**ITS Standards Advisories** provide the transportation community with information and guidance on key activities related to ITS standards. Standards Advisories are distributed monthly by the U.S. Department of Transportation's **ITS Standards Program**, with each Advisory focusing on a single ITS application and its corresponding standards. Standards Advisories highlight important, recent standards activities for the selected ITS application and provide links to more detailed information and resources. ITS Standards Advisories are posted on the ITS Standards Program web site at www.its-standards.net. Please email the following address if you would like to be notified by email when a new ITS Standards Advisory is posted on the web: flood@volpe.dot.gov.

If you are new to working with ITS standards, refer to the following introductory information.
- Frequently Asked Questions (FAQs) at the ITS Standards web site, www.its-standards.net/FAQ.htm
- Chapters 1, 2, and 3 of The NTCIP Guide, a comprehensive reference for NTCIP
- The ITS Specialist at your FHWA Resource Center or Division Office

## The ESS Standard:  What's New?

### Standards Development

NTCIP 1204:1998 *NTCIP Object Definitions for Environmental Sensor Stations* is V01.13 of the standard and includes Amendment 1 V02. NTCIP 1204 defines the data collected from sensors monitoring weather, pavement, and air quality conditions. Together with other related NTCIP standards, NTCIP 1204 allows the integration of devices and products from multiple vendors into a single system using standard communications and data.

NTCIP 1204 Version 2 is currently under development. A User Comment Draft is expected in October 2003; the Recommended Standard is expected in June 2004. Version 2 reflects industry-suggested edits to the data objects and allows the inclusion of new block objects for more efficient data exchange between an ESS and its central system. Other benefits include:
- An easier-to-use document that will facilitate the development of procurement specifications
- Additional data items requested by the community
- Reduced ambiguity.

NTCIP 1301 *Weather Report Message Set for ESS* is under development; a User Comment Draft is expected in June 2004. The Recommended Standard may be expected no earlier than June 2005.

Download the ESS standards from the NTCIP web site: http://www.ntcip.org/library/groupstatus/default.asp?groupid=6.

#### For the record
The history of NTCIP 1204:
- Version 1: Published October 1998
- Amendment 1: Approved January 2001
- Version 2: In working group draft.

### Testing

The purpose of testing the ESS standard is to evaluate the completeness, suitability, and effectiveness of its features.  Battelle, with the Minnesota Department of Transportation (MnDOT), independently tested NTCIP 1204 with the supporting global standard, NTCIP 1201, and related base standards, in May 2001.

#### For the record
The overall test results showed that the standard objects, associated message sets, and data definitions used to implement ESS in Minnesota achieved a successful ITS operational deployment.

As a result of the testing, four types of data were identified that are desirable to capture, but are missing from the standard:
- Historical data
- Single-frame CCTV images
- Frequent periodic solar radiation data
- Time-series data on subsurface soil moisture levels.

These results have been handed over to the ESS Standard Development Team.  This first test was a positive step forward.  However, more testing is needed to assess interoperability and interchangeability since the Minnesota implementation consisted of only one vendor ESS product in a relatively simple standalone system.  When ESS systems mature, additional testing will be done using multiple vendor products integrated with other transportation applications.

Consult  http://www.its-standards.net/testESS.htm  for information about ESS testing and the ITS Standards Testing Program.

# Rolling Out ESS

## Deployment

With the increasing development of advanced traveler information systems, ESS deployment objectives have begun to encompass a higher level of standards-based integration than was needed for the support of roadway maintenance activities alone. Two states with such ESS deployments are Wisconsin and Washington. In Wisconsin, upgrades will be based on the NTCIP ESS standards to allow for interoperability among devices as well as the ability to control devices such as dynamic message signs. The Washington State DOT used the NTCIP standards to integrate new ESS with legacy, proprietary ESS so that all devices could be controlled by a single server. Query the Contacts Database on the Standards web site for additional deployments (http://www.its-standards.net/deploy.htm).

### *Tools*

In addition to the ESS standard NTCIP 1204, there are several other ITS standards (see page 4) that are needed to implement ESS. For brevity we refer to these standards collectively as the ESS standards. Many tools and resources are available to assist those considering standards-based ESS deployments.

- **The ESS Standards Application Package** is a folder of documents providing an overview of ITS standards and specific information on ESS standards and ESS deployments. Send your request to flood@volpe.dot.gov.
- **The NTCIP SpecWizard** software helps deployers formulate NTCIP-compatible specifications for ESS procurements. This tool helps users remove many of the ambiguities that often slip into specifications. The SpecWizard is currently available from McTrans. Order by phone at 1-800-226-1013, by fax at 352-392-6629 or online at http://mctrans.ce.ufl.edu/catalog/.
- An **ESS Specification Guide** is currently under development that will address procurement of NTCIP-compliant environmental sensor stations.

- **The FHWA Road Weather Management Program** has published a brochure, *An Introduction to Standards for Road Weather Information Systems (RWIS): Siting Standards, Calibration Standards, Communications Standards.* The brochure is available at http://ops.fhwa.dot.gov/weather/publications/rwis_brochure.pdf.
- **Examples of state RWIS specifications** that cite the NTCIP standards are available on the Aurora Program web site at http://www.aurora-program.org/matrix.cfm. Aurora is an international partnership of public agencies working on RWIS.
- A **one-day course on RWIS** is planned; development of the course is expected to begin shortly. Among topics related to RWIS, the course will feature a section on ESS ITS standards. Contact Paul Pisano at 202-366-1301 or Paul.Pisano@fhwa.dot.gov for more information.

## Working with Vendors

Procuring NTCIP-conformant devices raises the issues of 1) how to certify a particular device's conformance with the standard and 2) how to test for a vendor's compliance with an agency's contractual requirements. While ESS vendors may assert conformance, there is no "official" conformance test for devices employing ESS Version 1.

These issues are compounded by an ESS architecture in which sensors are linked to a computer processor that transmits data to a central site. The sensors and the processor make up the ESS remote processing unit (RPU). The links between the sensors and the processor are often proprietary. Another area where vendors may not meet standards is archived data.

The NTCIP working group is wrestling with the issue of conformance testing for the family of NTCIP standards. ESS Version 2, which incorporates systems engineering process principles, will more easily permit the design of both conformance and compliance test procedures.

# U.S. DOT Urges Use of ESS Standards

The U.S. DOT strongly encourages state and local agencies to use ESS standards. ESS standards are mature and offer immediate benefits for agencies by 1) providing interoperability between ESS and other NTCIP-compatible field devices running on common communications channels, and 2) enabling simplified administration of ESS subsystems. Check the resources in the section below for help with systems assessment, migration, integration, and procurement. In particular, assistance is available to help you decide whether to implement standards-based ESS

now with Version 1, or whether to wait until the publication of Version 2. Our recommendations are organized by ESS deployer experience.

- **Current users of standards-based ESS:** Monitor the development of ESS Version 2 to determine the timing of an upgrade from Version 1 that will support your vision for future ESS usage.
- **Those considering using standards-based ESS:** ESS standards offer an ideal opportunity to introduce standards-based ITS into your agency's operations.

▪ **Those with legacy ESS systems considering migrating to standards-based ESS:** Migrating from proprietary to standards-based ESS can be complicated, but will provide both immediate and long-term benefits. Use the resources cited in this document to find peer agencies that are making, or have completed, the transition.

## Standards Resources

### Technical Assistance

Technical assistance for ESS (as well as other applications) is available in a number of formats.

▪ **The ITS JPO Standards Program Web Site** is the first stop for information on the ESS standards. The site contains a wealth of information on ITS standards, including the current status of the ESS standards. Visit http://www.its-standards.net/.

▪ **An ITS Specialist** is available at each of the four FHWA Resource Centers to provide guidance on issues related to ITS standards. Visit www.fhwa.dot.gov/field.html for contact information.

▪ **The ITS Field Support Team** is a major new technical assistance program sponsored by the Standards Program. (Visit http://www.its-standards.net/Documents/FSTflyer.pdf for more details.) The ITS Field Support Team offers intensive consultation and support on a broad range of standards-related issues, including:
  o Assessment of current system
  o Development of project specifications
  o Review of existing contracts and specifications
  o Identification of appropriate contracting and procurement mechanisms
  o Development of test plans
  o Evaluation of systems for contract compliance and conformance to specifications.

▪ **The ITS Standards Contacts Database** contains contact information for state-level deployers who have used, are using, or are planning to use ESS standards. Individuals in the database are available for informal discussions about using ESS standards. Find the database on the ITS Standards web site at http://www.its-standards.net/deploy.htm.

▪ **The Standards Forum** is a *moderated*, on-line community of individuals interested in learning about ITS standards and sharing their experiences with colleagues. The only requirement is a desire to learn about ITS standards. Questions posted to the Forum are answered quickly. Visit the forum at www.nawgits.com/stdsforum/.

### Training

Training is available for ESS standards, and other standards, through the Institute of Transportation Engineers (ITE) and the Transit Standards Consortium. Training is held at locations throughout the country. The following web sites provide more detail.

▪ www.ite.org
▪ www.tsconsortium.org
▪ www.pcb.its.dot.gov

### Partnerships and Programs

ENTERPRISE is a multi-agency, multi-national consortium to advance ITS. The Integrating NTCIP Hardware (INCH) program facilitates member-agency abilities to specify, procure, install, and test NTCIP-compliant hardware, and has the potential to support field testing of NTCIP-compliant devices for NTCIP Standards Developing Organizations (SDOs). ENTERPRISE-sponsored NTCIP test tools and deployment assessments are available from http://www.enterprise.prog.org/inch3.htm.

### Standards on Sale

Standards may be purchased from http://global.ihs.com/. Members of the American Association of State Highway and Transportation Officials (AASHTO), ITE, and the National Electrical Manufacturers Association may obtain a password from those organizations to purchase NTCIP standards for 50% off retail.

### Getting Involved

*ESS Working Group*
Contact the chair of the ESS working group, Gene Martin, for information on participating in the standards development process. His email is e.martin@virginiadot.org.

*2003 ITS Standards Registrants' Lists*
Registrants' Lists of interested parties are usually maintained for each ITE standards project. Registrants will receive periodic updates and calls for comments on draft standards; comments will assist the SDOs and committees in producing standards that meet the requirements of all interested parties. Each Registrants' List will be updated annually. To register, complete the form and send it to ITE by mail or fax.

# Standards Applicable to ESS Deployments
## Standards Developing Organization (SDO): AASHTO

The following section lists standards that can be used in an ESS deployment. **Note:** The **"Type"** column indicates whether the standard defines data or communications (and for communications which layer of the link from physical to message definition). **"SDO Status"** denotes the standard's current development status as determined by the working group that oversees the development of the standard. "**Comment**" refers to any additional information related to the status of the standard. For further information on each of the ESS standards, see http://www.its-standards.net/AAfactsheets.asp. For further information on the standards development process, see http://standards.ieee.org/resources/glance.html.

| Standard | Document Title | Description | Type | SDO Status | Comment |
|---|---|---|---|---|---|
| NTCIP 1204 | Object Definitions for Environmental Sensor Stations (ESS) | Defines data found in road-weather information stations and air quality sensors. | Data Dictionary | Version 1.13 Amendment 1 published Nov 01 | Version 2 draft distributed for user comment Jan 03 |
| NTCIP 1206 | Object Definitions for Data Collection and Monitoring (DCM) Devices | Defines the data stored in roadside count stations. | Data Dictionary | Current Status – User Comment Draft | Recommend standard expected Dec 03 |
| NTCIP 1301 | Weather Report Message Set for ESS | Defines messages used to exchange weather and pavement data between centers. | Data Dictionary | Current Status – Working Group Draft | Expected to go to User Comment Draft by Dec 03 |
| NTCIP 1201 | Global Object Definitions | Defines data, such as time, to be used in multiple device types including ESS. | Data Dictionary | Published Apr 97 | Version 2 in User Comment |
| NTCIP 1101 | Simple Transportation Management Framework | Rules and protocols for organizing, describing and exchanging transportation management information between applications and equipment for interoperability. | NTCIP Base Standard | Published Apr 97 Amended | To be replaced by NTCIP 1102, NTCIP 1103, and NTCIP 8004 |
| NTCIP 1102 | Base Standard: Octet Encoding Rules (OER) | Encoding/decoding rules to prepare data for transmission or to decode data before sending it to an application. | NTCIP Base Standard | Approved Aug 02 | |
| NTCIP 1103 | Simple Transportation Management Protocol (STMP) | Rules for exchanging data with little overhead for interoperability of transportation devices operating over limited bandwidth links. | NTCIP Base Standard | Preparing to submit to NTCIP Joint Committee as a recommended standard | Publication expected by Dec 03 |
| NTCIP 8004 | Structure and Identification of Management Information (SMI) | Defines how the NTCIP effort defines and registers its data, including how the SNMP MIB information is mapped into the ITS Data Registry. | NTCIP Base Standard | Current Status – Working Group Draft | Balloting expected by Dec 03 |
| NTCIP 2301 | Application Profile for Simple Transportation Management Framework (STMF) | Application, presentation, and session layer protocols to provide simple information management services. | Communications Protocol Profile – Application Layer | Published Mar 02 | Working Group developing Version 2 draft |

| Standard | Document Title | Description | Type | SDO Status | Comment |
|---|---|---|---|---|---|
| NTCIP 2201 | Transportation Transport Profile | Defines a transport profile to transmit data when devices are directly connected to the central controller or computer and do not require network services. | Communications Protocol Profile – Transport Layer | Approved standard, awaiting publication | Publication in 03 |
| NTCIP 2202 | Internet (TCP/IP and UDP/IP) Transport Profile | Transport and network layer protocols to provide connectionless and connection-oriented transport services. | Communications Protocol Profile – Transport Layer | Published Mar 02 | |
| NTCIP 2101 | Subnet Profile for Point to Multipoint Protocol using RS 232 | Data link and physical layer protocols applicable to roadside devices. | Communications Protocol Profile – Subnet Layer | Published Mar 02 | |
| NTCIP 2102 | Subnet Profile for PMPP over FSK Modems | Defines how to communicate over twisted wire using FSK modems. | Communications Protocol Profile – Subnet Layer | Approved standard awaiting publication | Publication in 03 |
| NTCIP 2103 | Subnet Profile for Point to Point Protocol using RS 232 | Rules for using the point-to-point protocol over RS-232 related circuits for interoperability of devices linked by dial-up circuits. | Communications Protocol Profile – Subnet Layer | In ballot | Version 2 in Working Group Draft |
| NTCIP 2104 | Subnetwork Profile for Ethernet | Provides interoperability for devices that communicate over local area network (LAN) interfaces. | Communications Protocol Profile – Subnet Layer | Approved standard awaiting publication | |

## Acronyms and Abbreviations

| | | | | |
|---|---|---|---|---|
| AASHTO | American Association of State Highway and Transportation Officials | | NTCIP | National Transportation Communications for ITS Protocol |
| CCTV | Closed Circuit Television | | OER | Octet Encoding Rules |
| DCM | Data Collection and Monitoring | | PMPP | Point-to-Multipoint Protocol |
| ESS | Environmental Sensor Station(s) | | RPU | Remote Processing Unit |
| FAQs | Frequently Asked Questions | | RWIS | Road Weather Information System |
| FHWA | Federal Highway Administration | | SDO | Standards Developing Organization |
| FSK | Frequency Shift Keying | | SMI | Structure of Management Information |
| FTP | File Transfer Protocol | | SNMP | Simple Network Management Protocol |
| INCH | Integrating NTCIP Hardware | | STMF | Simple Transportation Management Framework |
| ITE | Institute of Transportation Engineers | | STMP | Simple Transportation Management Protocol |
| ITS | Intelligent Transportation Systems | | | |
| JPO | Joint Program Office | | TCP/IP | Transmission Control Protocol/Internet Protocol |
| LAN | Local Area Network | | | |
| MIB | Management Information Base | | U.S. DOT | United States Department of Transportation |
| MnDOT | Minnesota Department of Transportation | | UDP/IP | User Datagram Protocol/Internet Protocol |
| NEMA | National Electrical Manufacturers Association | | WSDOT | Washington State DOT |