A transportation system operator may wish to monitor the movements of a mobile ESS and, if it is part of a mobile pavement treatment system, monitor the chemicals being dispersed.



2.5.1.1 Generic Features (Device ID...)

Deployment Examples: Sensor Manager



2.5.2 Sensor Manager Features

- ✓ Monitor weather conditions
- ✓ Monitor pavement
- ✓ Monitor subsurface conditions
- ✓ Monitor human readings
- ✓ Monitor water levels
- ✓ Monitor air quality and biohazards
- ✓ Monitor mobile weather profile

Deployment Examples: PTS Manager

2.5.3.2 Manage Mobile Spray System

A transportation system operator may need to manage the application of anti-icing or de-icing chemicals from a mobile pavement treatment system (e.g., a salt truck).



Source: FHWA

Learning Objectives

Review the **structure** of the standard

Identify specific ESS operational needs

Use the **PRL** to select the user needs and traceability to requirements

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

Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2	Sensor Manager Features			0.3 (1..*)	Yes / No	

What is a PRL?

Standardized Relationship Provided by the Standard

Agency selects

Templates Links to
Associated Requirements



What is a PRL?

Provides Guidance

(NTCIP 1204 v4, Section 3.3.3, Page 32)

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

Table 6 Protocol Requirements List

Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications

Agency completes the rows with text from the PRL provided by the standard object PRL

Parts of PRL Provided in the Standard (Section 3.3)

User Need Columns

Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.1.2	Monitor Door Status			O	Yes / No	
	3.5.1.2.1		Retrieve ESS Door Status	M	Yes / NA	

1st line is the headings of the PRL Table (**users 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 16), find the **optional user need**; and you must decide if it is desired for your project implementation

SUPPLEMENT

Parts of PRL Provided in the Standard (Section 3.3)

Conformance Column

Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.1.2	Monitor Winds			0.5 (1..*)	Yes / No / NA	

- Identifies if the user need (or requirement) is Mandatory (M) or Optional (O), plus some from group

- Some basic user needs are considered Mandatory

Example: Determine ESS Type, is it permanent, transportable or mobile?

Parts of PRL Provided in the Standard (Section 3.3)

Support/Project Requirement Column

Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.1.2	Monitor Winds			0.5(1..*)	Yes/No/NA	

- What should Agency do?
 - Circle Yes to indicate support for project user need; No for not needed
 - If the **Conformance** shows selected User Need Mandatory, then you must circle Yes regardless

Parts of PRL Provided in the Standard (Section 3.3)

Additional Project Requirements-Last Column

Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.1.4			Monitor Mobile Station Data	Mobile:M	Yes / NA	
		3.5.1.3.1	Retrieve Mobile ESS Movement	M	Yes / NA	NTCIP 1204 v04 does not impose any accuracy requirements. Any accuracy requirements should be inserted here.

Provides any additional details about the specific implementation

Parts of PRL Provided in the Standard (Section 3.3)

Agency Determines if an Optional ESS User Need is Required

2.5.2.1.2 Monitor Winds

A transportation system operator may need to monitor the current wind conditions in the vicinity of the ESS and to configure and retrieve the metadata for the wind measurements. This feature allows an operator to determine if vehicle restrictions on a given roadway or bridge span should be issued or to restrict roadway maintenance (e.g., fire alerts).

If the agency selects **YES**, then certain requirements will be allocated in the project PRL

User Need ID	User Need	FR ID	Functional Requirement
2.5.2.1.2	Monitor Winds		
		3.5.2.1.2 (Wind)	Retrieve Metadata for Each Wind Sensor - Text Description
		3.5.2.1.11.1 (WindLoc)	Retrieve Metadata for Each Wind Sensor - Location
		3.5.2.1.11.2	Retrieve Metadata for Each Wind Sensor - Sensor Information
		3.5.2.1.11.3	Configure Wind Sensor Metadata - Location
		3.5.2.3.2.2	Retrieve Wind Data
		3.6.2.	Required Number of Wind Sensors

EXAMPLE



Parts of PRL Provided in the Standard

Completing a Project PRL: Functional Requirements

Section number and the Functional Requirement

Protocol Requirements List (PRL)

User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.1.2	Monitor Winds			0.5 (1..*)	Yes / No / NA	
		3.5.2.1.2 (Wind)	Retrieve Metadata for Each Wind Sensor - Text Description	O	Yes / No / NA	
		3.5.2.1.11.1 (WindLoc)	Retrieve Metadata for Each Wind Sensor - Location	O	Yes / No / NA	
		3.5.2.1.11.2	Retrieve Metadata for Each Wind Sensor - Sensor Information	O	Yes / No / NA	
		3.5.2.1.11.3	Configure Wind Sensor Metadata - Location	Wind:O; WindLoc:O	Yes / No / NA	
		3.5.2.3.2.2	Retrieve Wind Data	M	Yes / NA	

Parts of PRL Provided in the Standard

Partially Filled-in PRL that Provides Standardized Requirement(s) Allocated to Each User Need

Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.4	Architectural Needs			M	Yes	
2.4.1	Generic Architectural Needs			M	Yes	
2.5	Features			M	Yes	
2.5.1	ESS Manager Features			M	Yes	
2.5.1.1	Generic Features			M	Yes	
2.5.1.2	Monitor Door Status			O	Yes / No	
	3.5.1.2.1	Retrieve ESS Door Status		M	Yes / NA	
2.5.1.3	Monitor Power			O	Yes / No	
	3.5.1.2.2	Retrieve Battery Status	0.1 (1..*)	Yes / No / NA		
	3.5.1.2.3	Retrieve Line Volts	0.1 (1..*)	Yes / No / NA		
2.5.1.4	Monitor Mobile Station Data			Mobile:M	Yes / NA	
	3.5.1.3.1	Retrieve Mobile ESS Movement	M	Yes / NA	NTCIR 1204 v04 does not impose any accuracy requirements. Any accuracy requirements should be inserted here.	
2.5.1.5	Determine ESS Type			M	Yes	
2.5.1.5.a	Permanent			0.2 (1)	Yes / No	
2.5.1.5.b	Transportable			0.2 (1)	Yes / No	
2.5.1.5.c (Mobile)	Mobile			0.2 (1)	Yes / No	
	3.5.1.1.1	Retrieve ESS Characteristics	M	Yes		
2.5.1.6	Monitor the Status of the ESS			O	Yes / No	
	3.5.1.2.4	Retrieve ESS Status	M	Yes / NA		
2.5.2	Sensor Manager Features			0.3 (1..*)	Yes / No	

Agency prepares a customized project PRL by selecting YES

Benefits of PRL to Stakeholders

Agency Perspective (Project PRL)

- “**Communicates**” the scope of the desired ESS interface
- Makes it easier to specify what the interface is to do (customize)
- “*Spells out*” Conformance requirements; what is needed
- A “**Checklist**” to validate the built system
- Aid 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 “*guessing*” to reduce risks
- Vendors “*confirms*” ESS functionality + offer optional features



Learning Objectives

Review the **structure** of the standard

Identify specific ESS operational needs

Use the **PRL** to select the user needs and traceability to requirements

Discuss how to prepare a project level PRL for ESS specification

Learning Objective 4

Discuss How to Prepare a
Project Level PRL for ESS
Specification

Steps to Select User Needs and Associated Requirements

Brief Review

- ESS **gathers weather data** and sends it to the central system management station for further processing
- Central management station “**monitors**” ESS as part of RWIS
- ESS specification begins with **identifying user needs** and specifying requirements

How PRL Fits into the ESS 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

remember!

Complete Project PRL with Entries (Populating Table)

Key Points to Remember While Completing a Project PRL

1. PRL must be consistent with the hardware specification
2. ESS specification should have project level PRL
3. PRL must be based on the NTCIP 1204 v04 with SNMP interface
4. Include only need-based specific ESS parameters- NOT All YOU Can GET



Complete Project PRL with Entries (Populating Table)

Conformance and Compliance Issues

- **Conformance:** Meets a specified standard
 - To claim "Conformance" to NTCIP 1204 v04, 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 1204 v04 and its normative references
- **Compliance:** Meets a specification

Complete Project PRL with Entries (Populating Table)

Fill-in PRL with User Needs/Requirements; YES

Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.1.2	Monitor Winds			0.5 (1..*)	Yes / No / NA	
		3.5.2.1.2 (Wind)	Retrieve Metadata for Each Wind Sensor - Text Description	O	Yes / No / NA	
		3.5.2.1.11.1 (WindLoc)	Retrieve Metadata for Each Wind Sensor - Location	O	Yes / No / NA	
		3.5.2.1.11.2	Retrieve Metadata for Each Wind Sensor - Sensor Information	O	Yes / No / NA	
		3.5.2.1.11.3	Configure Wind Sensor Metadata - Location	Wind:O; WindLoc:O	Yes / No / NA	
		3.5.2.3.2.2	Retrieve Wind Data	M	Yes / NA	
		3.6.2	Required Number of Wind Sensors	M	Yes / NA	The ESS shall support at least _____ (1..255:Default=1) wind sensors.

- Use the Support/Project Requirement column to indicate if the user need is required for the implementation
- If the YES is selected, the PRL identifies the requirements associated with that user need
- Add notes to the last column if required

EXAMPLE

Complete Project PRL with Entries (Populating Table)

Addressing Mandatory Needs for Conformity

Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.4	Architectural Needs			M	Yes	
2.4.1	Generic Architectural Needs			M	Yes	
2.5	Features			M	Yes	
2.5.1	ESS Manager Features			M	Yes	
2.5.1.1	Generic Features			M	Yes	
2.5.1.2	Monitor Door Status			O	Yes / No	
	3.5.1.2.1	Retrieve ESS Door Status		M	Yes / NA	
2.5.1.3	Monitor Power			O	Yes / No	
	3.5.1.2.2	Retrieve Battery Status		O.1 (1..*)	Yes / No / NA	
	3.5.1.2.3	Retrieve Line Volts		O.1 (1..*)	Yes / No / NA	
2.5.1.4	Monitor Mobile Station Data			Mobile:M	Yes / NA	
	3.5.1.3.1	Retrieve Mobile ESS Movement		M	Yes / NA	NTCIP 1204 v04 does not impose any accuracy requirements. Any accuracy requirements should be inserted here.
2.5.1.5	Determine ESS Type			M	Yes	
2.5.1.5.a	Permanent			O.2 (1)	Yes	
2.5.1.5.b	Transportable			O.2 (1)	No	
2.5.1.5.c (Mobile)	Mobile			O.2 (1)	Yes / No	
	3.5.1.1.1	Retrieve ESS Characteristics		M	Yes	
2.5.1.6	Monitor the Status of the ESS			O	Yes / No	
	3.5.1.2.4	Retrieve ESS Status		M	Yes / NA	
2.5.2	Sensor Manager Features			O.3 (1..*)	Yes / No	

Selected YES

Selected YES
For a project

YES for
Permanent

NO for Mobile
NO for Transportable

EXAMPLE

Complete Project PRL with Entries (Populating Table)

Addressing Generic Architectural (Communications) Needs

User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
F.1.1	Generic Architectural Needs					
F.1.1.1	Provide Live Data			M	Yes	
	F.2.1.1.1	Retrieve Data		M	Yes	
	F.2.1.1.2	Deliver Data		M	Yes	
	F.2.1.1.3	Explore Data		M	Yes	
	3.6.21	Maximum Response Time for Requests		M	Yes	The Response Time for all requests shall be _____ milliseconds (25-500: Default=100).
F.1.1.2 (Compressed)	Provide Compressed Data			Mobile:M; O	Yes / No	
	3.6.21	Maximum Response Time for Requests		M	Yes	The Response Time for all requests shall be _____ milliseconds (25-500: Default=100).
F.1.1.3	Provide Off-line Log Data			O	Yes / No	
	F.2.1.2.1	Retrieve Current Configuration of Logging Service		M	Yes / NA	
	F.2.1.2.2	Configure Logging Service		M	Yes / NA	
	F.2.1.2.3	Retrieve Logged Data		M	Yes / NA	
	F.2.1.2.4	Clear Log		M	Yes / NA	
	F.2.1.2.5	Retrieve Capabilities of Event Logging Service		M	Yes / NA	
	F.2.1.2.6	Retrieve Total Number of Logged Events		M	Yes / NA	

Selected YES

Selected NO
If not needed in a project

YES for Dial-up ESS

EXAMPLE

Backward Compatibility

NTCIP 1204 v04 Compatibility to Earlier Versions

- v04 is updated for newer user needs and generally backward compatible with v03, v02 and v01
- Previous ESS implementations that used v01 and v02 data objects may not be able to add newer sensor technologies
- v04 PRL and RTM tables headings have been revised



Module Summary

Review the **structure** of the standard

Identify specific ESS operational needs

Use the **PRL** to select the user needs and traceability to requirements

Discuss how to prepare a project level PRL for ESS specification

We Have Now Completed A313a in the ESS Curriculum



Module A313a: Understanding **User Needs** for ESS Systems Based on NTCIP 1204 v04 Standard

Module A313b: Specifying **Requirements** for NTCIP 1204 v04 ESS Standard

Module T313: Applying Your **Test Plan** to the Environmental Sensor Stations based on the NTCIP 1204 ESS Standard v04



Next Course Module

Module A313b: Specifying Requirements for NTCIP 1204 v04 ESS Standard

Concepts taught in next module (Learning Objectives):

- 1) Review the structure of the standard
- 2) Use the PRL and RTM to specify the standardized structure of requirements
- 3) Use the RTM to specify the standardized design
- 4) How to specify requirements not covered by the standard
- 5) Infer the relationship between selecting requirements and testing

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!

