



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  
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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 case studies.

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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.

**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

**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**

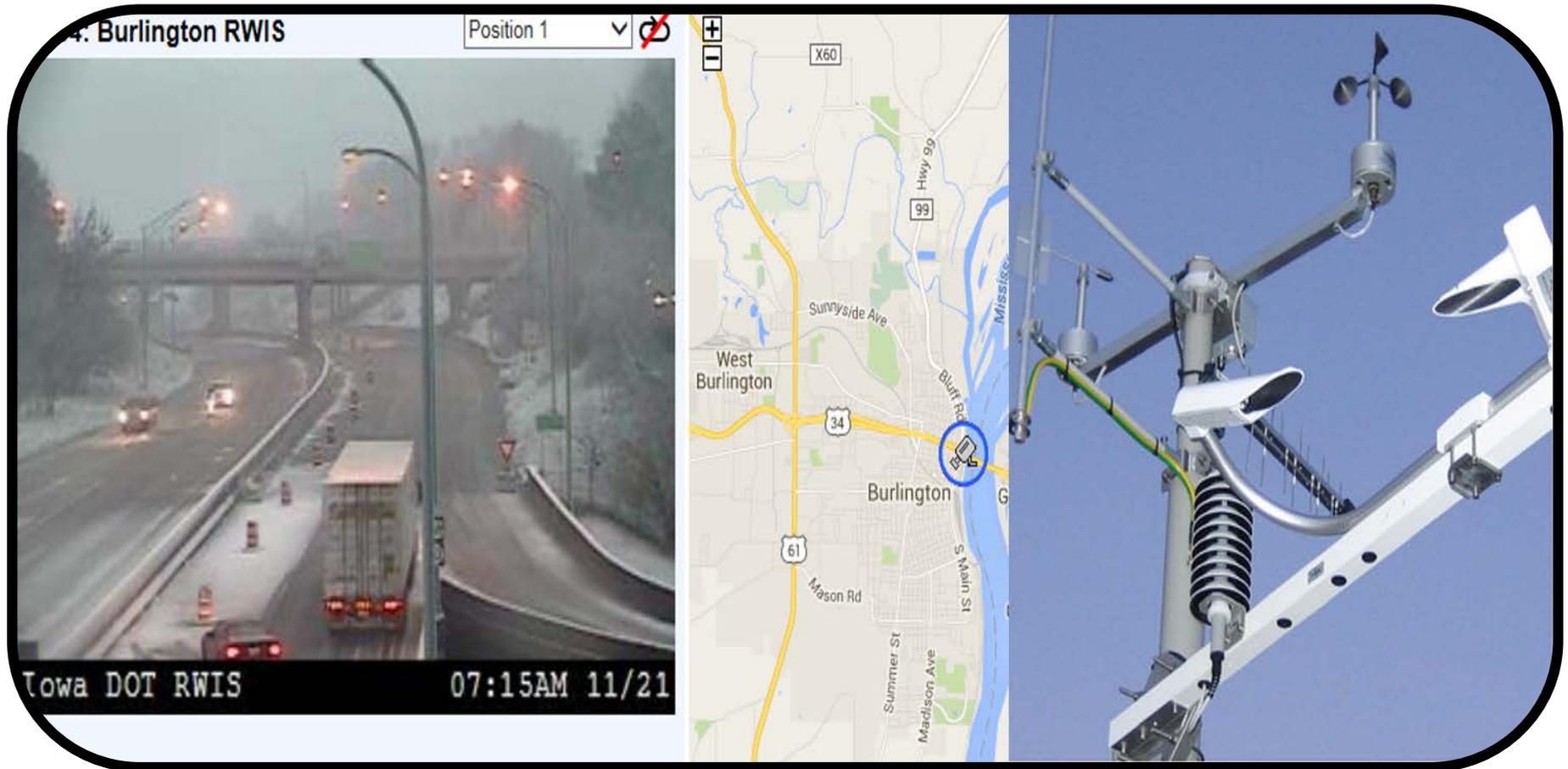
- National ITS Architecture

**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](http://www.pcb.its.dot.gov)

# A313a: Understanding User Needs for ESS Systems based on NTCIP 1204 v04 Standard



# Instructor



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# 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

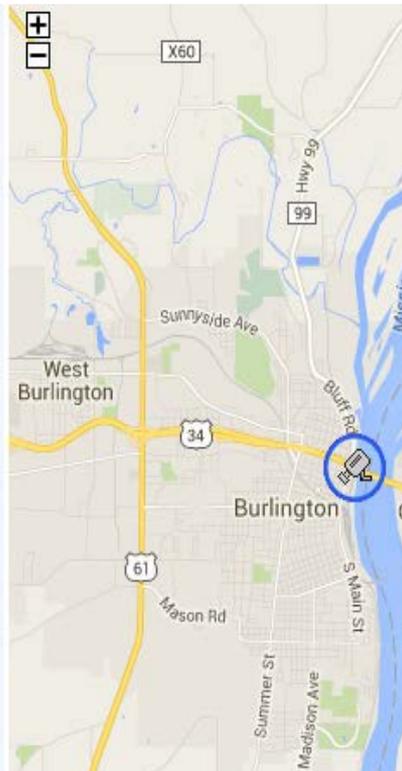
Management  
Station



# Terminology

## Road Weather Information System (RWIS)

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



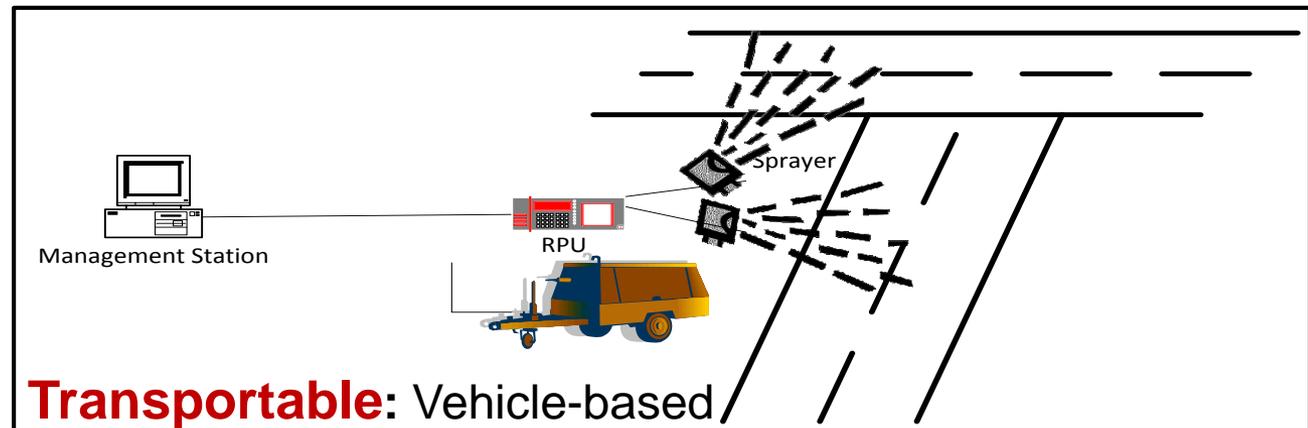
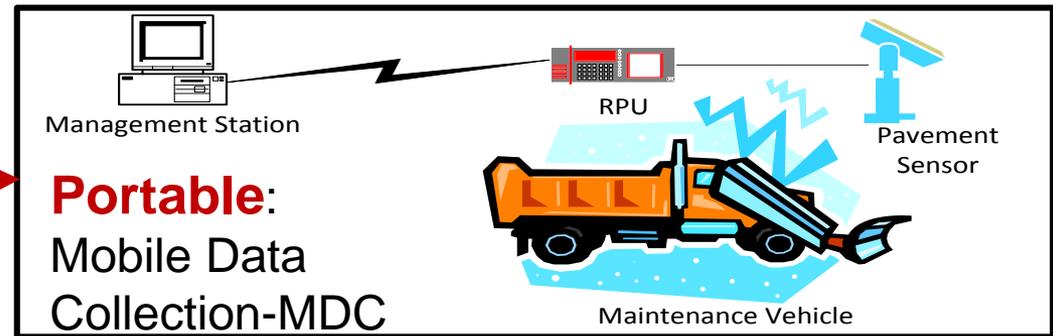
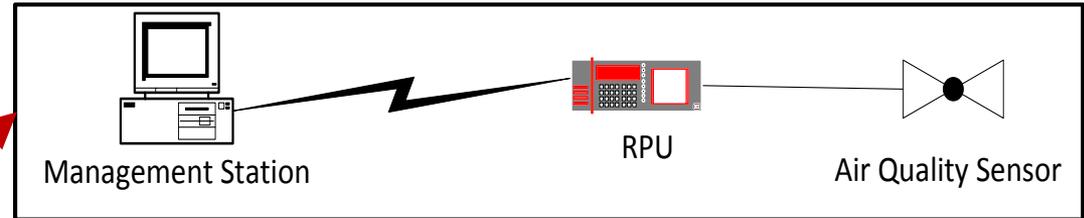
Source: Iowa DOT RWIS Camera Images

Source: National Conference of State Legislatures

# Terminology

## Types of RWIS

### **Permanent:** Fixed Locations-based ESS



# 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



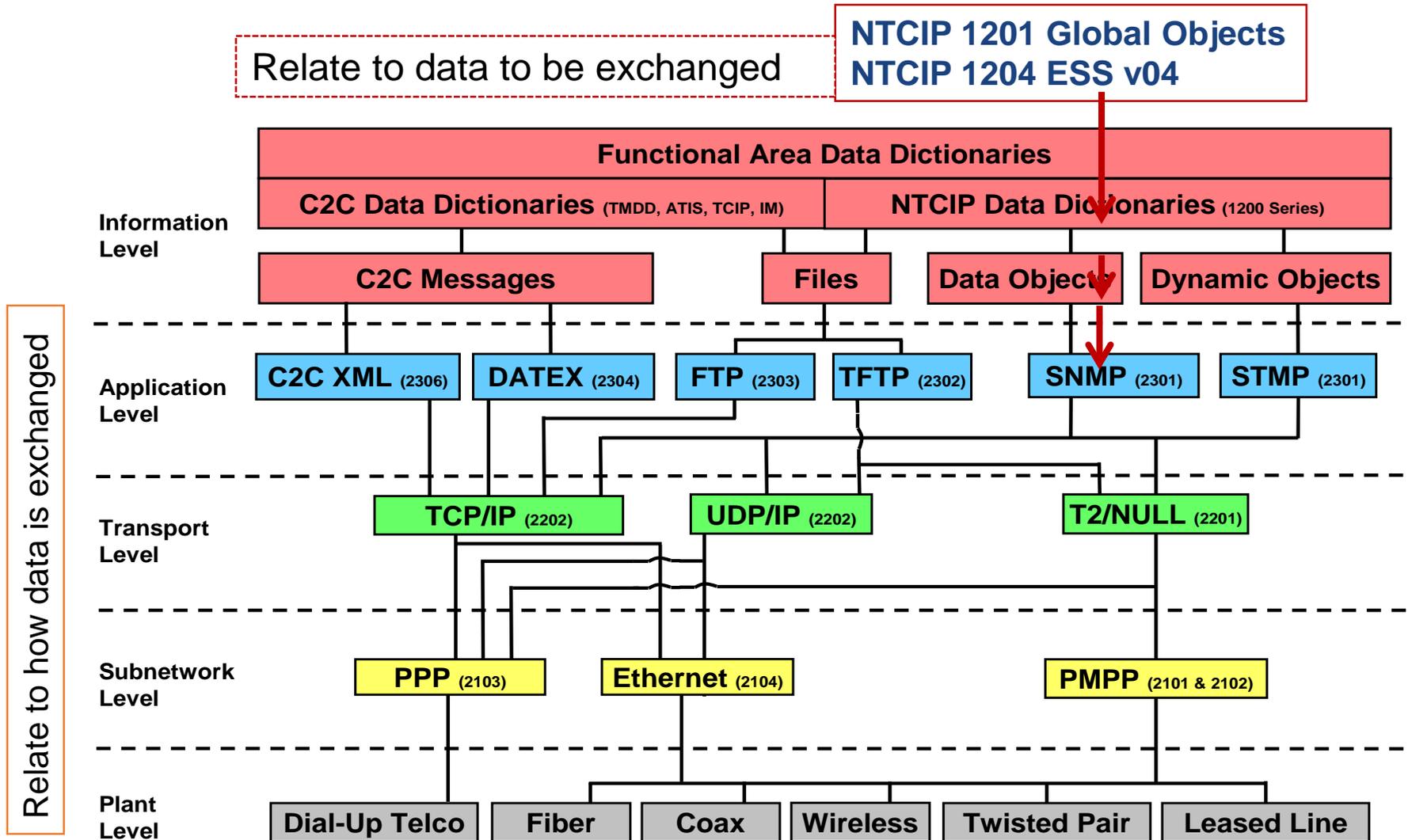
<http://www.iowadot.gov/maintenance/weather.html>

Source: Iowa DOT RWIS

SUPPLEMENT



# NTCIP Framework

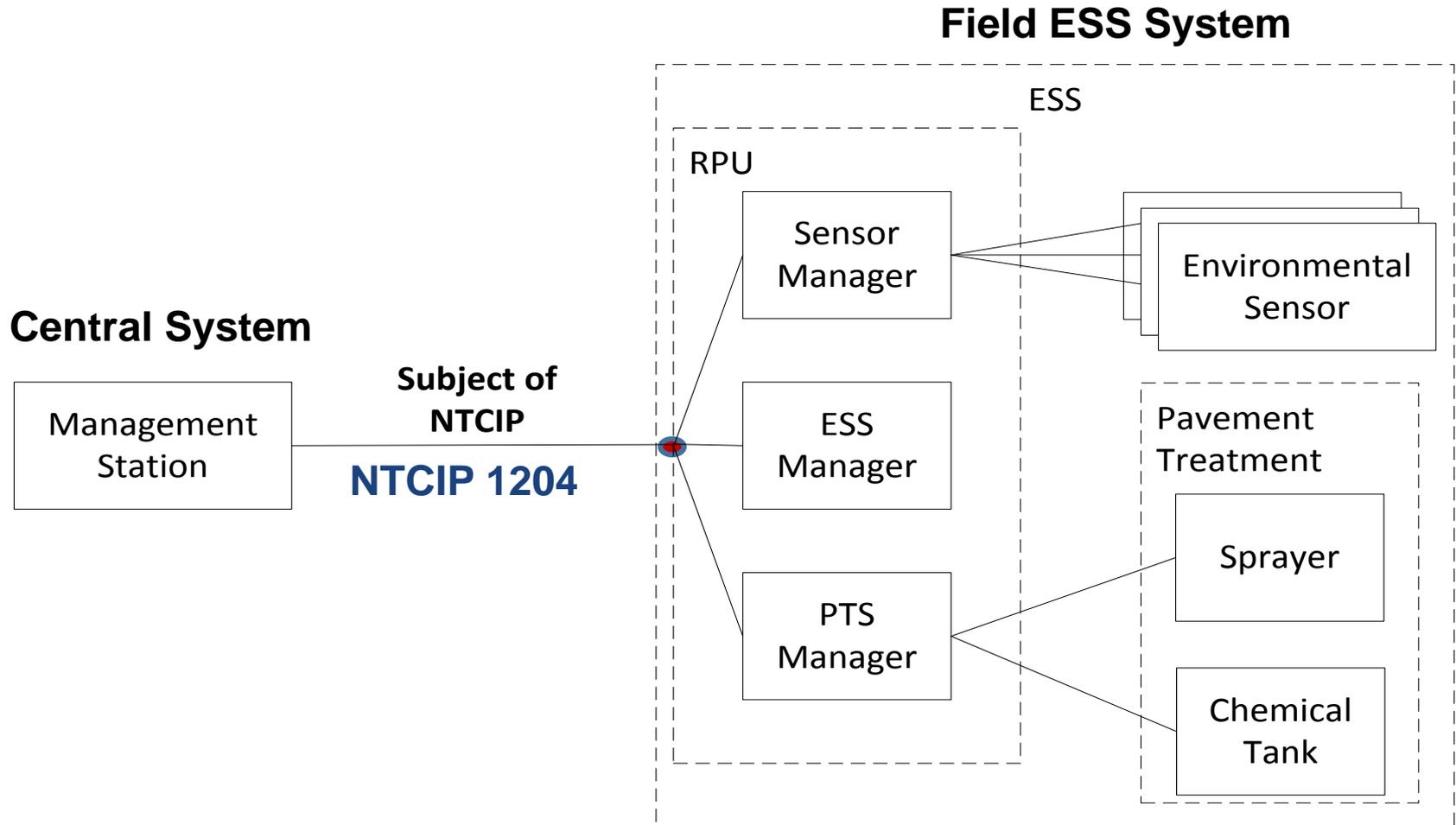


Source: NTCIP Guide



# Reference Architecture for ESS

## Major Components of ESS System



# 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 ( <b>Features-User Needs</b> )
Section 3	Functional Requirements
Section 3.3	Protocol Requirements List ( <b>PRL</b> )
Section 4	<b>Dialogs</b>
Section 5	Object Definitions (Management Information Base- <b>MIB</b> )



# Standard Organization

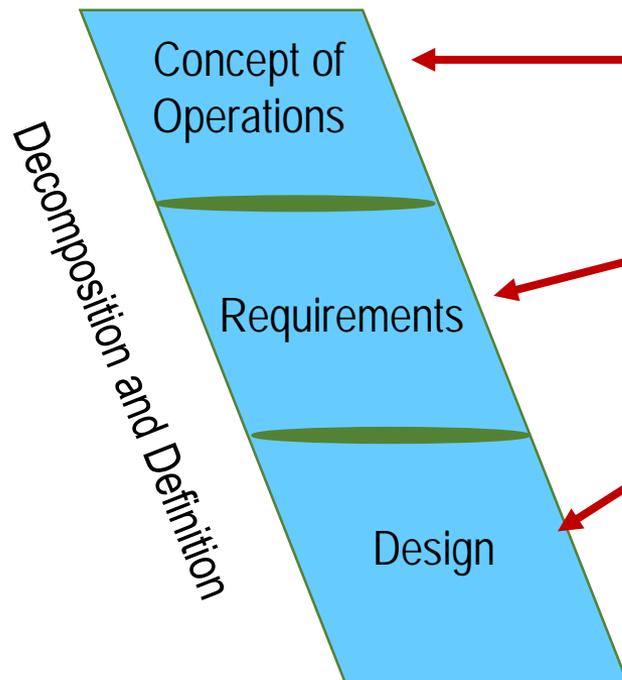
## Structure of the Standard (NTCIP 1204 v04)

Annex A	Requirements Traceability Matrix ( <b>RTM</b> )
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



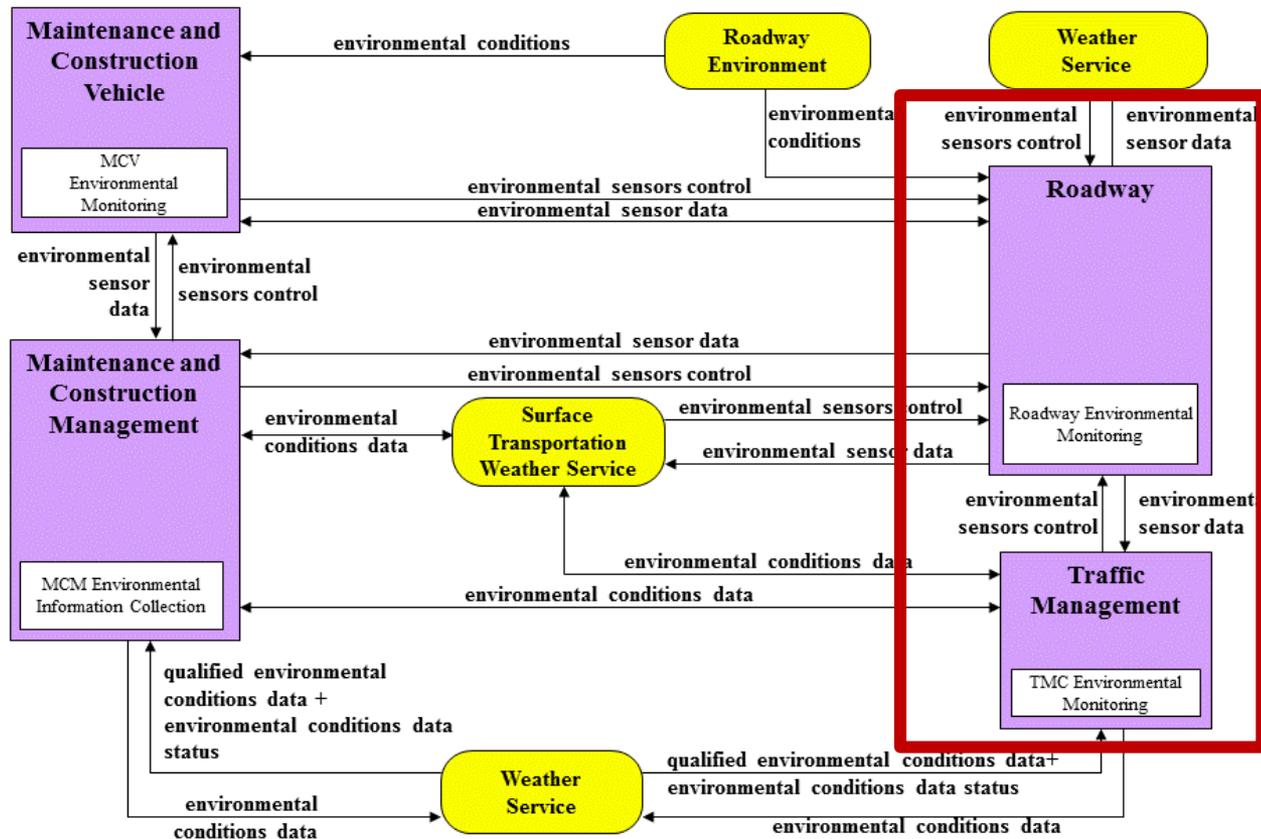
### Information from the Standard

- 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

MC03 – Road Weather Data Collection



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

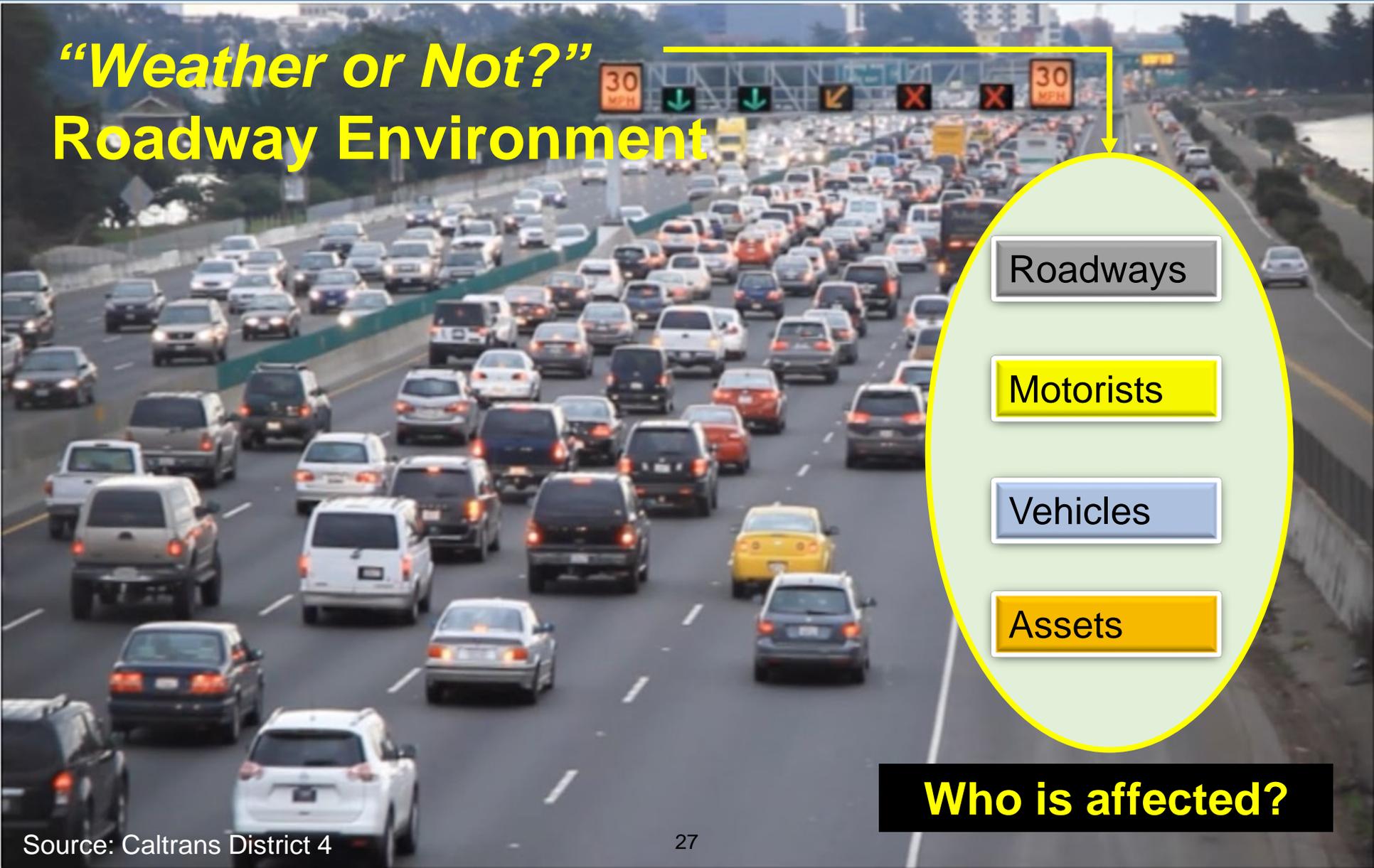
**Identify** specific ESS operational needs

## Learning Objective 2

**Identify Specific ESS  
Operational Needs**

# What are Your Operational Objectives?

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



Roadways

Motorists

Vehicles

Assets

**Who is affected?**

# What are Your Operational Objectives?

## Roadway Operational Environment Weather Variables



The image displays a map of New Jersey with several purple camera icons indicating weather monitoring stations. A video feed on the right shows a multi-lane highway with a green header reading "MM 034.4 South of Interchange 4". A "TP" logo is visible in the bottom left of the video feed. The source "Source: NJTPK" is noted in the bottom right of the video area.

- 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 WIRDE/AF

# 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

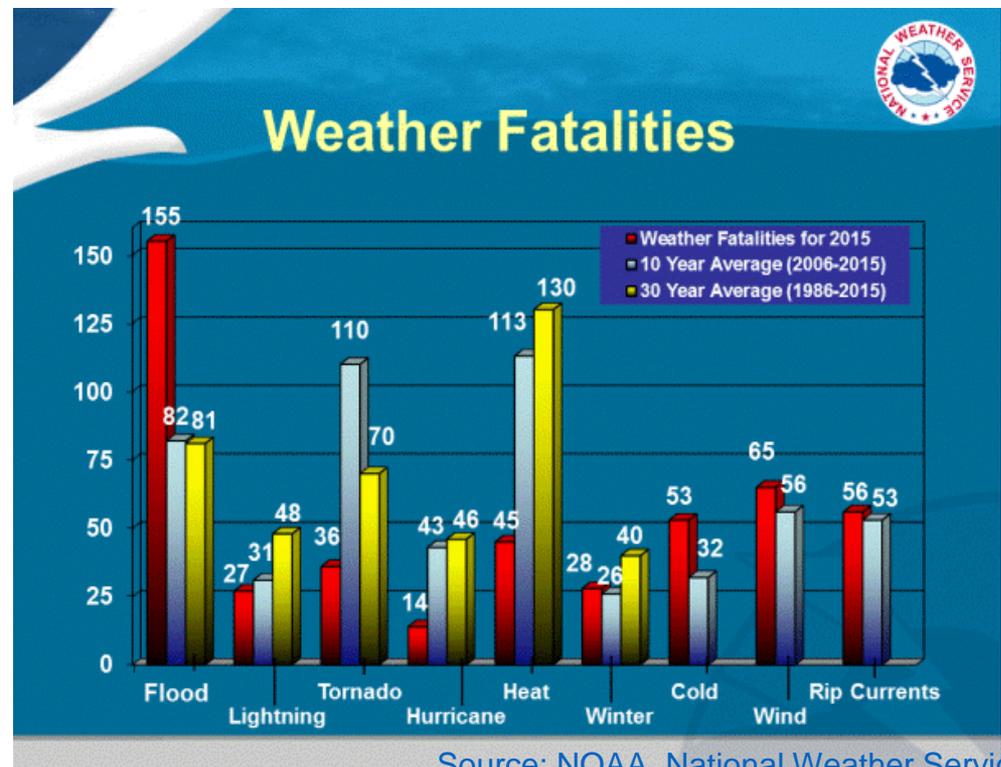
Traction, Stability  
Maneuverability

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**



# What are Your Operational Objectives?

## Operational Need

Deploy RWIS as a Decision Support System to Take Action

RWIS  
Decision Support Tool



Source: FHWA: WY TMC

Action

**Advisory**

**Control**

**Treatment**

# 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: NJTPA-Daktronics



Source: Caltrans

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



# What are Your Operational Objectives?

## Weather Related Control Actions



Source: National Conference of State Legislatures



Source: Tennessee Ramp Gate-FHWA

**EXAMPLE**

# 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: WYDOT TMC



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

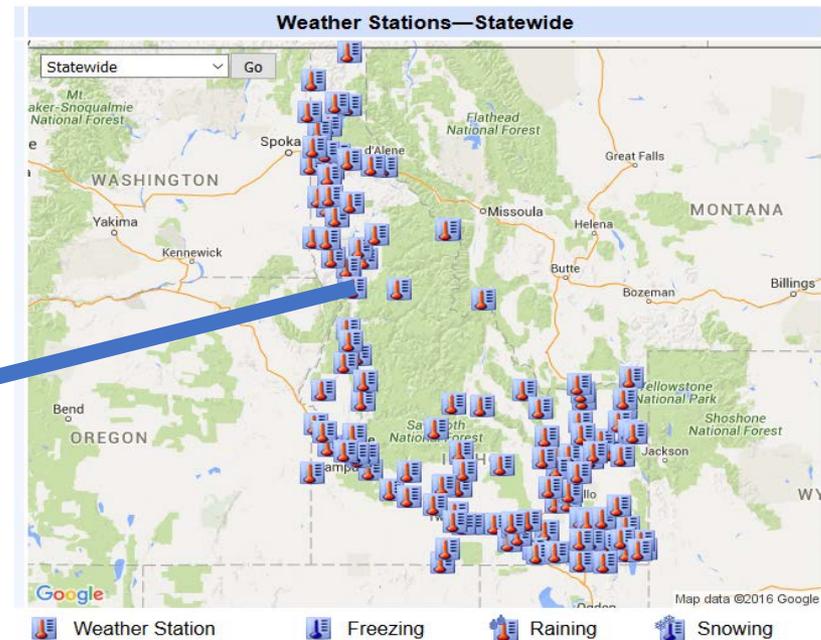
## Idaho DOT Statewide Deployments of Weather Stations



**US 95: Whitebird Hill**  
6 miles north of the White Bird area

**78 °F**

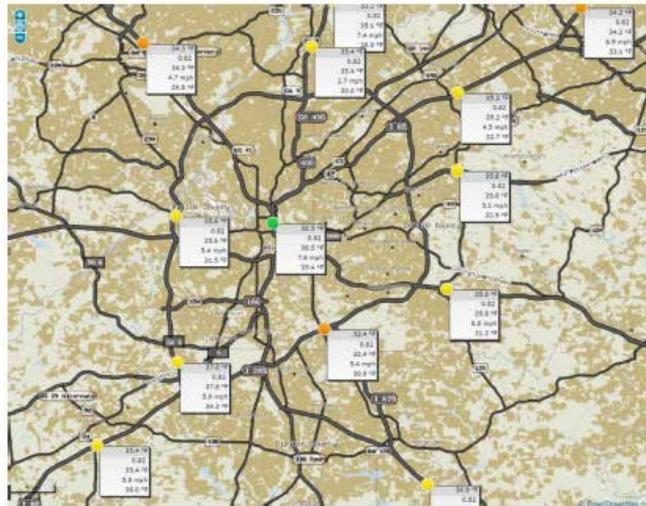
Precip (Yes/No)	No
Surface Status	Dry
Surface Friction	Good
Visibility	1.24 miles
Wind Speed (avg)	3.4 mph
Wind Speed (gust)	5.1 mph



# Deployment Examples



**Alabama DOT 26 SITES**



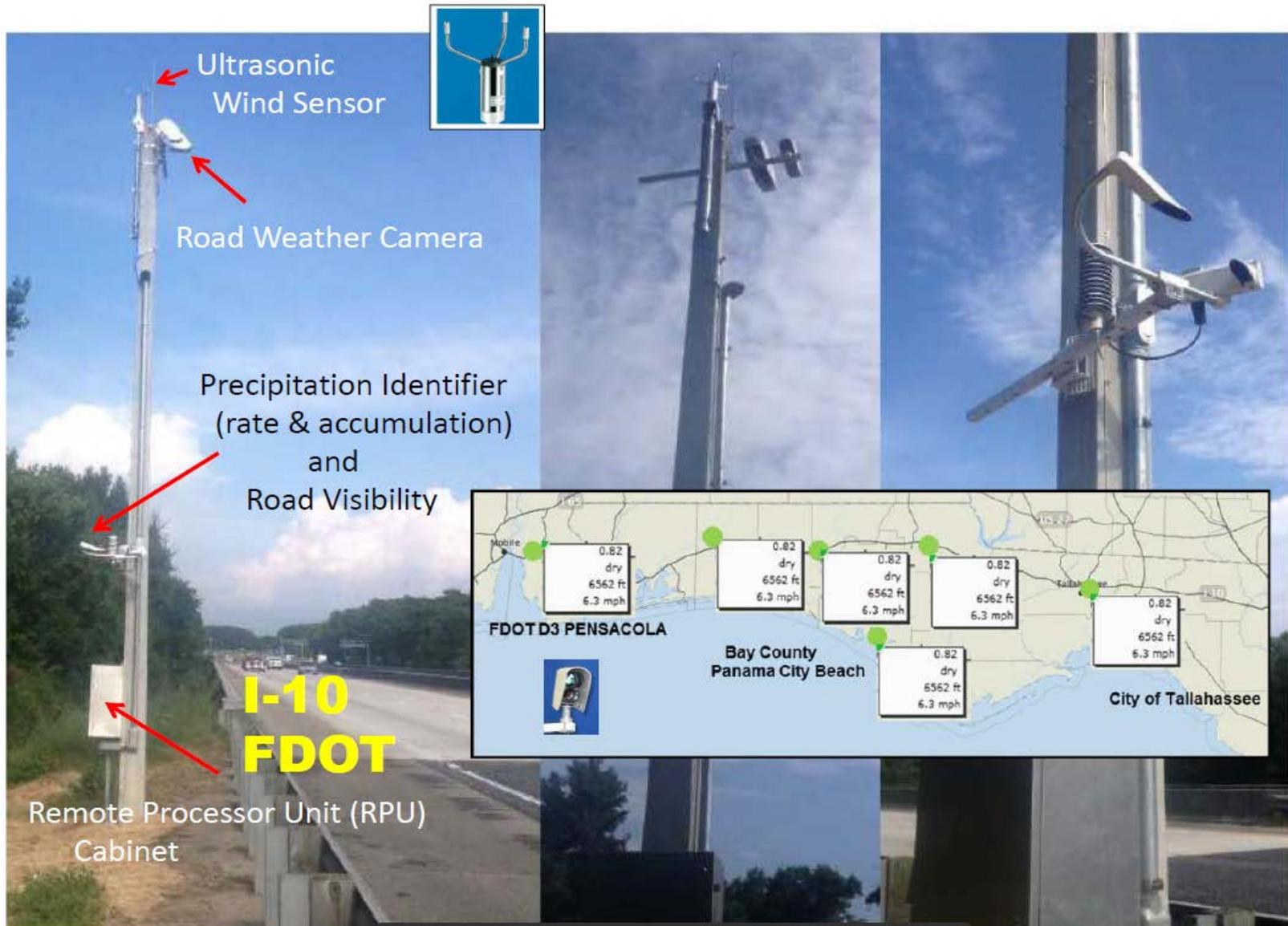
**Georgia DOT 27 RWIS Sites**



**Florida DOT 52 Sites**



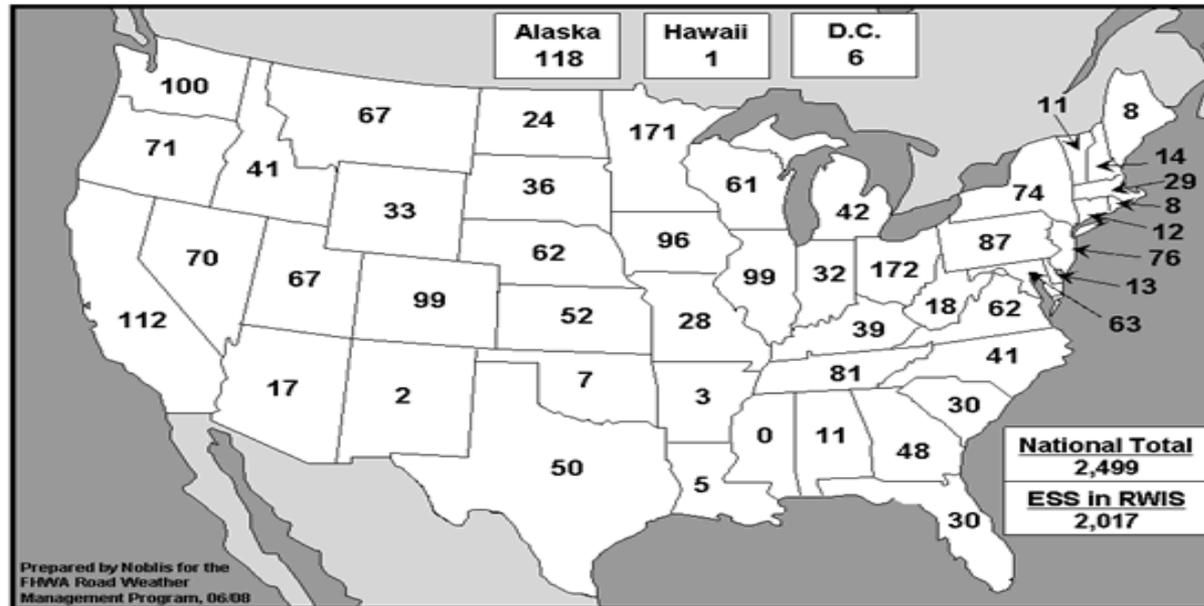
# Deployment Examples



# 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](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

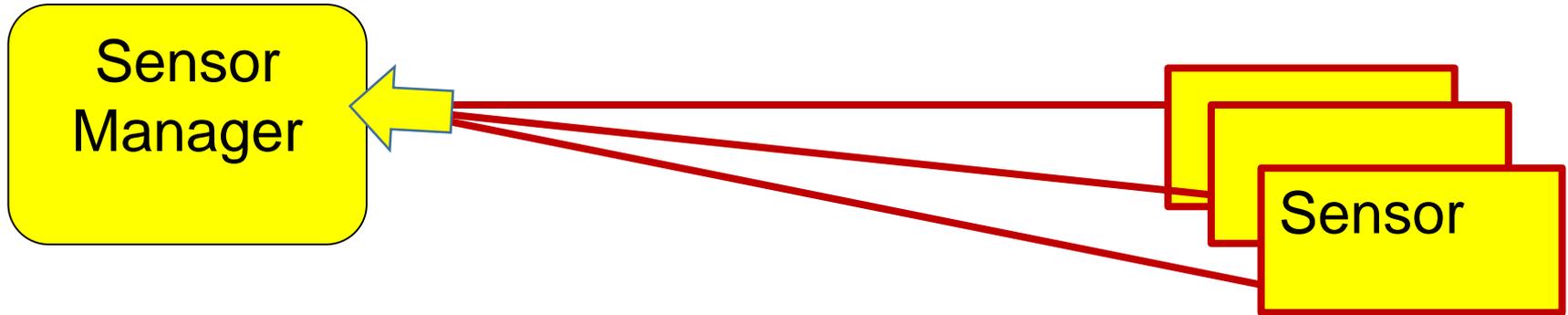
*A transportation system operator may wish to monitor the movements of a mobile ESS and, if it is part of a mobile pavement treatment system, monitor the chemicals being dispersed.*



Source: IOWADOT

## 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

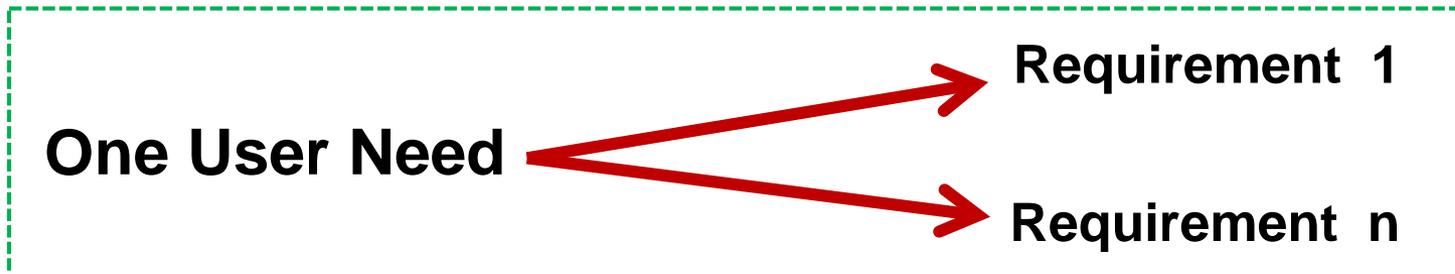
Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2	Sensor Manager Features			0.3 (1..*)	Yes / No	

# 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	

1<sup>st</sup> line is the headings of the PRL Table (**users cannot modify columns**)

2<sup>nd</sup> 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 v4 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	Retrieve Metadata for Each Wind Sensor - Text Description
		3.5.2.1.11.1	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	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	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			O.2 (1)	Yes / No	
2.5.1.5.b	Transportable			O.2 (1)	Yes / 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	

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

### 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

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			O.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



# 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 No	
2.5.1.5.b	Transportable			O.2 (1)	Yes 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



# 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



# 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!