A User Comment Draft (UCD)

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National Transportation Communications for ITS Protocol

Environmental Sensor Station (ESS) Interface Protocol

October 10, 2024

Revision Notes:

1. *This revision reflects all proposed changes to date, except as follows: Test procedures have not yet been updated*
2. *Other minor issues that are still for discussion within the WG*

v05.03 will accept the changes in this document as a new baseline so that subsequent changes are easier to identify.

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FOREWORD

This document is an NTCIP Device Data Dictionary Standard. Device Data Dictionary Standards provide formal definitions of data elements for use within NTCIP systems. The data is defined using the format specified in NTCIP 8004, which is based on the formats defined in RFC 2578. This data is typically exchanged using the Simple Network Management Protocol (SNMP) as defined in NTCIP 2301.

This document identifies and defines how a management station may wish to interface with a field device to control and monitor environmental sensor stations (ESS). This document defines requirements that are applicable to all NTCIP ESS and it also contains optional and conditional sections that are applicable to specific environments for which they are intended.

Approvals

NTCIP Data Dictionary Standards are separately balloted and approved by AASHTO, ITE, and NEMA after recommendation by the Joint Committee on the NTCIP. Each organization has approved this document as the following standard type:

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History

Version	Date	Description (latest on top)
V05	TBD	Updated to SMIv2 with related security updates, added support for multiple languages (e.g., DisplayString changed to SnmpAdminString), revised RTM to reference ISO 26048-1 for global objects, and revised test procedures to reflect changes.
v04	April 2022	Updated to reflect additional lessons learned and to support new user needs (e.g., adding support for sensor tables for most sensors rather than just a single instance).
v03	October 2009	Added Annex C (test procedures) along with minor corrections and clarifications
v02	July 2005	Developed to reflect additional lessons learned, to incorporate better documentation (e.g., Sections 2-4, which provide the concept of operations, requirements, and dialogs) and to add new features requested by the ITS community (e.g., the control of automated de-icing equipment).
v01A	November 2001	Technical corrections for objects
v01 (a.k.a. NEMA TS 3.7)	September 1998	Original version

INTRODUCTION

This document provides definitions of data elements for environmental sensor data, including weather data, pavement condition data, water level data, and air quality data. The data is defined using the Structure of Management Information version 2 (SMIv2) object-type format as defined in RFC 2578 and would typically be exchanged using SNMPv3 per the rules of NTCIP 2301. This document also relies upon the use of SFTP for the exchange of snapshot images captured by the ESS.

This document contains four normative and four informative annexes.

The following keywords apply to this document: AASHTO, ITE, NEMA, NTCIP, ESS, data, data dictionary, object, environmental sensor.

This document uses only metric units.

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Section 1
General [Informative]

1.1 Scope

This document specifies the logical interface between environmental sensor stations (ESS) and the host systems that control them (commonly referred to as “central” systems). This document describes the supported ESS functionality in terms of user needs and requirements; however, the nature of the interface is determined in part by the operational nature of the devices being controlled, and therefore this document touches on such operational issues on occasion.

ESS include a wide array of sensors, including those that monitor weather, roadway surface, water level, and air quality conditions. These sensors are typically connected to a nearby microprocessor termed a remote processor unit (RPU). An ESS consists of the RPU plus its suite of sensors.

Typically, this equipment is fixed or permanently located at a site along a travel corridor. In some cases, the "stations" may be transportable, or even mobile. For the purposes of this document, all three types of stations are called ESS. In the transportation community, these devices are frequently used to improve roadway maintenance and traffic operations.

Environmental sensors are also frequently co-located with pavement treatment systems (PTS) and, in fact, may use the same controller. Thus, for the purpose of this document, the term ESS may also include a PTS.

Note—The PTS portion of this document may be placed in a separate standard in the future.

Prior to standardizing the interface for ESS and their management stations, each manufacturer developed its own protocol to meet its own particular needs. This approach resulted in systems that were not interchangeable or interoperable. If an agency wished to use either a management station or additional ESS from a different vendor, the agency encountered significant systems integration challenges, requiring additional resources to address. These additional resource requirements inhibited information sharing within and between various potential users of the data and prevented vendor independence. Without manufacturer independence, resource requirements further increase because of a lack of a competitive market.

These problems were not limited to weather and environmental monitoring. Many other devices needed to exchange information. In surface transportation, examples included traffic signal controllers, dynamic message signs, bus priority sensors, etc. The NTCIP family of open standards for communications between field devices and management stations was developed to address these issues. This effort was later incorporated into ISO standards for some devices.

This document is part of that larger family and is designed to define an interoperable and interchangeable interface between a management station and an ESS, while still allowing for extensions beyond this document to allow for new functions as needed. This approach has proven to support the deployment of ESS from one or more vendors in a consistent and resource-efficient way.

This document only addresses a subset of the requirements needed for procurement. It does not address requirements related to the performance of the sensors (e.g., accuracy, the supported detection range, the time it takes to detect conditions, etc.), hardware components, mounting details, etc.

This document standardizes the communications interface by identifying the various operational needs of the users (Section 2) and subsequently identifying the necessary requirements (Section 3) that support each need. This document then defines the NTCIP standardized communications interface used to fulfill

these requirements by identifying the dialogs (Section 4) and related data concepts (Section 5) that support each requirement.

Traceability among the various sections is defined by the Protocol Requirements List (Section 3.3.3) and the Requirements Traceability Matrix (Annex A). Conformance requirements for this document are provided in Section 3.3.2.1.

An implementation of this document requires lower level services to structure, encode, and exchange the data concepts that it defines. This document assumes that the data concepts are exchanged by SNMPv3 per the rules defined in NTCIP 2301.

1.2 References

The following documents are referenced by this document. At the time of publication, the editions indicated were valid.

1.2.1 Normative References

Normative references contain provisions that, through reference in this text, constitute provisions of this document. All standards are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the standards listed.

Identifier	Title
AASHTO / ITE / NEMA NTCIP 8004 v03	*Structure and Identification of Management Information (SMI)* published
Glossary of Meteorology	*Glossary of Meteorology; American Meteorological Society, 2022, https://glossary.ametsoc.org/, accessed 20 July 2023.*
ISO/TS 26048-1: -	*Intelligent transport systems — Field equipment SNMP data interface — Part 1: Global objects (under ballot)*
ISO/IEC/IEEE 24765:2017	*Systems and software engineering — Vocabulary,* 2017, available at https://standards.iso.org/ittf/PubliclyAvailableStandards/index.html
ITU-T X.696 (a.k.a., ISO/IEC 8825-7)	*Information technology — ASN.1 encoding rules: Specification of Octet Encoding Rules (OER), published August 2015*
RFC 854	*Telnet Protocol Specifications*
RFC 2578	*Structure of Management Information Version 2 (SMIv2)*, April 1999
RFC 2579	*Textual Conventions for SMIv2,* April 1999
RFC 2580	*Conformance Statements for SMIv2*, April 1999
RFC 3411	*An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks*, December 2002
RFC 4250	*The Secure Shell (SSH) Protocol Assigned Numbers, January 2006*
RFC 4251	*The Secure Shell (SSH) Protocol Architecture, January 2006*
RFC 4252	*The Secure Shell (SSH) Authentication Protocol, January 2006*
RFC 4253	*The Secure Shell (SSH) Transport Layer Protocol, January 2006*
RFC 4254	*The Secure Shell (SSH) Connection Protocol, January 2006*
RFC 4255	*Using DNS to Securely Publish Secure Shell (SSH) Key Fingerprints, January 2006*
RFC 4256	*Generic Message Exchange Authentication for the Secure Shell Protocol (SSH), January 2006*
RFC 6933	*Entity MIB (Version 4)*
RFC 9110	*HTTP Semantics, June 2022*
SFTP v3	*SSH File Transfer Protocol, October 2001. Available at https://datatracker.ietf.org/doc/html/draft-ietf-secsh-filexfer-02*

WMO No. 306; 2019	*Technical Regulations; Manual on Codes, International Codes, Volume 1.2, Annex II, (Part B - Binary Codes, FM 94 BUFR),* 2019 edition, updated in 2022. https://library.wmo.int/doc_num.php?explnum_id=11283, accessed 20 July 2023

1.2.2 Other References

Other references are included to provide a more complete understanding of this document and its relationship to other documents.

Identifier	Title
AASHTO / ITE / NEMA NTCIP 2202 v02	*Internet (TCP/IP and UDP/IP) Transport Profile*, published
AASHTO / ITE / NEMA NTCIP 2301 v03	*Simple Transportation Management Framework (STMF) Application Profile (AP) (AP-STMF)*, published
AASHTO / ITE / NEMA NTCIP 8007 v02	*Testing and Conformity Assessment Documentation within NTCIP Standards Publications*, published
AASHTO / ITE / NEMA NTCIP 9001 v04	*The NTCIP Guide* published July 2009
Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT), Version 9.2	*National ITS Architecture, FHWA, 2023; available at https://www.arc-it.net*
EN 15518-3:2023	*Winter maintenance equipment - Road weather information systems - Part 3:Requirements on measured values of stationary equipment*, European Standard, 2023
ISO 15784-2:2024	*Intelligent transport systems — Data exchange involving roadside equipment communication — Part 2: Centre to field device communications using SNMP*
RFC 5935 (IAB)	*Expressing SNMP SMI Datatypes in XML Schema Definition Language,* M. Rose, K. McCloghrie, August 2010
OMG Unified Modeling Language Specification, Version 1.5	*OMG Unified Modeling Language Specification,* Object Management Group, 2003
SAE J1939	*Serial Control and Communications Heavy Duty Vehicle Network – Top Level Document, J1939_202306,* published June 2023
SAE 1979	*E/E Diagnostic Test Modes, J1979_201702,* published February 2017
TMDD	*Traffic Management Data Dictionary (TMDD) Standard v3.1 for the Center to Center Communications, v3.1,* AASHTO / ITE published January 13, 2020
Weather-Responsive Traffic Management	*Weather-Responsive Traffic Management – Concept of Operations. FHWA, 2003* ops.fhwa.dot.gov/weather/best_practices/WeatherConOps0103.pdf

1.2.3 Contact Information

1.2.3.1 AASHTO / ITE Traffic Management Data Dictionary (TMDD) Documents

The Traffic Management Data Dictionary (TMDD) documents can be downloaded at:

https://www.ite.org/technical-resources/standards/tmdd/

1.2.3.2 American Meteorological Society

The Glossary of Meteorology is available from:

https://glossary.ametsoc.org/

1.2.3.3 CEN (EN) Documents

Documents from the European Committee for Standardization (CEN and EN) are available at:

https://www.cencenelec.eu/

1.2.3.4 IAB and IETF (RFC) Documents

For Internet Architecture Board (IAB) and Internet Engineering Task Force documents, contact:
Internet Architecture Board (IAB)
www.rfc-editor.org

1.2.3.5 ISO

ISO documents are available from:

https://www.iso.org/standards.html
Electronic files that support ISO documents are available for free from:

https://standards.iso.org

1.2.3.6 ISO/IEC/IEEE

ISO/IEC/IEEE 24765:2017 can be downloaded for free from:

https://standards.iso.org/ittf/PubliclyAvailableStandards/index.html

1.2.3.7 ITU-T

ITU-T recommendations can be downloaded for free from:

https://www.itu.int/rec/T-REC-X/en

1.2.3.8 National ITS Architecture

The National ITS Architecture, also known as the Architecture Reference for Coopoerative and Intelligent Transportation (ARC-IT), may be viewed on-line at:

https://www.arc-it.net

1.2.3.9 NTCIP Standards

Copies of NTCIP standards may be obtained from:

NTCIP Coordinator
National Electrical Manufacturers Association
1300 N.17th Street, Suite 900
Rosslyn, Virginia 22209-3801
www.ntcip.org
e-mail: ntcip@nema.org

Draft amendments, which are under discussion by the relevant NTCIP Working Group, and amendments recommended by the NTCIP Joint Committee are available.

1.2.3.10 Object Management Group Documents

Copies of OMG standards may be obtained electronically from the Object Management Group at:

https://www.omg.org/

1.2.3.11 Office of the Federal Coordinator for Metrology (OFCM) Documents

Copies of OFCM documents may be obtained from:

Office of the Federal Coordinator for Meteorology
8455 Colesville Rd., Suite 1500
Silver Spring, MD 20910
(301) 427-2002
https://www.ofcm.gov/

1.2.3.12 SAE International Documents

Copies of SAE International documents may be obtained from:

SAE Customer Serrice
400 Commonwealth Drive
Warrendale, PA 15096-0001
(877) 606-7323
store.sae.org

1.2.3.13 World Meteorological Organization (WMO) Documents

WMO documents are available from:

https://public.wmo.int/en/resources/standards-technical-regulations

1.3 General Statements

1.3.1 SNMPv3

The information defined in this document can theoretically be exchanged over any communications stack, but is designed to be exchanged using SNMPv3. Within the context of this document SNMPv3 refers to a complete communications stack, as described in NTCIP 2301 v03 and ISO 15784-2:2024, which (among other requirements) require support for Transport Layer Security (TLS) version 1.3 and the TLS Transport Model (TLSTM). TLSTM defines how the SNMP engine uses the TLS certificate to manage SNMP data access

1.3.2 Compatibility with Versions Prior to NTCIP 1204 v05

Prior to v05, NTCIP 1204 was intended for use with SNMPv1, which has known security vulnerabilities. Starting with v05, NTCIP 1204 is intended for use with SNMPv3, which addresses the known security vulnerabilities with SNMPv1 with minimal redesign but is not directly compatible with prior implementations using SNMPv1.

Because the migration to SNMPv3 broke direct backward compatibility, the NTCIP community agreed to address a number of other known technical issues with NTCIP data to further address security, ambiguity, code reusability, longevity and other issues. Most of these issues were related with NTCIP 1201 and NTCIP 1103, which prior versions of this document normatively referenced. These references have been replaced with references to ISO 26048-1. In addition, v04 deprecated and replaced some objects from prior versions of NTCIP 1204.

This document does not define rules for exchanging any data that was deprecated in NTCIP 1204 v05 or earlier. Implementations that need to interoperate with equipment that conforms to versions of this document prior to NTCIP 1204 v05, should refer to those prior versions for specific requirements, especially in relation to data from NTCIP 1103 and NTCIP 1201.

Most of the objects directly defined in prior versions of NTCIP 1204 were upgraded without significant compatibility issues. Deprecated objects are retained within the MIB in order to provide an unambiguous definition of how they should be presented if they are exchanged using SNMPv3 (e.g., this might be done when communicating to a proxy agent that provides an SNMPv3 interface for a native SNMPv1 device).

1.3.3 Use of SMIv2

SNMPv3 is designed to exchange data defined using the Structure of Management Information (SMI) Version 2 (v2) as defined in RFC 2578. Versions of this document prior to NTCIP 1203 v04 defined data using SMIv1, as defined in RFC 1212. The data definitions also conform with NTCIP 8004, which defines additional rules (e.g., the subclauses used within the DESCRIPTION clause. This document updates the MIB to conform to SMIv2 and the current version of NTCIP 8004 while retaining the object identifiers of previously declared object types. In some cases, minor revisions have been made to objects; when these have any technical impact, the issue is identified in the Informative subclause of the object type description and in the object refinement table in Annex A, when necessary.

1.3.4 Superseding and Supplanting Objects

Many of the object types defined in this document identify superseding or supplanting object types by using a "<Superseded by>" or "<Supplanted by>" clause. Supplanting object type(s) provide similar functionality while superseding objects provide a new interface for the same device capability.

For example, eventConfigMode (defined in NTCIP 1103 v03) is supplanted with fdCondTriggerMode (defined in ISO 26048-1). Although both objects provide similar functionality (i.e., identifying a type of condition to trigger an event), setting an instance of eventConfigMode does not affect any instance of fdCondTriggerMode in an implementation that supports both objects because the associated event logs are defined separately.

By contrast, globalTime (defined in NTCIP 1201 v03) is superseded by fdClockUtcDate and fdClockUtcTime. In other words, if a device supports both globalTime and fdClockUtcTime, setting globalTime will affect the time reported by fdClockUtcTime. The core device capability is the same (e.g., keeping time), but there is a new interface that provides greater range and resolution.

1.4 Terms

For the purposes of this document, the following terms, definitions, acronyms, and abbreviations apply. Meteorological terms not defined in this section are in accordance with their definitions in the *Glossary of Meteorology*. Systems and software engineering terms not defined here are used in accordance with their definitions in ISO/IEC/IEEE 24765. NTCIP terms not defined in one of these sources are in accordance with their definitions in NTCIP 8004. English words not defined in one of these sources are used in accordance with their definitions in *Webster's New Collegiate Dictionary*.

Term	Definition
Binary Universal Form for the Representation of Meteorological Data (BUFR)	The name of the WMO standard binary code for the exchange and storage of non-gridded meteorological data.
Consistent	The ability of two or more systems or components to exchange information and use the supported information that has been exchanged and gracefully reject any unsupported information according to defined rules.
Controller	A host computing platform that is used to manage the collection and reporting of sensor data and/or to manage the treatment of pavement for icing conditions. Note: Within the ESS community, sometimes called a remote processor unit or "RPU".
Environmental Monitoring Equipment Package	The component within a management subsystem which performs advanced processing of the collected environmental data. This would include the analysis, forecasting and packaging of weather and road condition information for resource management.

Term	Definition
Environmental Sensor Station (ESS)	A location that includes a remote processor unit (RPU) connected to one or more sensors for the collection of environmental or meteorological data. It may also include a pavement treatment system (PTS). Note: The acronym ESS may also be used as a plural.
Feature	A behavior of the device.
Mobile	In the context of an ESS, the ESS, including environmental sensors and pavement treatment devices, is able to operate while in motion.
Operator	The person who interfaces with the management station software, typically located at a control center.
Permanent (Fixed)	In the context of an ESS, an ESS not designed to be relocated, hence fixed.
Remote Processor Unit (RPU)	A field processor that collects data from sensors and can communicate the collected data to other computers; the processor may also process the collected data and/or control equipment.
Return	When discussing device requirements for providing data when an external system requests it, the term “return” is understood to mean that the data is sent to the requester.
Road Weather Data Collection Market Package	A set of components that perform all operations related to sensing, collecting, processing, and exchanging environmental related information, including the exchange of data among the dispersedly located equipment.
Road/Weather Information System	The collection of RPUs and sensors connected to a central system for analysis and use by maintenance personnel and transportation system managers.
Sensor	A device that is capable of detecting a condition and reporting the result to an RPU.
Specification	A document that references a standard either to define the capabilities of a component (e.g., a specification sheet) or to define the required capabilities of a component being procured (e.g., a procurement specification).
Sub-Feature	A specialization of a more generic feature.
Transportable	In the context of an ESS, an ESS capable of being relocated, but its environmental sensors and pavement treatment devices do not operate while moving.
Upload	To transfer information from the referenced device to the central computer or an attached portable computer.

1.5 Abbreviations

The abbreviations and acronyms used in this document are defined as follows:

AASHTO American Association of State Highway and Transporation Officials

AQMC Air Quality Management Center

ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
ASN.1	Abstract Syntax Notation One
CEN	Comité Européen de Normalisation (European Committee for Standardization)
CPU	Central Processing Unit
CV	Connected Vehicle
DMS	Dynamic Message Sign
EN	Europäische Norm (European Standard)
ESS	Environmental Sensor Station
FFMC	Fleet and Freight Management Center
FR	Functional Requirement
FTRT	Feature To Requirement Table
IAB	Internet Architecture Board
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IETF	Internet Engineering Task Force
IP	Internet Protocol
IRE	ITS Roadway Equipment
ISO	International Organization for Standardization
ITE	Institute of Transporation Engineers
ITS	Intelligent Transportation Systems
ITU-T	International Telecommunication Union Telecommunication Standardization Sector
MCMC	Maintenance and Construction Management Center
MCV	Maintenance and Construction Vehicle
METR	Management of Electronic Traffic Regulations
MIB	Management Information Base
NA	Not Applicable
NEMA	National Electrical Manufacturers Association
NTFT	Needs To Feature Table
OBE	On-Board Equipment
OFCM	Office of Federal Coordinator for Meteorology
OMG	Object Management Group
PDF	Portable Document Format
PICS	Protocol Implementation Conformance Statement
PRL	Profile Requirements List

PTS	Pavement Treatment System (or Systems)
RFC	Request for Comments
RPU	Remote Processor Unit
RSE	Roadside Equipment
RTM	Requirments Traceability Matrix
SAE	Society of Automotive Engineers
SFTP	Secure File Transfer Protocol
SNMP (v1 or v3)	Simple Network Management Protocol (version 1 or 3)
STMF	Simple Transportation Management Framework
STWS	Surface Transportation Weather Service
TCP	Transmission Control Protocol
TIC	Transportation Information Center
TMC	Traffic Management Center
TMDD	Traffic Management Data Dictionary
UDP	User Datagram Protocol
WG	Working Group
WMO	World Meteorological Organization
WSS	Weather Service System

Section 2
Concept of Operations [Normative]

This section defines user needs that this document addresses in subsequent sections. Accepted system engineering processes detail that requirements should only be developed to fulfill well-defined user needs. The first stage in this process is to identify the ways in which the system is likely to be used. For this document, this entails identifying the various ways in which transportation operations personnel may use ESS information to fulfill their duties.

This concept of operations provides the reader with:

a) a detailed description of the scope of this standard;
b) an explanation of how an ESS is expected to fit into the larger context of an intelligent transportation system (ITS) network;
c) a starting point in the agency procurement process; and
d) an understanding of the perspective of the designers of this document.

Section 2 is intended for all readers of this document, including:

a) transportation operations managers
b) transportation operations personnel
c) transportation engineers
d) system integrators
e) device manufacturers

For the first three categories of readers, this section provides a useful understanding of how ESS equipment can be used in their system. For this audience, Section 2 serves as the starting point in the procurement process. Readers can become familiar with each feature and determine whether that feature is appropriate for their agency-specific implementation. If it is, then the agency procurement specification should require support for the feature and all of the mandatory requirements related to that feature.

For the last two categories of readers, this section is useful to gain a more thorough understanding as to why more detailed requirements exist later in this document.

2.1 Tutorial [Informative]

A ConOps describes a proposed system from the users' perspective. Typically, a ConOps is used on a project to ensure that the system developers understand users' needs. Within NTCIP standards, it is used to document the intent of each feature that the NTCIP standard supports. It also serves as the starting point for users to select which features may be appropriate for their project.

The ConOps starts with a discussion of the current situation and issues that have led to the need to deploy systems covered by the scope of this document and to the development of this document itself. This discussion is presented in lay terms such that both the potential users of the system and system developers can understand and appreciate the situation.

The ConOps then documents key aspects about the proposed system, including:

a) Reference Physical Architecture - The reference physical architecture defines the overall context of the proposed system and defines the specific interface addressed. The reference physical architecture may be supplemented with one or more samples that describe how the reference physical architecture may be realized in an actual deployment.
b) Architectural Needs - The architectural needs discuss issues and needs relative to the system architecture that have a direct impact on this document.

c) Features - The features identify and describe the various functions that users may want components of an ESS system to perform. These features are derived from the high level user needs identified in the problem statement but are refined and organized into a more manageable structure that forms the basis of the Protocol Requirements List (PRL) and Requirements Traceability Matrix (RTM) contained in Section 3.3.3 and Annex A, respectively.

Architectural needs and features are collectively called *user needs*. In Section 3, user needs provide a basis to analyze the system and define the various functional requirements of an ESS. Each user need is required to trace to one or more functional requirements, and each functional requirement is required to be derived from at least one user need. This traceability is shown in the PRL as provided in Section 3.3.3.

This document is intended for use in a broad range of deployments and not every feature is required for every deployment. To accommodate this diversity, the PRL identifies each user need and requirement as being mandatory, optional, or conditional. The only items marked mandatory are those that relate to the most basic functionality of the device. To obtain a device that meets specific needs, the user identifies the optional and conditional needs appropriate for the specific project.

Each requirement is also presented in the RTM in Annex A, which defines how the requirement is fulfilled through the standardized dialogs and data element definitions provided in Section 4 and Section 5, respectively.

A conformant device may support other user needs, as long as they are conformant with the requirements of this document and its normative references (e.g., ISO 26048-1, NTCIP 8004). For example, a device may support data that has not been defined by this document; however, when exchanged via NTCIP 2301, the data shall be properly registered with a valid OBJECT IDENTIFIER under the Global ISO Naming Tree.

> Note: Off-the-shelf interoperability and interchangeability can only be obtained by using well-documented user needs, along with their corresponding requirements and design, that are broadly supported by the industry as a whole. Designing a system that uses environments or features not defined in a standard or not typically deployed in combination with one another inhibits the goals of interoperability and interchangeability, especially if the documentation of these user needs is not available for distribution to system integrators. this document allows implementations to support additional user needs to support innovation, which is constantly needed within the industry, but users should be aware of the risks involved with using such environments or features.

The ConOps concludes by describing security needs and by providing a description of how this document relates to the National ITS Architecture.

2.2 Current Situation and Problem Statement [Informative]

Transportation system managers use ESS in a variety of ways to improve transportation system operations. The primary uses of ESS data support the following:

a) sharing data with the broader weather community contributes to better weather forecasts
b) improved highway maintenance operations through supporting timely, accurate, and relevant weather forecasting and knowledge of existing road weather conditions
c) more accurate traveler information, which can result in better route planning by travelers and more effective, safer transportation system use
d) improved management of facilities maintenance resources, leading to more timely facilities clearance and improved traveler safety
e) more effective use of advisory and regulatory mechanisms to ensure public safety
f) enhanced monitoring of potentially hazardous conditions, to improve transportation system security and traveler safety
g) Facilitate sharing of air quality information collected by sensors in field devices and on mobile platforms

Additional information about how this data can be used is provided in *Weather-Responsive Traffic Management-Concept of Operations.* One of the most common ESS deployed by transportation system managers is the road/weather ESS. These ESS are used to collect information about road and weather conditions, such as precipitation and air and surface temperatures. With the data returned by these ESS, transportation system managers can determine when there are incipient hazardous travel conditions because of precipitation, fog, high winds, snow, ice, and/or flooding. When travel is becoming hazardous because of snow and/or ice, transportation system managers can dispatch road maintenance crews to treat the roads and remove snow and ice if possible.

Transportation system managers can also use ESS in conjunction with other ITS devices, such as Dynamic Message Signs (DMS), to advise travelers of poor travel conditions or to notify travelers of travel policy changes because of bad weather. For example, foggy conditions could trigger a DMS to display a lowered speed limit in a high-speed area. Snow and ice conditions could trigger a DMS to display a requirement for travelers to use chains on their tires. Icy conditions on bridges or roadways can also lead to the triggering of a spraying device that sprays anti-icing or de-icing chemicals on bridge or roadway surfaces to improve driving conditions. High water or high wind conditions could trigger a DMS to display a message either recommending that travelers choose a different route or that they reduce their speed to protect themselves against the potential hazard.

Although transportation system managers are the normal users of ESS, the data from these ESS are sometimes used by emergency management personnel. For example, when flood conditions occur, regardless of their extent, emergency management personnel use data on the depth of water in areas covered by ESS to determine how and when to respond to flooding. Emergency management personnel re-route travelers from flooded areas, in some cases by deploying (in conjunction with transportation system personnel) signs indicating that sections of road are closed because of flooding.

A transportation system manager may also be interested in using an ESS to measure air quality. This data can be used to monitor concentrations of certain chemicals to ensure that they do not exceed toxic levels. For example, tunnel systems frequently use sensors to ensure that carbon monoxide levels stay within safe levels. The data can also provide a valuable resource to air quality management systems to determine the accuracy of predictions. Finally, some research has suggested that air quality hot spots could be monitored to encourage traffic to avoid these areas during problematic periods.

An ESS is typically deployed along the roadside as part of a network of sensors that report their findings to a central management system. The ESS data received at the central system is processed to provide the transportation system manager with intelligence about road weather conditions that can trigger operator action. For example, high wind conditions might trigger a warning to travelers; if the high wind conditions are severe or in an area where they constitute a high risk, they might trigger the closing of a bridge or a section of roadway. Likewise, a network of ESS may also be used to provide the transit system operator information about conditions that affect the health or safety of transit riders. The processing logic could be rather simple (e.g., monitoring high winds) or very complex (e.g., predictions of weather conditions on or near the road). In the latter case, the ESS data would likely serve as one of many inputs; others might include data from the national weather service and other sources.

However, ESS can also be deployed on a vehicle or a transportable platform (such as on a trailer). Usually, these ESS are atmospheric sensors or pavement sensors, gathering information about snow and ice conditions, pavement conditions, and similar data designed to provide the transportation system manager with information about conditions along a particular section of roadway. The data from mobile ESS are used to complement those from stationary ESS also deployed along the transportation network.

If the ESS data is shared with other agencies, that agency may be interested in the metadata about the sensor used to report the data. Such metadata might include the make, model, and version of the device components, the technology used, and, on a mobile station, the placement of the sensor relative to the mobile platform. The metadata is needed to indicate how the sensor readings can be used. For example, the snow depth on the roadway, before and after a snow plow passes, indicates two very different things.

2.3 Reference Physical Architecture [Informative]

In order to ensure a consistent understanding of the terminology used by this document and the intended deployment environment, this document defines a reference architecture. The reference architecture is presented according to the rules defined within the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) and defines the overall context of a deployment.

While the definition of this reference architecture follows ARC-IT conventions, the content is generally more detailed and uses terminology that is more consistent with the ESS industry. Section 2.8 provides a mapping between the reference architecture defined in this section and the elements contained in ARC-IT.

2.3.1 Physical View of the Reference Architecture

The physical view of the reference architecture is depicted in Figure 1 and includes:

a) Functional objects that identify high-level functions that are required within the system
b) Physical objects that identify where functions typically reside, and
c) Information flows that provide a very high-level indication of the information that needs to be exchanged between specific physical objects

Sections **2.3.2** through **2.3.6** provide sample physical architectures that are supported by this reference architecture.

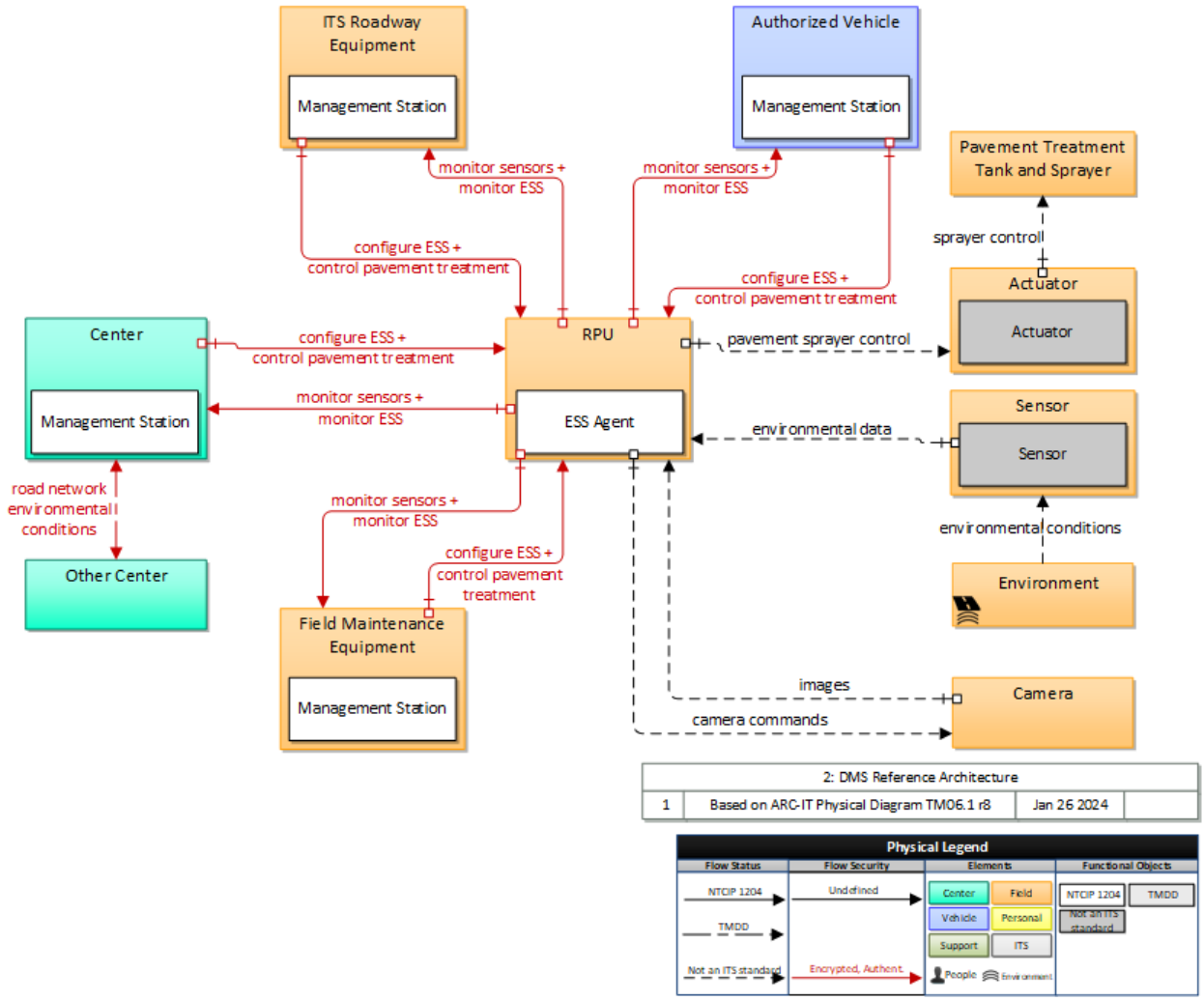

Figure 1: Physical View of Reference Architecture for ESS

2.3.1.1 Functional Objects

2.3.1.1.1 Management Station

A management station is a functional object that is responsible for allowing the end user (e.g., field technician, traffic engineer) to configure and manage one or more field devices, including the ESS. The management station can be located in a center (e.g., traffic management center, maintenance and construction management center), ITS roadway equipment (e.g., traffic signal controller), field maintenance equipment (e.g., technician's laptop), or an authorized vehicle (e.g., maintenance and construction vehicle).

The primary functions of the NTCIP Manager are to allow an end user to perform the following:

a) manage the ESS configuration,
b) control the ESS, and
c) monitor the status of the ESS.

Several management stations may communicate with the same ESS. The user should ensure that only one management station at a time controls the ESS (e.g., when to activate the pavement treatment system). Further, all control operations should be carefully coordinated with the management of the configuration to ensure the intended operation. All management stations may monitor the status simultaneously.

2.3.1.1.2 ESS Agent

The ESS agent is a functional object that is responsible for continuously monitoring weather, roadway, surface, water level and air quality conditions. When the ESS agent receives a request from a management station, it shall immediately respond with its most recent reading for that data. A system operator should be aware that the nature of some information may require significant time to collect (e.g., average wind speed), or may be dated (e.g., information stored in a log); thus, the information contained in the response may have been collected some time prior to the request being sent. The ESS agent is often deployed in a device dedicated to ESS functionality, but it can also be deployed as a module in an advanced transportation controller.

The primary functions of the ESS agent are to perform the following:

a) convert NTCIP data into the appropriate commands to control its components (e.g., pavement treatment system),
b) manage the ESS to ensure that it operates according to the configuration,
c) manage the resulting NTCIP data (e.g., maintaining logs per configuration), and
d) providing NTCIP data in response to authorized requests.

2.3.1.1.3 Actuator

An actuator converts electrical signals to produce changes in a physical characteristic. Within the context of this document, the actuator converts electrical signal to control a sprayer of the pavement treatment equipment.

2.3.1.1.4 Sensor

A sensor can observe one or more physical properties and convert those properties into electrical signals.

2.3.1.2 Physical Objects

ESS deployments typically include a traffic management center (TMC), a remote processing unit (RPU), and sensors. The deployments are in an environment where the sensors are able to detect properties of interest to users. Deployments can also include pavement treatment equipment (e.g., chemical tanks, sprayers, and actuators), other centers, other ITS roadway equipment (e.g., traffic signal controllers,

weather stations, parking equipment), field maintenance equipment, and/or authorized vehicles. The following paragraphs describe the primary functions of the physical objects.

2.3.1.2.1 Camera

A camera is a device that is able to capture still images or video and provide them to the RPU. The camera is controlled by commands received from the RPU.

2.3.1.2.2 Center

A center is an entity that provides application, management, administrative, and support functions from a fixed location not in proximity to the road network. Within the ESS community, a central system is sometimes called a central processing unit or "CPU".

2.3.1.2.3 Remote Processing Unit

The remote processing unit (RPU) is the controller used to host the ESS agent and thereby manage the collection and reporting of sensor data and/or to manage the treatment of pavement for icing conditions.

The RPU along with its cabinet, sensors, actuators and associated equipment are jointly called the "ESS". Within Figure 1, these physical objects are depicted as orange (representing field equipment), as this is the most typical deployment scenario. However, the ESS objects can also be implemented as a part of a vehicle, in which case, they would more accurately be depicted in a blue shade (indicating vehicle-based equipment).

2.3.1.2.4 ITS Roadway Equipment

Within the scope of this document, ITS Roadway Equipment is another installation of ITS equipment along the roadway that interacts with the RPU. The ITS Roadway Equipment could be another ESS, but it is typically another device that has a need to obtain trustworthy environmental sensor information. For example, a field-based application might monitor pavement sensors attached to the ESS and command an associated DMS to display an ice warning when ice is detected.

2.3.1.2.5 Field Maintenance Equipment

Field Maintenance Equipment includes any portable equipment used by field personnel to locally troubleshoot, initialize, reprogram, and test infrastructure equipment.

2.3.1.2.6 Authorized Vehicles

An authorized vehicle is any specialized service vehicle or equipment that has been explicitly granted access permissions to the RPU.

2.3.1.2.7 Sensor

A sensor represents any attached device that responds to an environmental physical stimulus and transmits a resulting impulse.

2.3.1.2.8 Actuator

An actuator represents any attached physical unit that activates a sprayer.

2.3.1.2.9 Pavement Treatment Tank and Sprayers

A system to perform maintenance on a roadway pavement. This may include a snowplow, a device to dispense materials on the roadway pavement, or a device that stores the materials to be dispensed.

2.3.1.2.10 Environment

The environment represents the environmental conditions of and immediately surrounding the roadway, including the physical condition of the road surface.

2.3.1.3 Information Flows

The ESS reference architecture includes the first four information flows that are addressed by this document; the reference architecture also references seven additional information flows that provide a broader context.

2.3.1.3.1 camera commands

Information that activates or changes the way in which the camera operates.

2.3.1.3.2 configure ESS

Information that manages the internal operation of the ESS controller and decisions that it makes. For example, this includes the configuration of user access, configuration of event logging, etc.

2.3.1.3.3 control pavement treatment

Information that manages the operation of the pavement treatment system. For example, this includes the mixture of chemicals to disperse and the rate of dispersal.

2.3.1.3.4 environmental data

Raw data as obtained from the sensors. For example, the data can be presented as analog readings that are converted to digital readings by the RPU.

2.3.1.3.5 environmental conditions

Current physical conditions that are being monitored.

2.3.1.3.6 images

The images (still or video) captured by the camera.

2.3.1.3.7 monitor ESS

Information that allows a manager to monitor the status of the ESS as whole. For example, this includes the status of cabinet doors, the health of the RPU, etc.

2.3.1.3.8 monitor sensors

Information that allows a manager to monitor the status of the sensors connected to the ESS. For example, this includes the current ambient temperature, current pavement temperature, indications of the presence of ice, etc.

2.3.1.3.9 pavement sprayer control

Information that activates or changes the way in which the pavement treatment system operates. For example, this includes commands to control the devices (e.g., valves) that manage the current mixture of chemicals.

2.3.1.3.10 road network environmental conditions

Environmental information that has been collected, likely from multiple ESS, and processed by a center and is ready for sharing with other centers that might have interest in the information.

2.3.1.3.11 sprayer control

The activation and deactivation of the sprayer.

2.3.2 Remote Weather Station

Figure 2 depicts a wind sensor that is connected by a low-speed wireless radio link because of its remote location.

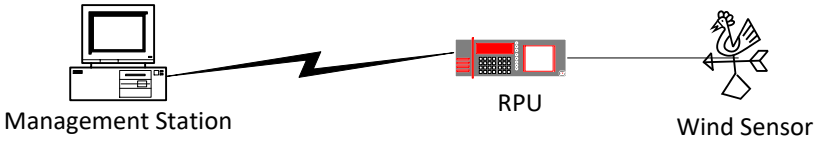

Figure 2 Remote Weather Station

2.3.3 Air Quality Station

Figure 3 depicts an air quality sensor that is connected by a fiber optic network.

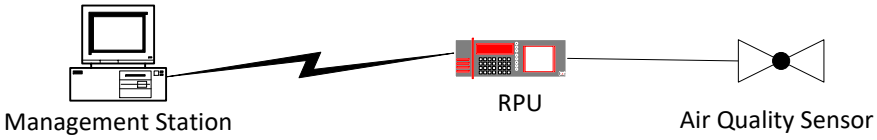

Figure 3 Air Quality Station

2.3.4 Mobile Weather Station

Figure 4 depicts a non-invasive pavement sensor mounted on a maintenance vehicle that is connected by a cellular data modem because of its mobile characteristics.

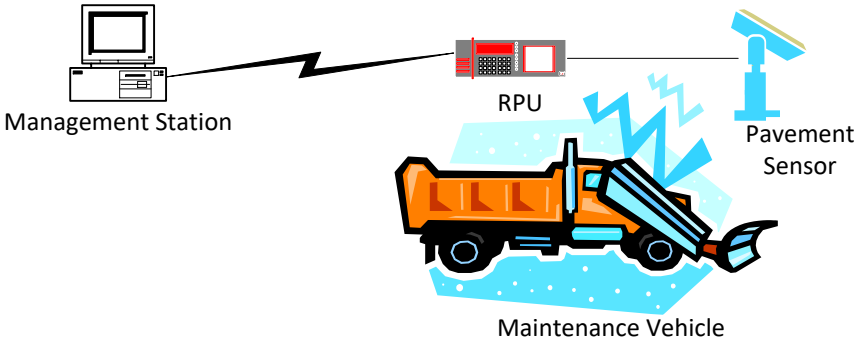

Figure 4 Mobile Weather Station

2.3.5 Sprayer Combined with a Pavement Sensor

Figure 5 depicts an ESS consisting of a RPU, a pavement sensor, and a sprayer. The RPU is connected to the management station through a separate connection, perhaps a dial-up link.

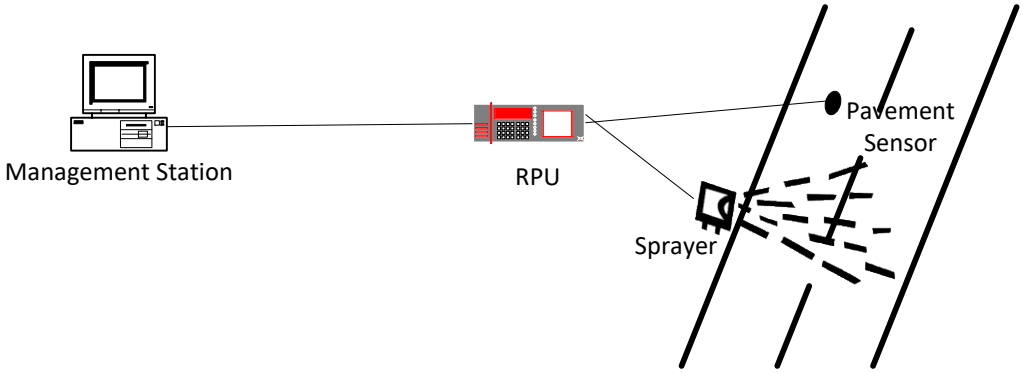

Figure 5 Sprayer Combined with a Pavement Sensor

2.3.6 Pavement Treatment Station

Figure 6 depicts a transportable ESS that only consists of sprayers for pavement treatment.

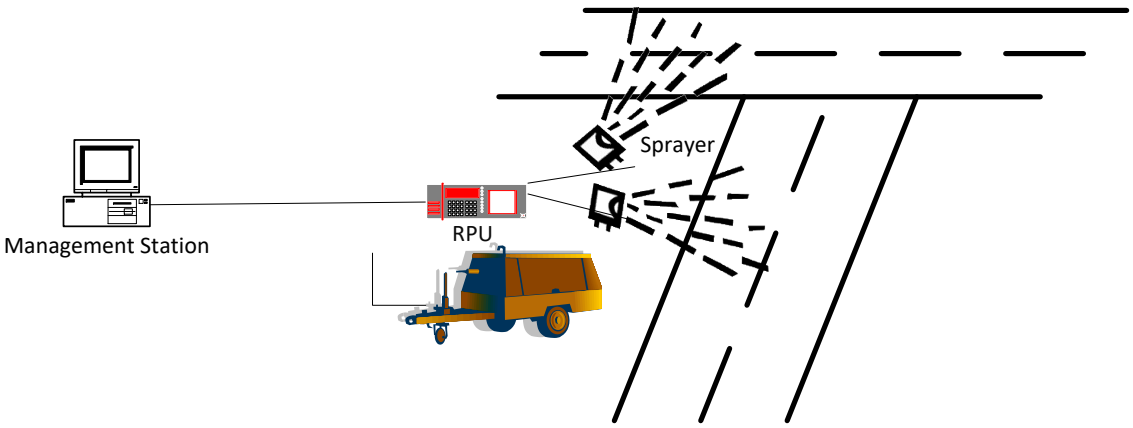

Figure 6 Transportable Pavement Treatment Station

2.3.7 ESS Characteristics

Some features defined within this document are not applicable to all ESS - some features are dependent on whether an ESS is permanent, transportable, or mobile.

a) **Permanent:** The ESS is not designed to be relocated.
b) **Transportable:** The ESS is capable of being relocated, but its environmental sensors and pavement treatment devices do not operate while moving.
c) **Mobile:** The ESS, including environmental sensors and pavement treatment devices, is able to operate while in motion.

Thus, the user categorizes the ESS according to whether it is permanent, transportable, or mobile prior to determining which requirements are mandatory for a particular project or ESS.

Note: An agency (procurement) specification may include one to all of these types.

2.4 Architectural Needs

2.4.1 ISO 26048-1 Needs Included in PRL

All the architectural needs are defined within the user needs of ISO 26048-1. Commonly used architectural needs within the scope of a ESS are listed in the PRL with references to the relevant ISO 26048-1 clauses and include the following:

a) **Authenticate users:** allows users to ensure that all communications with the device are with authenticated users.
b) **Control access to data:** allows administrators to configure the detailed access privileges that are granted to each authenticated user.
c) **Monitor failed access to the field device:** allows administrators to discover when unauthorized attempts are made to access the device.
d) **Manage the field device:** allows a user to remotely reset the controller and configure and monitor basic information about the field device, such as its:
    a. Identity,
    b. Location,
    c. Power source,
    d. Default language,
    e. Capabilities (e.g., which objects are supported, maximum message size),
    f. Status, and
    g. Configuration identifier.
e) **Receive notification of triggers firing:** allows a user to define trigger conditions (e.g., an object value exceeding a defined value) and to automatically receive an SNMP notification when the trigger condition occurs.
f) **Manage device-specific notifications:** allows the user to configure all supported notifications to use notification channels, which prevent notifications from flooding the communications channel.
g) **Log system events:** allows the device to record information about internal events that can be of interest during forensic analysis, e.g., for debugging purposes.
h) **Log user-defined data snapshots:** allows a user to define trigger conditions (e.g., an object value exceeding a defined value) and to automatically log information when the trigger condition occurs.
i) **Issue trigger-based commands:** allows a user to define trigger conditions (e.g., an object value exceeding a defined value) and to automatically send another device an SNMP set request when the trigger condition occurs. For example, when ice is detected by a pavement sensor, command an attached gate to close (however, this example is discouraged as a gate closure should include verification mechanisms not offered by this feature to ensure safe operations).

2.4.2 ISO 26048-1 Needs Omitted Due to Duplication

ISO 26048-1 also defines the following user needs that duplicates user needs that previous versions of this document had already defined with its own design. These user needs are not included in the PRL to avoid their inadvertent selection, but they are not prohibited:

a) **Monitor ambient air temperature:** The body of this document provides a more robust way to monitor ambient air temperature (2.5.2.1.3) that predates the design contained in ISO 26048-1.
b) **Monitor ambient relative humidity:** The body of this document provides a more robust way to monitor ambient relative humidity (2.5.2.1.4) that predates the design contained in ISO 26048-1.

2.4.3 ISO 26048-1 Needs Not Envisioned for ESS

ISO 26048-1 also defines the following user needs that are not envisioned to be needed for most ESS deployments. These user needs are not included in the PRL to avoid their inadvertent selection, but they are not prohibited:

a) **Monitor ambient light:** allows the device to measure ambient light levels (e.g., from the sun).
b) **Record a series of data snapshots:** allows a user to define trigger conditions (e.g., an object value exceeding a defined value) and to automatically log a series of snapshots based on the trigger condition occurring. For example, when the cabinet door opens, record the cabinet temperature once a second for 60 seconds.

c) **Configure a complex device:** allows a user to buffer changes to a large number of inter-related configuration parameters so that the proposed changes can be validated as a whole prior to ensure a safe configuration prior to implementation.
d) **Efficient exchange of data:** allows a management station to define dynamic objects that can be used for frequent requests to reduce communications overhead. For example, rather than monitoring 15 discreet status objects, the 15 objects can be placed into a dynamic object and retrieved as a single entity. This can be useful when a management station frequently exchanges a large number of integer values with the device.

2.4.4 Responsive Device

A transportation system operator needs the device to be responsive to conditions without causing unnecessary communication delays.

2.5 Features

Section 2.4.4 identifies and describes the various features that may be offered by the ESS. It is divided into the following:

a) ESS Manager Features
b) Sensor Manager Features
c) Pavement Treatment System Manager Features

2.5.1 ESS Manager Features

Section 2.5.1 identifies and describes the various features that may be offered by the ESS Manager, which is the part of the RPU that performs the functionality that may apply to both a Sensor Manager and a PTS Manager. It consists of the following features:

a) Monitor Mobile Station Data
b) Determine ESS Type

2.5.1.1 Reserved

NOTE—This header was previously used by the "Generic Features" user need, which has been replaced by the user needs defined in ISO 26048-1. The heading number has been preserved so that all subsequent user needs have the same heading number as used in previous versions of this document. NTCIP reserves the right to reassign the meaning of this heading in future versions of this document.

2.5.1.2 Reserved

NOTE—This header was previously used by the "Monitor Door Status" user need, which has been superseded by the "Monitor cabinet doors" user need defined in ISO 26048-1. The heading number has been preserved so that all subsequent user needs have the same heading number as used in previous versions of this document. NTCIP reserves the right to reassign the meaning of this heading in future versions of this document.

2.5.1.3 Reserved

NOTE—This header was previously used by the "Monitor Power " user need, which has been superseded by the "Monitor cabinet <mains, battery, generator, solar, and wind> power" user need defined in ISO 26048-1. The heading number has been preserved so that all subsequent user needs have the same heading number as used in previous versions of this document. NTCIP reserves the right to reassign the meaning of this heading in future versions of this document.

2.5.1.4 Monitor Mobile Station Data

A transportation system operator may need to monitor the movements of a mobile ESS. This feature allows the transportation system operator to determine the location where sensor readings are collected.

2.5.1.5 Determine ESS Type

A transportation system operator needs to be able to determine whether the ESS is staffed or automated to understand the type of information that is likely to be available from the ESS.

2.5.1.6 Reserved

NOTE—This header was previously used by the "Monitor the Status of the ESS " user need, which has been superseded by the "Monitor controller operational status " requirement defined in ISO 26048-1. The heading number has been preserved so that all subsequent user needs have the same heading number as used in previous versions of this document. NTCIP reserves the right to reassign the meaning of this heading in future versions of this document.

2.5.2 Sensor Manager Features

Section 2.5.2 identifies and describes the various features that may be offered by the Sensor Manager:

a) monitor weather conditions
b) monitor pavement
c) monitor subsurface conditions
d) monitor human readings
e) monitor water levels
f) monitor air quality and biohazards
g) monitor mobile weather profile

2.5.2.1 Monitor Ambient Weather Conditions

This feature focuses on ambient weather conditions that can directly or indirectly affect the transportation system. It includes the following sub-features.

2.5.2.1.1 Monitor Atmospheric Pressure

A transportation system operator may need to monitor the atmospheric pressure in the vicinity of the ESS and to configure and retrieve the metadata for the atmospheric pressure measurements. This feature allows the operator to monitor changing weather conditions.

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).

2.5.2.1.3 Monitor Air Temperature

A transportation system operator may need to monitor the air temperature at the ESS location and to configure and retrieve the metadata for the temperature measurement. This feature allows an operator to dispatch maintenance vehicles to treat roadway pavement or to determine if restrictions or warnings to travelers should be issued.

2.5.2.1.4 Monitor Relative Humidity

A transportation system operator may need to monitor the relative humidity at the ESS location and to configure and retrieve the metadata for the humidity measurement. This feature allows an operator to schedule roadway maintenance activities, such as painting.

2.5.2.1.5 Monitor Precipitation

A transportation system operator may need to monitor the amount, intensity, and type of precipitation in the vicinity of the ESS and to configure and retrieve the metadata for the precipitation measurements. This feature allows an operator to determine if restrictions or warnings, such as flood warnings, should be issued to travelers.

2.5.2.1.6 Monitor Solar Radiation

A transportation system operator may need to monitor the amount of solar radiation in the vicinity of the ESS and to configure and retrieve the metadata for the solar radiation measurements. This feature allows an operator to schedule maintenance activities (e.g., based on pavement temperatures) or restrict roadway usage.

2.5.2.1.7 Monitor Visibility

A transportation system operator may need to monitor the visibility in the vicinity of the ESS and to configure and retrieve the metadata for the visibility measurement. This feature allows an operator to determine if restrictions or warnings are needed, such as lowering vehicle speed limits.

2.5.2.1.8 View Environmental Image

A transportation system operator may need to visually inspect weather or pavement conditions and/or verify the reported weather or pavement conditions.

2.5.2.1.9 Monitor Dewpoint Temperature

A transportation system operator may need to monitor the dew point temperature. The dew point temperature can be calculated or measured, and is used to determine the temperature when condensation (dew, frost) occurs.

2.5.2.2 Monitor Pavement

This feature focuses on monitoring road conditions that may adversely affect transportation operations immediately or in the near future. It supports the transportation system operator's ability to dispatch equipment to address the condition or to provide appropriate warnings. It includes the following sub-features.

2.5.2.2.1 Monitor Pavement Surface Condition

A transportation system operator may need to monitor the pavement surface temperature, the moisture condition (e.g., dry, wet, snowy, icy, chemical concentration, etc.) on and around the roadway pavement, and to configure and retrieve the metadata for the roadway pavement sensors. This feature allows an operator to monitor for readings that could lead to hazardous conditions on the roadway based on moisture or low roadway friction, and allows maintenance managers to determine, in combination with other data, if they need to treat the road.

2.5.2.2.2 Monitor Icing Conditions

A transportation system operator may need to monitor whether pavement conditions are likely for ice formation on the pavement. This includes the ability to monitor pavement temperature (i.e., as opposed to surface temperature), the depth of any water film on the surface, and the predicted freeze point of the surface. This feature focuses on the conditions on the roadway pavement surface that can directly or indirectly lead to icing that affects the transportation system. A transportation system operator may also need to monitor and configure the RPU parameters. The operator needs to be able to change the parameters based on the treatment that is being applied on the pavement so accurate readings are measured by the pavement sensors.

2.5.2.2.3 View Pavement Image

A transportation system operator may need to visually inspect pavement conditions and/or verify the reported pavement conditions.

2.5.2.3 Monitor Subsurface Conditions

A transportation system operator may need to retrieve the conditions below the road surface and to retrieve the metadata for the subsurface measurements. The operator may monitor for readings that could lead to road damage and/or affect the onset of icing conditions (e.g., water level table). It supports the transportation system operator's ability to dispatch equipment to address the condition or to provide appropriate warnings.

2.5.2.4 Monitor Human Readings

A transportation system operator may need to retrieve data that was manually observed and entered by field personnel, such as a snow plow operator. This feature allows an operator to verify measured sensor readings.

2.5.2.5 Monitor Water Level

A transportation system operator may need to monitor the depth of water at one or more locations (e.g., over a roadway, in a stream, of a reservoir, etc.). This feature allows an operator to issue flood warnings to travelers, public safety agencies, and maintenance crews, if necessary.

2.5.2.6 Monitor Air Quality and Biohazards

A transportation system operator may need to monitor the current air quality in the vicinity of the ESS and to retrieve the metadata for the air quality measurements. The operator may monitor these measurements to determine whether there are airborne biohazards in the vicinity of the ESS. These measurements are also used to issue ozone alert warnings to the public.

2.5.2.7 Monitor Mobile Weather Profile

A transportation system operator may need to monitor information that is specific to a mobile ESS such as its position and data collected. This feature allows an operator to log the route of the mobile ESS and develop an environmental profile that can be used as an input for weather forecast models or maintenance decision support systems. This may also include odometer readings for verification purposes.

2.5.3 Pavement Treatment System Manager Features

The following identify and describe the various features that may be offered by a Pavement Treatment System Manager. It consists of the following features:

a) manage stationary spray system
b) manage mobile spray system

2.5.3.1 Manage Stationary Spray System

A transportation system operator may need to manage the application of anti-icing or de-icing chemicals through the use of a sprayer connected to a permanent or transportable ESS (e.g., a bridge sprayer). This feature includes the configuration, monitoring, and activation of a permanent or transportable spray system. This feature allows pre-treatment of the roadway pavement, either manually or programmatically, before hazardous conditions occur, or to remedy a hazardous condition.

2.5.3.2 Manage Mobile Spray System

A transportation system operator may need to manage the application of anti-icing or de-icing materials from a mobile pavement treatment system (e.g., a salt truck). This feature allows an operator to monitor and change the rate anti-icing or de-icing materials are applied.

2.5.3.3 Monitor Mobile Spray System Profile

A transportation system operator may need to monitor the operation of a mobile pavement treatment system along a path, by collecting its position and information about the anti-icing or de-icing material distributed. This feature allows an operator to log the route of the mobile pavement treatment system to improve road-condition forecasts. This may also include odometer readings for verification purposes.

2.5.4 Backward Compatibility Needs

SNMPv3 is not backwards compatible with SNMPv1 without the use of a proxy agent. Implementations that need to exchange data with implementations conforming to NTCIP 1204 versions prior to v05 should reference the requirements and design elements of the specific version of NTCIP 1204 to be used.

2.6 Security

A management station needs to have confidence that communications with its devices are always secure and trustworthy. This requires confidentiality, integrity, and availability.

2.6.1 Addressing Vulnerabilities

This document standardizes the objects that can be used by a remote entity to monitor and/or control a device. Allowing remote operations without providing sufficient information security can have a negative effect on the communications network and/or the transportation system. In particular, the mis-configuration of "read-write" and/or "read-create" objects can result in the activation of unauthorized features or unauthorized changes to the device configuration; these changes can result in potentially hazardous situations.

Further, even failing to secure exchanges of "read-only" objects can have harmful effects. Providing unauthorized access to read-only objects can reveal information about the device that can be useful in conducting a cyber-attack against the device itself, other devices, and potentially the central system. Likewise, failing to authenticate the source of the read-only data allows a cyber threat actor to potentially impersonate the device and provide false information to a traffic management center.

The object types defined by this document are intended to be transmitted over SNMPv3. SNMP versions prior to SNMPv3 do not include adequate security. Prior SNMP versions do not provide any control as to who on the network is allowed to access and read/change/create/delete objects, even if the network itself is secure.

2.6.2 Conformant Security Environment

The conformant security environment is highly recommended as it does not allow the device to support any unsecured protocol.

2.6.3 Consistent Security Environment

It is recognized that during a transition to a secure environment, agencies might need to procure equipment that conforms to their current unsecured environment while still wanting something that can be reconfigured to support their future secure environment. This is allowed as long as the device is able to disable the unsecured protocols. Nonetheless, the fact that consistent devices support unsecured protocols mean that the unsecured protocols can be enabled and the device is inherently less secure than a conformant device.

2.7 Operational Policies and Constraints

To provide adequate information security, deployments should:

a) Disable any SNMP versions prior to SNMPv3 as soon as possible,
b) Use the communications stack defined in NTCIP 2301,
c) Ensure that implementations are properly configured to only give read and/or, write access to objects based on the legitimate needs of each principal (i.e., user), and
d) Update security keys at intervals that inhibit brute-force attacks from being successful.

2.8 Relationship to the ITS National Architecture [Informative]

This document addresses the following information flows that are defined by the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT).

a) **air quality sensor control:** Data used to configure and control area pollution and air quality sensors.
b) **air quality sensor data:** Measured air quality data, including measured levels of atmospheric pollutants including ozone, particulate matter, carbon monoxide, and nitrogen oxides, and operational status of the sensors.
c) **environmental sensors control:** Data used to configure and control environmental sensors.
d) **environmental sensor coordination:** The direct flow of information between field equipment. This includes configuration and control of environmental sensors and the current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by fixed and/or mobile environmental sensors. Operational status of the sensors is also included.
e) **environmental sensor data:** Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature,

wind speed, precipitation, visibility) as measured and reported by fixed and/or mobile environmental sensors. Operational status of the sensors is also included.

f) **field equipment commands:** System-level control commands issued to field equipment such as reset and remote diagnostics.
g) **field equipment configuration settings:** Control settings and parameters that are used to configure field equipment.
h) **field equipment status:** Reports from field equipment (sensors, signals, signs, controllers, etc.) which indicate current operational status.
i) **field equipment status for METR:** This flow provides reports from field equipment (sensors, signals, signs, controllers, etc.) indicating current operational status. Certain METR rules and corresponding physical rules will rely on the supporting data provided by field equipment. For example, a roadside sensor can be used to detect precipitation, which might be defined to activate a rule for a lower speed limit. This infrastructure-sourced supporting data can be provided to a CV RSE and then transmitted to METR user systems so that they can become aware of current status of rules.
j) **maint and constr vehicle operational data:** Data that describes the maintenance and construction activity performed by the vehicle. Operational data includes materials usage (amount stored and current application rate), operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), vehicle safety status, and other measures associated with the operation of a maintenance, construction, or other special purpose vehicle. Operational data may include basic operational status of the vehicle equipment or a more precise record of the work performed (e.g., application of crack sealant with precise locations and application characteristics).
k) **maint and constr vehicle system control**: Configure and control data that supports remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle. For example, the data can be used to adjust material application rates and spread patterns.
l) **roadway treatment coordination:** The direct flow of information between field equipment. This includes control data for remotely located, automated devices, that treat the road surface (e.g., de-icing applications) and the current operational status of automated roadway treatment devices.
m) **roadway treatment system control:** Control data for remotely located, automated devices that treat the road surface (e.g. de-icing applications).
n) **roadway treatment system status:** Current operational status of automated roadway treatment devices (e.g., anti-icing systems).

This document is applicable to interfaces defined for the physical objects identified in Table 1 and defined by ARC-IT:

Table 1 ESS Relevant Physical Objects in ARC-IT

Acronym	Physical Object
AQMC	Emissions Management Center
CV OBE	Commercial Vehicle OBE
FFMC	Fleet and Freight Management Center
IRE	ITS Roadway Equipment
MCMC	Maintenance and Construction Management Center
MCV OBE	Maintenance and Construction Vehicle Onboard Equipment
CV RSE	Connected Vehicle Roadside Equipment
STWS	Surface Transportation Weather Service
TMC	Traffic Management Center
WSS	Weather Service System
Other IRE	Other ITS Roadside Equipment
Other Vehicles	Other Vehicles
TIC	Transportation Information Center
Vehicle	Vehicle

Specifically, this document provides a viable communication solution for the ARC-IT information transfers (i.e., an information flow from a source to a destination) identified in Table 2

Table 2 ARC-IT Information Transfers Related to This Document

ESS Information Flow	Source	ARC-IT Architecture Flow	Destination
configure ESS	AQMC	air quality sensor control	IRE
monitor sensors	IRE	air quality sensor data	AQMC
configure ESS	MCMC	environmental sensors control	IRE
configure ESS	MCMC	environmental sensors control	MCV OBE
configure ESS	MCV OBE	environmental sensors control	IRE
configure ESS	STWS	environmental sensors control	IRE
configure ESS	TMC	environmental sensors control	IRE
monitor sensors/ monitor ESS	IRE	environmental sensor coordination	Other IRE
monitor sensors/ monitor ESS	Other IRE	environmental sensor coordination	IRE
monitor sensors/ monitor ESS	IRE	environmental sensor data	CV RSE
monitor sensors/ monitor ESS	IRE	environmental sensor data	MCMC
monitor sensors/ monitor ESS	IRE	environmental sensor data	MCV OBE
monitor sensors/ monitor ESS	IRE	environmental sensor data	STWS
monitor sensors/ monitor ESS	IRE	environmental sensor data	TMC
monitor sensors/ monitor ESS	IRE	environmental sensor data	WSS
monitor sensors/ monitor ESS	MCV OBE	environmental sensor data	IRE
monitor sensors/ monitor ESS	MCV OBE	environmental sensor data	MCMC
monitor sensors/ monitor ESS	MCV OBE	maint and constr vehicle operational data	MCMC
configure ESS	MCMC	maint and constr vehicle system control	MCV OBE
control pavement treatment	IRE	roadway treatment coordination	Other IRE
control pavement treatment	Other IRE	roadway treatment coordination	IRE
control pavement treatment	MCMC	roadway treatment system cont	IRE
monitor ESS	IRE	roadway treatment system statu	MCMC

In addition, this document could theoretically provide a viable communication solution for a portion of the "vehicle environmental data" information transfer (i.e., from a vehicle to a center, another vehicle, or an CV RSE). However, this standard is not known to be widely used for this interface and SAE J2945/3 is more typically used for this interface rather than exchanging the data via SNMP.

The main user need groups (features), as identified in Section 2, are related to the ARC-IT information flows as shown in Table 3.

Table 3 User Need Groups and ARC-IT Information Flows

Section	User Need Group	Information Flow(s)
2.5.1	ESS Manager Features	environmental sensors control
		air quality sensor control
2.5.2.1	Monitor weather conditions	environmental sensor data
2.5.2.2	Monitor pavement	environmental sensor data
2.5.2.3	Monitor subsurface conditions	environmental sensor data
2.5.2.4	Monitor human readings	environmental sensor data
2.5.2.5	Monitor water level	environmental sensor data
2.5.2.6	Monitor air quality and biohazards	air quality sensor data
2.5.2.7	Monitor mobile weather profile	maint and constr vehicle operational data
2.5.3	Pavement treatment system manager	maint and constr vehicle system control
		roadway treatment coordination
		roadway treatment system control
		roadway treatment system status

In addition, the data elements defined by this standard are referenced by SAE J2735 to address portions of additional information flows in defined in ARC-IT.

a) **vehicle environmental data:** Data from vehicle safety and convenience systems that can be used to estimate environmental and infrastructure conditions, including measured air temperature, exterior light status, wiper status, sun sensor status, rain sensor status, traction control status, anti-lock brake status, vertical acceleration, and other collected vehicle system status and sensor information. The collected data is reported along with the location, heading, and time that the data was collected. Both current data and snapshots of recent events (e.g., traction control or anti-lock brake system activations) may be reported.

Section 3
Functional Requirements [Normative]

This section defines the Functional Requirements based on the user needs identified in the Concept of Operations, as defined in Section 2.This section is intended for all readers, including:

a) transportation operations managers
b) transportation operations personnel
c) transportation engineers
d) system integrators
e) device manufacturers

For the first three categories of readers, Section 3 provides a useful understanding of the details of what this document requires of an ESS. Section 3.3 may be particularly useful to these readers in preparing procurement specifications and mapping various rows of this table to the more detailed text contained elsewhere.

For the last two categories of readers, Section 3 provides a useful understanding of what is required of equipment conforming to this document. For these readers, Section 3.3 provides a table to document the capabilities of their implementations.

3.1 Tutorial [Informative]

Section 3 defines the requirements that are intended to fulfill the user needs identified in Section 2. This is achieved through the development of a Protocol Requirements List (PRL) that traces each user need to one or more requirements. The details of each requirement are then presented following the PRL. The requirements are presented in three broad categories as follows:

a) **Architectural Requirements**: These requirements define the required behavior of the system in exchanging data across the communications interface, including any restrictions to general architectural requirements, based upon the architectural needs identified in Section 2.
b) **Data Exchange Requirements:** These requirements define the required behavior of the system in exchanging data across the communications interface based on the features identified in Section 2.
c) **Supplemental Requirements:** These requirements define additional requirements of the system that are derived from the architectural and/or data exchange requirements, but are not themselves architectural or data exchange requirements. A given supplemental requirement may relate to multiple architectural and/or data exchange requirements.

3.2 Scope of the Interface [Informative]

Section 3.2 does not apply in the context of this document.

3.3 Protocol Requirements List (PRL)

The PRL, provided in a table in Section 3.3.3, maps the user needs defined in Section 2 to the requirements defined in Section 3. The PRL can be used by:

a) a user or specification writer to indicate which requirements are to be implemented in a project-specific implementation
b) the protocol implementer, as a checklist to reduce the risk of failure to conform to the standard through oversight
c) the supplier and user, as a detailed indication of the capabilities of the implementation
d) the user, as a basis for initially checking the potential interoperability with another implementation

3.3.1 Notation [Informative]

The following notations and symbols are used to indicate status and conditional status in the PRL within all NTCIP standards. Not all of these notations and symbols may be used within this document.

3.3.1.1 Conformance Symbols

The symbols in Table 4 are used to indicate status in the PRL table (Section 3.3.3).

Table 4 Conformance Symbols

Symbol	Status
M	Mandatory
M.#	Support of every item of the group labeled by the same numeral # required, but only one is active at time
O	Optional
O.# (range)	Part of an option group. Support of the number of items indicated by the '(range)' is required from all options labeled with the same numeral #
C	Conditional
N/A	Not applicable (i.e., logically impossible in the this document scope)
X	Excluded or prohibited

The O.# (range) notation is used to show a set of selectable options (e.g., O.2 (1..*) would indicate that one or more of the option group 2 options is required to be implemented). Two-character combinations are used for dynamic requirements. In this case, the first character refers to the static (implementation) status, and the second refers to the dynamic (use); thus "MO" means "mandatory to be implemented, optional to be used."

3.3.1.2 Conditional Status Notation

The predicate notations in
Table 5 may be used.

Table 5 Conditional Status Notation

Predicate	Notation
<predicate>:	This notation introduces a single item that is conditional on the <predicate>.
<predicate>::	This notation introduces a table or a group of tables, all of which are conditional on the <predicate>.
(predicate)	This notation introduces the first occurrence of the predicate. The feature associated with this notation is the base feature for all options that have this predicate in their conformance column.

The <predicate>: notation means that the status following it applies only when the PRL states that the feature or features identified by the predicate are supported. In the simplest case, <predicate> is the identifying tag of a single PRL item. The <predicate>:: notation may precede a table or group of tables in a section. When the group predicate is true then the associated section shall be completed. The symbol <predicate> also may be a Boolean expression composed of several indices. "AND", "OR", and "NOT" shall be used to indicate the Boolean logical operations.

The predicates used in this document map to the sections indicated in Table 6.

Table 6 Predicate Mapping to this document Section

Predicate Traceability (PT) Table	
Predicate	**Reference**
	ISO 26048-1, 8.4
	ISO 26048-1, 8.4.4.1.1
	ISO 26048-1, 8.6
	ISO 26048-1, 8.4.4.1.2
	ISO 26048-1, 8.18.3.1
	ISO 26048-1, 8.18.3.3
	ISO 26048-1, 8.4.4.1.3
	ISO 26048-1, 8.18.3.2
	ISO 26048-1, 8.18.3.3
	ISO 26048-1, 8.14
	ISO 26048-1, 8.7.3.5
	ISO 26048-1, 8.2.1.3.1.1
	ISO 26048-1, 8.7.3.6
	ISO 26048-1, 8.7.3.5
	ISO 26048-1, 8.7.3.6
	ISO 26048-1, 8.19.3.1
	ISO 26048-1, 8.19.3.3
	ISO 26048-1, 8.11.4
	ISO 26048-1, 8.8.2.2.3
	ISO 26048-1, 6.6
	ISO 26048-1, 8.18.3.4

3.3.1.3 Support Column Symbols

The support column can be used in a procurement specification to identify the required features for the given procurement or by an implementer to identify which features have been implemented. In either case, the user circles the appropriate answer (Yes, No, or N/A) in the support column. See Table 7.

Table 7 Support Column Entries

Entry	Identifier
Yes	Supported by the implementation.
No	Not supported by the implementation.
NA	Not applicable for the implementation.

3.3.2 Instructions for Completing the PRL [Informative]

In the Support column, each response shall be selected either from the indicated set of responses (for example: Yes / No / N/A), or it shall reference additional items that are to be attached.

If a conditional requirement is inapplicable, use the Not Applicable (N/A) choice. If a mandatory requirement is not satisfied, exception information shall be supplied by entering a reference Xi, where i is a unique identifier, to an accompanying rationale for the non-conformance. When the status is expressed as a two-character combination, the response shall address each element of the requirement; e.g., for the requirement "mo," the possible compliant responses are "yy" or "yn."

> Note: An agency specification can allow for flexibility in a deliverable by leaving the selection in the 'Support' column blank for a given row. For example, an agency specification could allow for

either passive or active icing detectors by selecting ‘Yes’ on PRL line 2.5.2.2.2, and leaving PRL lines 3.5.2.3.3.2 and 3.5.2.3.3.3 blank.

3.3.2.1 Conformance Definition

To claim "Conformance" to this document, the vendor shall minimally fulfill the mandatory requirements as identified in the PRL table (see Section 3.3.3). In addition, a conformant device may offer additional (optional) features, as long as they are conformant with the requirements of this document and the standards it references.

> Note: The reader and user of this document is advised that 'conformance' to this document should not be confused with 'compliance' to a specification. this document is as broad as possible to allow a very simple ESS implementation to be 'conformant' to this document. An agency specification needs to identify the requirements of a particular project and needs to require the support of those requirements. A specification writer is advised to match the requirements of a project with the corresponding standardized requirements defined in this document to achieve interoperability. This means that functions and requirements defined as 'optional' in this document might need to be selected in a specification (in effect made 'mandatory' for the project-specific specification).

A conformant device may offer additional (optional) features, as long as they are conformant with the requirements of this document and the standards it references (e.g., NTCIP 2301). For example a device may also support data that has not been defined by this document; however, when exchanged via NTCIP 2301, the data shall be properly registered with a valid OBJECT IDENTIFIER under the Global ISO Naming Tree.

> Note: Off-the-shelf interoperability and interchangeability can only be obtained through well documented features broadly supported by the industry as a whole. Designing a system that uses features not defined in a standard or not typically deployed in combination with one another inhibits the goals of interoperability and interchangeability, especially if the documentation of these features is not available for distribution to system integrators. Standards allow the use of additional features to support innovation, which is constantly needed within the industry; but users should be aware of the risks involved with using such features.

3.3.3 Protocol Requirements List (PRL) Table

In addition to the Conformance column and the Support column, which were discussed in Section 3.3.1, the additional columns in the PRL table are the User Need ID and User Need columns, FR ID and Functional Requirement columns and the Additional Specifications column.

a) User Need ID - the number assigned to the user need statement. The user needs are defined within Section 2 and the PRL is based upon the user need sections within that Section.
b) User Need – a short descriptive title identifying the user need.
c) FR ID – the number assigned to the functional requirement statement. The requirements are defined within Section 3 and the PRL references the traces from user needs to these requirements.
d) Functional Requirement – a short descriptive title identifying the functional requirement.
e) Conformance – Indicates if the implementation is mandatory or optional.
f) Support – user selectable to indicate yes or no to the requirement.
g) Additional Specifications - identifies other requirements that are required tobe satisfied, including user selectable range values. The "Additional Specifications" column may (and should) be used by a procurement specification to provide additional notes and requirements for the product to be procured or may be used by an implementer to provide any additional details about the implementation. In some cases, default text already exists in this field, which the user should complete to fully specify the equipment. However, additional text can be added to this field as needed to fully specify a feature.

Table 8 Protocol Requirements List

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
2.3.7	ESS Characteristics				Yes	
2.3.7.	a) Permanent			O.1 (1)	Yes / No	
2.3.7.	b) Transportable			O.1 (1)	Yes / No	
2.3.7.	c) Mobile			O.1 (1)	Yes / No	
ISO 26048-1, §6.1	Authenticate users			M	Yes	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.2	Control access to data			M	Yes	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.3	Monitor failed access to the field device			M	Yes	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.4	Manage the field device			M	Yes	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.2.1	Monitor field device doors			M	Yes	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.2.2	Monitor field device enclosure air temperature			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.2.3	Monitor field device processor temperature			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.2.4	Monitor field device enclosure humidity			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
ISO 26048-1, §6.5.3.1	Manage field device fans			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.3.2	Manage field device heaters			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.3.3	Manage field device dehumidifiers			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.3.4	Manage field device air conditioners			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.3.5	Manage field device thermostat			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.4.1	Monitor field device power supplies			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.4.2	Monitor field device mains power			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.4.3	Monitor field device battery power			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.4.4	Monitor field device generator power			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.4.5	Monitor field device solar power			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
ISO 26048-1, §6.5.4.6	Monitor field device wind power			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.5.1	Manage field device auxiliary bi-directional ports			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.5.2	Monitor field device auxiliary inputs			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.5.5.3	Manage field device auxiliary outputs			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.6	Receive notification of triggers firing			O.2 (1..*)	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.7	Manage device-specific notifications			deviceNotifications:M	Yes / NA	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.8	Log system events			M	Yes	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.9	Log user-defined data snapshots			O.2 (1..*)	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
ISO 26048-1, §6.11	Issue trigger-based commands			O	Yes / No	
		See ISO 26048-1 NTFT and FTRT tables (available at https://standards.iso.org/iso/ts/26048/-1/ed-1/en/)				
2.4.4	Responsive Device			M	Yes	
		§3.6.29	Maximum Response Time for Requests	M	Yes	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.6.30	Maximum Transmission Start Time	Notifications:M	Yes / NA	
2.5	Features			M	Yes	
2.5.1	ESS Manager Features			M	Yes	
2.5.1.4	Monitor Mobile Station Data			Mobile:M	Yes / NA	
		§3.5.1.2	Retrieve Mobile ESS Movement	M	Yes	
2.5.1.5	Determine ESS Type			M	Yes	
		§3.5.1.1	Retrieve ESS Type of Station	M	Yes	
2.5.2	Sensor Manager Features			O.3 (1..*)	Yes / No	
2.5.2.1	Monitor Ambient Weather Conditions			O.4 (1..*)	Yes / No	
2.5.2.1.1	Monitor Atmospheric Pressure			O.5 (1..*)	Yes / No	
		§3.5.2.1.1	Determine Number of Atmospheric Pressure Sensors	M	Yes	
		§3.5.2.1.5	Retrieve Atmospheric Pressure	M	Yes	
		§3.6.1	Required Number of Atmospheric Pressure Sensors	M	Yes	The ESS shall support at least ____ (1..255:Default =1) atmospheric pressure sensors.
		§3.5.2.1.2 (PressLoc)	Retrieve Atmospheric Pressure Sensor Location	O	Yes / No	
		§3.5.2.1.3	Retrieve Atmospheric Pressure Sensor Identity	O	Yes / No	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.5.2.1.4	Configure Atmospheric Pressure Sensor Location	PressLoc:O	Yes / No / NA	
2.5.2.1.2	Monitor Winds			O.5 (1..*)	Yes / No	
		§3.5.2.2.1	Determine Number of Wind Sensors	M	Yes	
		§3.5.2.2.5	Retrieve Wind Data	M	Yes	
		§3.6.2	Required Number of Wind Sensors	M	Yes	The ESS shall support at least ____ (1..255:Default=1) wind sensors.
		§3.5.2.2.2 (windLoc)	Retrieve Wind Sensor Location	O	Yes / No	
		§3.5.2.2.3	Retrieve Wind Sensor Identity	O	Yes / No	
		§3.5.2.2.4	Configure Wind Sensor Location	windLoc:O	Yes / No / NA	
2.5.2.1.3	Monitor Air Temperature			O.5 (1..*)	Yes / No	
		§3.5.2.3.1	Determine Number of Temperature Sensors	M	Yes	
		§3.5.2.3.5	Retrieve Air Temperature	M	Yes	
		§3.5.2.3.6	Retrieve Daily Minimum and Maximum Temperature	M	Yes	
		§3.6.3	Required Number of Temperature Sensors	M	Yes	The ESS shall support at least ____ (1..255:Default=1) temperature sensors.
		§3.5.2.3.2 (TempLoc)	Retrieve Temperature Sensor Location	O	Yes / No	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.5.2.3.3	Retrieve Temperature Sensor Identity	O	Yes / No	
		§3.5.2.3.4	Configure Temperature Sensor Location	TempLoc:O	Yes / No / NA	
2.5.2.1.4	Monitor Relative Humidity			O.5 (1..*)	Yes / No	
		§3.5.2.4.1	Determine Number of Humidity Sensors	M	Yes	
		§3.5.2.4.5	Configure Humidity Sensor Temperature	M	Yes	
		§3.5.2.4.6	Retrieve Relative Humidity	M	Yes	
		§3.6.4	Required Number of Humidity Sensors	M	Yes	The ESS shall support at least ____ (1..255:Default=1) humidity sensors.
		§3.5.2.4.2 (HumidityLoc)	Retrieve Humidity Sensor Location	O	Yes / No	
		§3.5.2.4.3	Retrieve Humidity Sensor Identity	O	Yes / No	
		§3.5.2.4.4	Configure Humidity Sensor Location	HumidityLoc:O	Yes / No / NA	
2.5.2.1.5	Monitor Precipitation			O.5 (1..*)	Yes / No	
		§3.5.2.5.1	Determine Number of Precipitation Sensors	M	Yes	
		§3.5.2.5.6	Retrieve Precipitation Presence	M	Yes	
		§3.6.5	Required Number of Precipitation Sensors	M	Yes	The ESS shall support at least ____ (1..255:Default=1) precipitation sensors.

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.5.2.5.2 (PrecipLoc)	Retrieve Precipitation Sensor Location	O	Yes / No	
		§3.5.2.5.3	Retrieve Precipitation Sensor Identity	O	Yes / No	
		§3.5.2.5.7 (precipRates)	Retrieve Precipitation Rates	O	Yes / No	
		§3.5.2.5.8	Retrieve Precipitation Totals	O	Yes / No	
		§3.5.2.5.9 (PrecipPeriod)	Retrieve Precipitation Totals - User Specified	O	Yes / No	
		§3.5.2.5.10	Retrieve Precipitation Type	O	Yes / No	
		§3.5.2.12.2	Retrieve Precipitation Situation	O	Yes / No	
		§3.5.2.5.4	Configure Precipitation Sensor Location	PrecipLoc:O	Yes / No / NA	
		§3.5.2.5.5	Configure Precipitation Total User-Specified Period	PrecipPeriod:M	Yes / NA	
		ISO 26048-1, §8.2.1	UTC clock	precipRates:M	Yes / NA	
2.5.2.1.6	Monitor Solar Radiation			O.5 (1..*)	Yes / No	
		§3.5.2.6.1	Determine Number of Solar Radiation Sensors	M	Yes	
		§3.5.2.6.5	Retrieve Solar Radiation	M	Yes	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.6.6	Required Number of Solar Radiation Sensors	M	Yes	The ESS shall support at least ____ (1..255:Default=1) solar radiation sensors.
		§3.5.2.6.2 (radLoc)	Retrieve Solar Radiation Sensor Location	O	Yes / No	
		§3.5.2.6.3	Retrieve Solar Radiation Sensor Identity	O	Yes / No	
		§3.5.2.6.4	Configure Solar Radiation Sensor Location	radLoc:O	Yes / No / NA	
2.5.2.1.7	Monitor Visibility			O.5 (1..*)	Yes / No	
		§3.5.2.7.1	Determine Number of Visibility Sensors	M	Yes	
		§3.5.2.7.5	Retrieve Visibility	M	Yes	
		§3.6.7	Required Number of Visibility Sensors	M	Yes	The ESS shall support at least ____ (1..255:Default=1) visibility sensors.
		§3.5.2.7.2 (VisLoc)	Retrieve Visibility Sensor Location	O	Yes / No	
		§3.5.2.7.3	Retrieve Visibility Sensor Identity	O	Yes / No	
		§3.5.2.12.3	Retrieve Visibility Situation	O	Yes / No	
		§3.5.2.12.4	Retrieve Cloud Situation	O	Yes / No	
		§3.5.2.7.4	Configure Visibility Sensor Location	VisLoc:O	Yes / No / NA	
2.5.2.1.8	View Environmental Image			O	Yes / No	
		§3.5.2.13.1	Determine Number of Snapshot Cameras	M	Yes	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.5.2.13.2	Retrieve Snapshot Camera Identity	M	Yes	
		§3.5.2.13.3	Determine Supported Image Storage Formats	M	Yes	
		§3.5.2.13.4	Configure Snapshot Camera	M	Yes	
		§3.5.2.13.5	Retrieve Snapshot Camera Configuration	M	Yes	
		§3.5.2.13.6	Capture Snapshot Image	M	Yes	
		§3.5.2.13.7	Retrieve Snapshot	M	Yes	
		§3.5.2.13.8	Delete Snapshot	M	Yes	
		§3.6.23	Required Number of Snapshot Cameras	M	Yes	The ESS shall support at least ____ (1..255:Default=1) snapshot cameras.
		§3.6.24	Support Camera Number in Filename	O	Yes / No	
		§3.6.25	Support Sequence Number in Filename	O	Yes / No	
		§3.6.26	Support Date in Filename	O	Yes / No	
		§3.6.27	Support Time in Filename	O	Yes / No	
		§3.6.28	Support Long Filenames	O	Yes / No	
2.5.2.1.9	Monitor Dewpoint Temperature			O.5 (1..*)	Yes / No	
		§3.5.2.4.5	Configure Humidity Sensor Temperature	M	Yes	
		§3.5.2.4.6	Retrieve Relative Humidity	M	Yes	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
2.5.2.2	Monitor Pavement			O.4 (1..*)	Yes / No	
2.5.2.2.1	Monitor Pavement Surface Condition			M	Yes	
		§3.5.2.8.1	Determine Number of Pavement Sensors	M	Yes	
		§3.5.2.8.10	Retrieve Pavement Surface Temperature	M	Yes	
		§3.6.8	Required Number of Pavement Sensors	M	Yes	The ESS shall support at least ____ (1..255:Default=1) pavement sensors.
		§3.5.2.8.2 (PaveLoc)	Retrieve Pavement Sensor Location	O	Yes / No	
		§3.5.2.8.3	Retrieve Pavement Sensor Identity	O	Yes / No	
		§3.5.2.8.5 (PaveSensor)	Retrieve Pavement Sensor Metadata	O	Yes / No	
		§3.5.2.8.11	Retrieve Pavement Surface Condition	O	Yes / No	
		§3.5.2.8.12	Retrieve Forecasted Pavement Surface Condition	O	Yes / No	
		§3.5.2.8.13	Retrieve Roadway Friction Coefficient	O	Yes / No	
		§3.5.2.8.15	Retrieve Adjacent Snow Depth	O	Yes / No	
		§3.5.2.8.16	Retrieve Roadway Snow Depth	O	Yes / No	
		§3.5.2.8.17	Retrieve Roadway Ice Thickness	O	Yes / No	
		§3.5.2.8.6	Configure Pavement Sensor Metadata	PaveSensor:O	Yes / No / NA	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.5.2.8.4	Configure Pavement Sensor Location	PaveLoc:O	Yes / No / NA	
2.5.2.2.2	Monitor Icing Conditions			O	Yes / No	
		§3.5.2.8.1	Determine Number of Pavement Sensors	M	Yes	
		§3.5.2.8.2 (PaveLoc)	Retrieve Pavement Sensor Location	O	Yes / No	
		§3.5.2.8.3	Retrieve Pavement Sensor Identity	O	Yes / No	
		§3.5.2.8.5 (PaveSensor)	Retrieve Pavement Sensor Metadata	O	Yes / No	
		§3.5.2.8.14	Retrieve Ice Percentage	O	Yes / No	
		§3.6.9 (ActiveIceDetect)	Active Pavement Treatment Sensors	O.7	Yes / No	
		§3.6.10 (PassiveIceDetect)	Passive Pavement Treatment Sensors	O.7	Yes / No	
		§3.5.2.8.6	Configure Pavement Sensor Metadata	PaveSensor:O	Yes / No / NA	
		§3.5.2.8.4	Configure Pavement Sensor Location	PaveLoc:O	Yes / No / NA	
		§3.5.2.8.7	Configure Passive Ice Detection Logic	PassiveIceDetect:M	Yes / NA	
		§3.5.2.8.9	Retrieve Conditions for Freezing Algorithms - Passive	PassiveIceDetect:M	Yes / NA	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.5.2.8.8	Retrieve Conditions for Freezing Algorithms - Active	ActiveIceDetect:M	Yes / NA	
2.5.2.2.3	View Pavement Image			O	Yes / No	
		§3.5.2.13.1	Determine Number of Snapshot Cameras	M	Yes	
		§3.5.2.13.2	Retrieve Snapshot Camera Identity	M	Yes	
		§3.5.2.13.3	Determine Supported Image Storage Formats	M	Yes	
		§3.5.2.13.4	Configure Snapshot Camera	M	Yes	
		§3.5.2.13.5	Retrieve Snapshot Camera Configuration	M	Yes	
		§3.5.2.13.6	Capture Snapshot Image	M	Yes	
		§3.5.2.13.7	Retrieve Snapshot	M	Yes	
		§3.5.2.13.8	Delete Snapshot	M	Yes	
		§3.6.23	Required Number of Snapshot Cameras	M	Yes	The ESS shall support at least ____ (1..255:Default=1) snapshot cameras.
		§3.6.24	Support Camera Number in Filename	O	Yes / No	
		§3.6.25	Support Sequence Number in Filename	O	Yes / No	
		§3.6.26	Support Date in Filename	O	Yes / No	
		§3.6.27	Support Time in Filename	O	Yes / No	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.6.28	Support Long Filenames	O	Yes / No	
2.5.2.3	Monitor Subsurface Conditions			O.4 (1..*)	Yes / No	
		§3.5.2.9.1	Determine Number of Subsurface Sensors	M	Yes	
		§3.5.2.9.7	Retrieve Subsurface Temperature	M	Yes	
		§3.6.11	Required Number of Subsurface Sensors	M	Yes	The ESS shall support at least ____ (1..255:Default=1) subsurface sensors.
		§3.5.2.9.2 (SubSurfLoc)	Retrieve Subsurface Sensor Location	O	Yes / No	
		§3.5.2.9.3	Retrieve Subsurface Sensor Identity	O	Yes / No	
		§3.5.2.9.5 (SubSurface)	Retrieve Subsurface Sensor Metadata	O	Yes / No	
		§3.5.2.9.8	Retrieve Subsurface Moisture	O	Yes / No	
		§3.5.2.9.6	Configure Subsurface Sensor Metadata	SubSurface:O	Yes / No / NA	
		§3.5.2.9.4	Configure Subsurface Sensor Location	SubSurfLoc:O	Yes / No / NA	
2.5.2.4	Monitor Human Readings			O.4 (1..*)	Yes / No	
		§3.5.2.12.1	Retrieve Wind Situation	M	Yes	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.5.2.12.2	Retrieve Precipitation Situation	M	Yes	
		§3.5.2.12.3	Retrieve Visibility Situation	M	Yes	
		§3.5.2.12.4	Retrieve Cloud Situation	M	Yes	
		§3.5.2.12.5	Retrieve Ground State	O	Yes / No	
		§3.5.2.12.6	Retrieve Pavement State	O	Yes / No	
2.5.2.5	Monitor Water Level			O.4 (1..*)	Yes / No	
		§3.5.2.11.1	Determine Number of Water Level Sensors	M	Yes	
		§3.5.2.11.7	Retrieve Water Level	M	Yes	
		§3.6.22	Required Number of Water Level Sensors	M	Yes	The ESS shall support at least ____ (1..255:Default=1) water level sensors.
		§3.5.2.11.2 (WaterLoc)	Retrieve Water Level Sensor Location	O	Yes / No	
		§3.5.2.11.3	Retrieve Water Level Sensor Identity	O	Yes / No	
		§3.5.2.11.4 (WaterWarn)	Retrieve Water Level Sensor Warning Level	O	Yes / No	
		§3.5.2.11.5	Configure Water Level Sensor Location	WaterLoc:O	Yes / No / NA	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.5.2.11.6	Configure Water Level Sensor Warning Level	WaterWarn:O	Yes / No / NA	
2.5.2.6	Monitor Air Quality and Biohazards			O.4 (1..*)	Yes / No	
		§3.5.2.10.1	Determine Number of Air Quality Sensors	M	Yes	
		§3.5.2.10.2 (AQLoc)	Retrieve Air Quality Sensor Location	O	Yes / No	
		§3.5.2.10.3	Retrieve Air Quality Sensor Identity	O	Yes / No	
		§3.5.2.10.5 (CO)	Retrieve Carbon Monoxide Reading	O.8	Yes / No	
		§3.5.2.10.6 (NO2)	Retrieve Nitrogen Dioxide Reading	O.8	Yes / No	
		§3.5.2.10.7 (SO2)	Retrieve Sulfur Dioxide Reading	O.8	Yes / No	
		§3.5.2.10.8 (PM10)	Retrieve Small Particulate Matter Reading	O.8	Yes / No	
		§3.5.2.10.9 (PM2.5)	Retrieve Particulate Matter 2.5 Reading	O.8	Yes / No	
		§3.5.2.10.10 (PM1.0)	Retrieve Particulate Matter 1.0 Reading	O.8	Yes / No	
		§3.5.2.10.11 (CO2)	Retrieve Carbon Dioxide Reading	O.8	Yes / No	
		§3.5.2.10.12 (NO)	Retrieve Nitric Oxide Reading	O.8	Yes / No	
		§3.5.2.10.13 (O3)	Retrieve Ozone Reading	O.8	Yes / No	
		§3.5.2.10.4	Configure Air Quality Sensor Location	AQLoc:O	Yes / No / NA	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.6.13	Required Number of Carbon Monoxide Sensors	CO:M	Yes / NA	The ESS shall support at least ____ (Default=1) carbon monoxide sensors.
		§3.6.14	Required Number of Carbon Dioxide Sensors	CO2:M	Yes / NA	The ESS shall support at least ____ (Default=1) carbon dioxide sensors.
		§3.6.15	Required Number of Nitric Oxide Sensors	NO:M	Yes / NA	The ESS shall support at least ____ (Default=1) nitric oxide sensors.
		§3.6.16	Required Number of Nitrogen Dioxide Sensors	NO2:M	Yes / NA	The ESS shall support at least ____ (Default=1) nitrogen dioxide sensors.
		§3.6.17	Required Number of Sulfur Dioxide Sensors	SO2:M	Yes / NA	The ESS shall support at least ____ (Default=1) sulfur dioxide sensors.
		§3.6.18	Required Number of Ozone Sensors	O3:M	Yes / NA	The ESS shall support at least ____ (Default=1) ozone sensors.
		§3.6.19	Required Number of Small (10) Particulate Matter Sensors	PM10:M	Yes / NA	The ESS shall support at least ____ (Default=1) small particulate matter sensors.
		§3.6.20	Required Number of Small (2.5) Particulate Matter Sensors	PM2.5:M	Yes / NA	The ESS shall support at least ____ (Default=1) particulate matter (2.5) sensors.
		§3.6.21	Required Number of Small (1.0) Particulate Matter Sensors	PM1.0:M	Yes / NA	
2.5.2.7	Monitor Mobile Weather Profile			O	Yes / No	
		ISO 26048-1, §8.1	Action feature	M	Yes	
		ISO 26048-1, §8.2.1	UTC clock	M	Yes	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		ISO 26048-1, §8.4	Conditional trigger feature	M	Yes	
		ISO 26048-1, §8.7	Dynamic object feature	M	Yes	
		ISO 26048-1, §8.10	Logging feature	M	Yes	
		§3.5.1.2	Retrieve Mobile ESS Movement	M	Yes	
2.5.3	Pavement Treatment System Manager Features			O.3 (1..*)	Yes / No	
2.5.3.1	Manage Stationary Spray System			Mobile:X; O	Yes / NA	
		§3.5.3.1.4	Retrieve Stationary Pavement Treatment Configuration	M	Yes	
		§3.5.3.1.5	Configure Stationary Pavement Treatment System	M	Yes	
		§3.5.3.2.1	Retrieve Pavement Treatment Status	M	Yes	
		§3.5.3.2.2	Retrieve PTS Operational Mode	M	Yes	
		§3.5.3.4.1	Set PTS Operational Mode	M	Yes	
		§3.5.3.4.2	Manually Activate PTS Sprayer	M	Yes	
		§3.6.12	Required Number of Pavement Treatment Products	M	Yes	The ESS shall support at least ____ pavement treatment products (1..255).
		§3.5.3.1.1 (PtsLoc)	Retrieve Pavement Treatment System Location	O	Yes / No	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
		§3.5.3.1.2	Retrieve Pavement Treatment System Identity	O	Yes / No	
		§3.5.3.1.3	Configure Pavement Treatment System Location	PtsLoc:O	Yes / No / NA	
2.5.3.2	Manage Mobile Spray System			Mobile:O	Yes / No / NA	
		§3.5.3.2.1	Retrieve Pavement Treatment Status	M	Yes	
		§3.5.3.1.1 (PtsLoc)	Retrieve Pavement Treatment System Location	O	Yes / No	
		§3.5.3.1.2	Retrieve Pavement Treatment System Identity	O	Yes / No	
		§3.5.3.1.6	Configure Mobile Pavement Treatment System	O	Yes / No	
		§3.5.3.1.7	Retrieve Mobile Pavement Treatment Configuration	O	Yes / No	
		§3.5.3.2.2	Retrieve PTS Operational Mode	O	Yes / No	
		§3.5.3.4.1	Set PTS Operational Mode	O	Yes / No	
		§3.5.3.4.2	Manually Activate PTS Sprayer	O	Yes / No	
		§3.5.3.1.3	Configure Pavement Treatment System Location	PtsLoc:O	Yes / No / NA	

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Project Requirements
2.5.3.3	Monitor Mobile Spray System Profile			O	Yes / No	
		ISO 26048-1, §8.1	Action feature	M	Yes	
		ISO 26048-1, §8.2.1	UTC clock	M	Yes	
		ISO 26048-1, §8.4	Conditional trigger feature	M	Yes	
		ISO 26048-1, §8.7	Dynamic object feature	M	Yes	
		ISO 26048-1, §8.10	Logging feature	M	Yes	
		§3.5.1.2	Retrieve Mobile ESS Movement	M	Yes	
2.6	Security			M	Yes	
2.6.2	Conformant Security Environment			O.6 (1..*)	Yes / No	
		§3.7.1	Conformant Security	M	Yes	
2.6.3	Consistent Security Environment			O.6 (1..*)	Yes / No	
		§3.7.2	Consistent Security	M	Yes	

NOTE—The user needs for "Monitor ambient air temperature" and , "Monitor ambient relative humidity" as defined in ISO 26048-1, 6.5.1.1 and 6.5.1.2 are duplicative of "Monitor Air Temperature" and "Monitor Relative Humidity" as defined in 2.5.2.1.3 and 2.5.2.1.4 of this document and are therefore omitted from the PRL, but support for these user needs is not prohibited. They are omitted from the PRL to reduce the risk of procurements inadvertently selecting features that are expected to be uncommon and which could significantly increase procurement costs by specifying an unnecessary feature that is not widely used.

NOTE—The user needs for "Monitor ambient light", "Record a series of data snapshots", "Configure a complex device", and "Efficient exchange of data", as defined in ISO 26048-1, 6.5.1.3, 6.10, 6.12 and 6.13, are not envisioned to be needed for ESS deployments, but support for these user needs is not prohibited. They are omitted from the PRL to reduce the risk of procurements inadvertently selecting features that are expected to be uncommon and which could significantly increase procurement costs by specifying an unnecessary feature that is not widely used.

3.4 Common Requirements

Requirements that are common to many NTCIP device types are provided in ISO 26048-1.

3.5 Data Exchange and Operational Environment Requirements

Data exchange requirements for ESS follow.

3.5.1 ESS Manager Requirements

Requirements for managing an ESS Manager follow.

3.5.1.1 Retrieve ESS Type of Station

Upon request, the ESS shall indicate whether the sensor data is collected automatically (e.g., electronically or mechanically) or manually (e.g., human readings). If the ESS is a hybrid station (i.e., data is collected electronically/mechanically and by humans), the field device should include two SNMP contexts, one to report automatic readings and the other to report human readings;

3.5.1.2 Retrieve Mobile ESS Movement

Upon request, the ESS shall return the following information about the mobile platform:
a) the location of the mobile platform;
b) the speed of the mobile platform;
c) the bearing (direction of travel) of the mobile platform; and
d) the distance traveled.

3.5.2 Sensor Manager Requirements

Requirements for managing a Sensor Manager follow.

3.5.2.1 Manage Atmospheric Pressure Sensors

Requirements for managing atmospheric pressure sensors follow.

3.5.2.1.1 Determine Number of Atmospheric Pressure Sensors

Upon request, the ESS shall return the number of atmospheric pressure sensors connected to the ESS.

3.5.2.1.2 Retrieve Atmospheric Pressure Sensor Location

Upon request, the ESS shall return the following information for the specified atmospheric pressure sensor:
a) a textual description of the sensor location;
b) the relative height of the sensor from the reference height of the ESS; and
c) the location of the sensor.

3.5.2.1.3 Retrieve Atmospheric Pressure Sensor Identity

Upon request, the ESS shall return the entity identifier of the specified atmospheric pressure sensor so that the management station is able to properly interpret the accuracy, resolution and limits of the data.

3.5.2.1.4 Configure Atmospheric Pressure Sensor Location

Upon request, the ESS shall store the following information for a specified atmospheric pressure sensor:
a) a textual description of the sensor location;
b) relative height of the sensor from the reference height of the ESS; and
c) the location of the sensor.

3.5.2.1.5 Retrieve Atmospheric Pressure

Upon request, the ESS shall return the current atmospheric pressure reported by the specified atmospheric pressure sensor.

3.5.2.2 Manage Wind Sensors

Requirements for managing wind sensors follow.

3.5.2.2.1 Determine Number of Wind Sensors

Upon request, the ESS shall return the number of wind sensors connected to the ESS.

3.5.2.2.2 Retrieve Wind Sensor Location

Upon request, the ESS shall return the following information for the specified wind sensor:
a) a textual description of the sensor location;
b) the relative height of the sensor from the reference height of the ESS; and
c) the location of the sensor.

3.5.2.2.3 Retrieve Wind Sensor Identity

Upon request, the ESS shall return the entity identifier of the specified wind sensor so that the management station is able to properly interpret the accuracy, resolution and limits of the data.

3.5.2.2.4 Configure Wind Sensor Location

Upon request, the ESS shall store the following information for a specified wind sensor:
a) a textual description of the sensor location;
b) the relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.2.5 Retrieve Wind Data

Upon request, the ESS shall return the following information reported by the specified wind sensor:
a) the average wind speed recorded during the 2 minutes preceding the observation;
b) the average direction the wind is blowing from, as recorded during the 2 minutes preceding the observation;
c) the current wind speed;
d) the current direction the wind is blowing from;
e) the maximum wind gust recorded during the 10 minutes preceding the observation;
f) the direction of the maximum wind gust recorded during the 10 minutes preceding the observation; and
g) the assessment of the wind situation as defined by the Beaufort Wind Scale in the Glossary of Meteorology. Valid values are: other, unknown, calm, light breeze, moderate breeze, strong breeze, gale, moderate gale, strong gale, storm winds, hurricane force winds, and gusty winds.

3.5.2.3 Manage Temperature Sensors

Requirements for managing temperature sensors follow.

3.5.2.3.1 Determine Number of Temperature Sensors

Upon request, the ESS shall return the number of air temperature sensors connected to the ESS.

3.5.2.3.2 Retrieve Temperature Sensor Location

Upon request, the ESS shall return the following information for the specified air temperature sensor:
a) a textual description of the air temperature sensor location;
b) the relative height of the air temperature sensor to the reference height of the ESS; and
c) the location of the air temperature sensor.

3.5.2.3.3 Retrieve Temperature Sensor Identity

Upon request, the ESS shall return the entity identifier of the specified temperature sensor so that the management station is able to properly interpret the accuracy, resolution and limits of the data.

3.5.2.3.4 Configure Temperature Sensor Location

Upon request, the ESS shall store the following information for a specified air temperature sensor:
a) a textual description of the sensor location;

b) the relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.3.5 Retrieve Air Temperature

Upon request, the ESS shall return the current ambient air temperature reported by the specified air temperature sensor.

3.5.2.3.6 Retrieve Daily Minimum and Maximum Temperature

Upon request, the ESS shall return the minimum and maximum ambient air temperatures that have been recorded within the previous 24 hours.

3.5.2.4 Manage Humidity Sensors

Requirements for managing humidity sensors follow.

3.5.2.4.1 Determine Number of Humidity Sensors

Upon request, the ESS shall return the number of humidity sensors connected to the ESS.

3.5.2.4.2 Retrieve Humidity Sensor Location

Upon request, the ESS shall return the following information for the specified humidity sensor:
a) a textual description of the sensor location;
b) the relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.4.3 Retrieve Humidity Sensor Identity

Upon request, the ESS shall return the entity identifier of the specified humidity sensor so that the management station is able to properly interpret the accuracy, resolution and limits of the data.

3.5.2.4.4 Configure Humidity Sensor Location

Upon request, the ESS shall store following information for a specified humidity sensor:
a) a textual description of the sensor location;
b) the relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.4.5 Configure Humidity Sensor Temperature

Upon request, the ESS shall store the index of the temperature sensor that is associated with the specified humidity sensor.

3.5.2.4.6 Retrieve Relative Humidity

Upon request, the ESS shall return the following information reported by the specified humidity sensor:
a) the current humidity;
b) the temperature sensor associated with this humidity sensor;
c) the derived ambient dewpoint temperature; and
d) the derived ambient wet-bulb temperature.

3.5.2.5 Manage Precipitation Sensors

Requirements for managing precipitation sensors follow.

3.5.2.5.1 Determine Number of Precipitation Sensors

Upon request, the ESS shall return the number of precipitation sensors connected to the ESS.

3.5.2.5.2 Retrieve Precipitation Sensor Location

Upon request, the ESS shall the following information for the specified precipitation sensor:
a) a textual description of the sensor location;
b) the relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.5.3 Retrieve Precipitation Sensor Identity

Upon request, the ESS shall return the entity identifier of the specified precipitation sensor so that the management station is able to properly interpret the accuracy, resolution and limits of the data.

3.5.2.5.4 Configure Precipitation Sensor Location

Upon request, the ESS shall store the following information for a specified precipitation sensor:
a) a textual description of the sensor location;
b) relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.5.5 Configure Precipitation Total User-Specified Period

Upon request, the ESS shall store the user-specified collection period for measuring the precipitation recorded for a specified precipitation sensor.

3.5.2.5.6 Retrieve Precipitation Presence

Upon request, the ESS shall return an indication of whether precipitation is currently being reported by the specified precipitation sensor. Precipitation is detected if 0.01 inches of liquid water equivalent is detected.

3.5.2.5.7 Retrieve Precipitation Rates

Upon request, the ESS shall return the the following information reported by the specified precipitation sensor:
a) the current water-equivalent rate of precipitation;
b) the rate that snow is accumulating; and
c) the start and stop times of the latest recorded precipitation event. The precipitation event can be rainfall or snowfall.

3.5.2.5.8 Retrieve Precipitation Totals

Upon request, the ESS shall return the total amount of precipitation recorded over the last one hour, three hour, six hour, twelve hour, and twenty-four hour rolling periods, reported by the specified precipitation sensor.

3.5.2.5.9 Retrieve Precipitation Totals - User Specified

Upon request, the ESS shall return the total amount of precipitation recorded over a user specified, rolling time period for the specified precipitation sensor.

3.5.2.5.10 Retrieve Precipitation Type

Upon request, the ESS shall return the assessment of the type and intensity of the current precipitation situation. The precipitation intensity shall be defined as follows: slight < 2 mm/hour water equivalent, moderate is ≥ 2 and < 8 mm/hour equivalent, and heavy is ≥ 8 mm/hour water equivalent.

3.5.2.6 Manage Solar Radiation Sensors

Requirements for managing solar radiation sensors follow.

3.5.2.6.1 Determine Number of Solar Radiation Sensors

Upon request, the ESS shall return the number of solar radiation sensors connected to the ESS.

3.5.2.6.2 Retrieve Solar Radiation Sensor Location

Upon request, the ESS shall return the following information for the specified solar radiation sensor:
a) a textual description of the sensor location;
b) the relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.6.3 Retrieve Solar Radiation Sensor Identity

Upon request, the ESS shall return the entity identifier of the specified solar radiation sensor so that the management station is able to properly interpret the accuracy, resolution and limits of the data.

3.5.2.6.4 Configure Solar Radiation Sensor Location

Upon request, the ESS shall store the following information for a specified solar radiation sensor:
a) a textual description of the sensor location;
b) the relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.6.5 Retrieve Solar Radiation

Upon request, the ESS shall return the solar radiation data reported by each solar radiation sensor. The types of measured solar radiation data that the ESS shall provide are:
a) the total minutes of sunshine measured over the preceding 24-hour period, as defined by WMO Code Form FM 94 BUFR Table B item 0 14 031;
b) the instantaneous infrared radiation measured, in watts per square meter, as defined by WMO Code Form FM 94 BUFR Table B item 0 14 017;
c) the instantaneous ultraviolet, visible and near-infrared radiation measured, in watts per square meter, as defined by WMO Code Form FM 94 BUFR Table B item 0 14 018; and
d) the average total radiation measured, in watts per square meter, as defined by WMO Code Form FM 94 BUFR Table B item 0 14 025, over a user defined rolling period, measured in seconds.

3.5.2.7 Manage Visibility Sensor

Requirements for managing visibility sensors follow.

3.5.2.7.1 Determine Number of Visibility Sensors

Upon request, the ESS shall return the number of visibility sensors connected to the ESS.

3.5.2.7.2 Retrieve Visibility Sensor Location

Upon request, the ESS shall return the following information for a visibility sensor:
a) a textual description of the sensor location;
b) the direction that the sensor uses to measure distance
c) the relative height of the sensor to the reference height of the ESS; and
d) the location of the sensor.

3.5.2.7.3 Retrieve Visibility Sensor Identity

Upon request, the ESS shall return the entity identifier of the visibility sensor so that the management station is able to properly interpret the accuracy, resolution and limits of the data.

3.5.2.7.4 Configure Visibility Sensor Location

Upon request, the ESS shall store the following information for a visibility sensor:
a) a textual description of the sensor location;
b) the direction that the sensor uses to measure distance;
c) the relative height of the sensor to the reference height of the ESS; and
d) the location of the sensor.

3.5.2.7.5 Retrieve Visibility

Upon request, the ESS shall return the current visibility distance.

3.5.2.8 Manage Pavement Sensors

Requirements for managing pavement sensors follow.

3.5.2.8.1 Determine Number of Pavement Sensors

Upon request, the ESS shall return the number of pavement sensors connected to the ESS.

3.5.2.8.2 Retrieve Pavement Sensor Location

Upon request, the ESS shall return the following information for the specified pavement sensor:
a) a textual description of the sensor location and the location of the area the sensor is monitoring;
b) the relative height of the pavement surface to the reference height of the ESS;
c) the location of the sensor; and
d) the location of the geometric center of the surface area that the sensor is monitoring.

3.5.2.8.3 Retrieve Pavement Sensor Identity

Upon request, the ESS shall return the entity identifier of the specified pavement sensor so that the management station is able to properly interpret the accuracy, resolution and limits of the data.

3.5.2.8.4 Configure Pavement Sensor Location

Upon request, the ESS shall store the following information for the specified pavement sensor:
a) a textual description of the sensor location and the location of the area the sensor is monitoring;
b) the relative height of the pavement surface to the reference height of the ESS.
c) the location of the sensor; and
d) the location of the geometric center of the pavement surface area that the sensor is monitoring.

3.5.2.8.5 Retrieve Pavement Sensor Metadata

Upon request, the ESS shall return the following information for the specified pavement sensor:
a) a textual description of the location that the pavement sensor is monitoring;
b) the type of pavement the sensor is monitoring;
c) an indication of the skyview factor to which the monitored pavement is subjected. A value of 100 (percent) indicates a fully visible sky; and
d) an indication of the sensor technology used.

3.5.2.8.6 Configure Pavement Sensor Metadata

Upon request, the ESS shall store configuration information for a specified pavement sensor. The configuration information includes:
a) a textual description of the location that the pavement sensor is monitoring;
b) the type of pavement the sensor is monitoring; and
c) an indication of the skyview factor to which the monitored pavement is subjected.

3.5.2.8.7 Configure Passive Ice Detection Logic

Upon request, the ESS shall store information regarding the pavement treatments being applied so that the ESS may more accurately estimate icing conditions using passive logic. The information includes:
a) the number of different pavement treatments types;
b) the type of each pavement treatment;
c) the form of each pavement treatment type; and
d) the percentage of each pavement treatment type and form by total application weight.

Different pavement treatments may be the same pavement treatment type but in different forms and in different percentages (by weight).

> Note: There are now combinations of pavement treatments that are used, and they may impact the calibration of the algorithms used.

3.5.2.8.8 Retrieve Conditions for Freezing Algorithms - Active

There are two methods to determine ice and moisture conditions on the pavement surface – active and passive. Active pavement sensors determine the freeze point on the pavement surface by actively freezing a portion of the roadway surface. For an active pavement sensor, upon request, the ESS shall return:
a) the pavement surface temperature;
b) the pavement temperature;
c) the depth below the pavement surface that the pavement temperature is measured;

d) the freeze point on the pavement surface at which the existing solution on the roadway freezes;
e) whether black ice is currently detected on the pavement surface;
f) the depth of any water/solution film or ice on the pavement surface; and
g) an indication of whether any of this data might be in error.

3.5.2.8.9 Retrieve Conditions for Freezing Algorithms - Passive

There are two methods to determine ice and moisture conditions on the pavement surface - active and passive. Passive pavement sensors determine the freeze point on the pavement surface using algorithms without freezing the chemical mixture on the roadway surface. For a passive pavement sensor, upon request, the ESS shall return the following:
a) the pavement surface temperature;
b) the pavement temperature;
c) the depth below the pavement surface that the pavement temperature is measured;
d) the freeze point on the pavement surface at which the existing solution on the roadway freezes;
e) whether black ice is currently detected on the pavement surface;
f) the depth of any water/solution film or ice on the pavement surface;
g) the salinity of the water/solution film on the pavement surface;
h) the conductivity of the water/solution film on the pavement surface, as detected by the pavement surface sensor;
i) an indication of whether any of this data might be in error;
j) the pavement treatment type used for algorithm;
k) the form of each pavement treatment type; and
l) the percentage of the total application weight that is of the pavement treatment type.

3.5.2.8.10 Retrieve Pavement Surface Temperature

Upon request, the ESS shall return the following information reported by the specified pavement sensor:
a) the current pavement surface temperature; and
b) the validity of the data reported.

3.5.2.8.11 Retrieve Pavement Surface Condition

Upon request, the ESS shall return the following information reported by the specified pavement sensor:
a) any presence of moisture and the type of moisture on the surface; and
b) the validity of the data reported.

3.5.2.8.12 Retrieve Forecasted Pavement Surface Condition

Upon request, the ESS shall return the forecasted pavement surface condition for the specified pavement sensor. The forecast is derived based on the current pavement surface condition and other weather observations.

3.5.2.8.13 Retrieve Roadway Friction Coefficient

Upon request, the ESS shall return the estimated friction coefficient of the roadway pavement for the specified pavement sensor. The actual coefficient of friction is dependent on many variables, including characteristics of the tire traveling on the pavement; thus it is recognized that it is impossible to provide a on a single mathematically precise value. However, the reported friction coefficient shall be based on an empirical model that has a strong correlation with actual measured friction coefficients using a standard test method and test apparatus, such as a decelerometer or a surface friction tester.

3.5.2.8.14 Retrieve Ice Percentage

Upon request, the ESS shall return the percentage of ice in the mixture on the surface of the pavement for the specified pavement sensor.

3.5.2.8.15 Retrieve Adjacent Snow Depth

Upon request, the ESS shall return the current depth of snow adjacent to the traveled way (e.g., shoulders) for the specified sensor. The depth shall be representative of the snow depth in the area, exclusive of plowed areas and snow drifts.

3.5.2.8.16 Retrieve Roadway Snow Depth

Upon request, the ESS shall return the current depth of packed and unpacked snow on the roadway pavement (i.e., roadway, rail line, etc.) for the specified sensor.

3.5.2.8.17 Retrieve Roadway Ice Thickness

Upon request, the ESS shall return the current thickness of ice on the roadway pavement reported by the specified pavement sensor.

3.5.2.9 Manage Subsurface Sensors

Requirements for managing subsurface sensors follow.

3.5.2.9.1 Determine Number of Subsurface Sensors

Upon request, the ESS shall return the number of subsurface sensors connected to the ESS.

3.5.2.9.2 Retrieve Subsurface Sensor Location

Upon request, the ESS shall return the following information for the specified subsurface sensor:
a) a textual description of the sensor location; and
b) the location of the geometric center of the sensor.

3.5.2.9.3 Retrieve Subsurface Sensor Identity

Upon request, the ESS shall return the entity identifier of the specified subsurface sensor so that the management station is able to properly interpret the accuracy, resolution and limits of the data.

3.5.2.9.4 Configure Subsurface Sensor Location

Upon request, the ESS shall store the following information for a specified subsurface sensor:
a) a textual description of the sensor location; and
b) the location of the geometric center of the sensor.

3.5.2.9.5 Retrieve Subsurface Sensor Metadata

Upon request, the ESS shall return the following information for the specified subsurface sensor:
a) a textual description of the location that the sensor is monitoring;
b) the type of subsurface the sensor is monitoring; and
c) the depth of the sensor location below the pavement surface.

3.5.2.9.6 Configure Subsurface Sensor Metadata

Upon request, the ESS shall store configuration information for a specified subsurface sensor. The configuration information includes:
a) a textual description of the location that the sensor is monitoring;
b) the type of subsurface the sensor is monitoring; and
c) the depth of the sensor location below the pavement surface.

3.5.2.9.7 Retrieve Subsurface Temperature

Upon request, the ESS shall return the current subsurface temperature reported by the specified subsurface sensor. The ESS shall also return an indication of whether this data might be in error.

3.5.2.9.8 Retrieve Subsurface Moisture

Upon request, the ESS shall return the amount of moisture currently reported by the specified subsurface sensor. A value of 0% indicates that the subsurface is dry, while a value of 100% indicates the subsurface is saturated.

3.5.2.10 Manage Air Quality Sensors

Requirements for managing air quality sensors follow.

3.5.2.10.1 Determine Number of Air Quality Sensors

Upon request, the ESS shall return the number of air quality sensors connected to the ESS.

3.5.2.10.2 Retrieve Air Quality Sensor Location

Upon request, the ESS shall return the following information for the specified air quality sensor:
a) a textual description of the sensor location;
b) the relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.10.3 Retrieve Air Quality Sensor Identity

Upon request, the ESS shall return the entity identifier of the specified air quality sensor so that the management station is able to properly interpret the accuracy, resolution and limits of the data.

3.5.2.10.4 Configure Air Quality Sensor Location

Upon request, the ESS shall store the following information for a specified air quality sensor:
a) a textual description of the sensor location;
b) the relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.10.5 Retrieve Carbon Monoxide Reading

Upon request, the ESS shall return the current concentration detected by the specified air quality sensor of carbon monoxide.

3.5.2.10.6 Retrieve Nitrogen Dioxide Reading

Upon request, the ESS shall return the current concentration detected by the specified air quality sensor of nitrogen dioxide.

3.5.2.10.7 Retrieve Sulfur Dioxide Reading

Upon request, the ESS shall return the current concentration detected by the specified air quality sensor of sulfur dioxide.

3.5.2.10.8 Retrieve Small Particulate Matter Reading

Upon request, the ESS shall return the current concentration detected by the specified air quality sensor of small particulate matter of 10 micrometers or less in diameter.

3.5.2.10.9 Retrieve Particulate Matter 2.5 Reading

Upon request, the ESS shall return the current concentration detected by the specified air quality sensor of small particulate matter of 2.5 micrometers or less in diameter.

3.5.2.10.10 Retrieve Particulate Matter 1.0 Reading

Upon request, the ESS shall return the current concentration detected by the specified air quality sensor of small particulate matter of 1.0 micrometers or less in diameter.

3.5.2.10.11 Retrieve Carbon Dioxide Reading

Upon request, the ESS shall return the current concentration detected by the specified air quality sensor of carbon dioxide.

3.5.2.10.12 Retrieve Nitric Oxide Reading

Upon request, the ESS shall return the current concentration detected by the specified air quality sensor of nitric oxide.

3.5.2.10.13 Retrieve Ozone Reading

Upon request, the ESS shall return the current concentration detected by the specified air quality sensor of ozone.

3.5.2.11 Manage Water Level Sensors

Requirements for managing water level sensors follow.

3.5.2.11.1 Determine Number of Water Level Sensors

Upon request, the ESS shall return the number of water level sensors connected to the ESS.

3.5.2.11.2 Retrieve Water Level Sensor Location

Upon request, the ESS shall return the following information for the specified water level sensor:
a) a textual description of the sensor location, including a description of the reference point that the water depth is measured against;
b) the relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.11.3 Retrieve Water Level Sensor Identity

Upon request, the ESS shall return the entity identifier of the specified water level sensor so that the management station is able to properly interpret the accuracy, resolution and limits of the data.

3.5.2.11.4 Retrieve Water Level Sensor Warning Level

Upon request, the ESS shall return the water level depth that is a cause of concern for the specified water level sensor. This water level depth may be the depth when the water levels may overflow onto the roadway pavement, or may damage electronic roadside equipment in a cabinet.

3.5.2.11.5 Configure Water Level Sensor Location

Upon request, the ESS shall store the following information for a specified water level sensor:
a) a textual description of the sensor location, including a description of the reference point that the water depth is measured against;
b) the relative height of the sensor to the reference height of the ESS; and
c) the location of the sensor.

3.5.2.11.6 Configure Water Level Sensor Warning Level

Upon request, the ESS shall store the water level depth that is a cause of concern for the specified water level sensor.

3.5.2.11.7 Retrieve Water Level

Upon request, the ESS shall return the current depth of water from a user defined point for the specified water level sensor. The current depth of water can be over a body of water, such as a stream or a reservoir, or the current depth of water on a roadway pavement, such as an underpass. This requirement is concerned with the water depth in bodies of water or the pavement surface for flooding concerns, as opposed to requirements 3.5.2.8.8.f or 3.5.2.8.9.f, water film depth, which are concerned about icing or hydroplaning on the pavement surface.

3.5.2.12 Monitor Situation Assessments

Requirements for monitoring situation assessments follow.

3.5.2.12.1 Retrieve Wind Situation

Upon request, the ESS shall return the assessment of the wind situation from a staffed station as defined by the Beaufort Wind Scale in the Glossary of Meteorology.

3.5.2.12.2 Retrieve Precipitation Situation

Upon request, the ESS shall return the assessment of the type and intensity of the current precipitation situation. The assessment may be made through automated processes, or if it is a staffed station, manually.

3.5.2.12.3 Retrieve Visibility Situation

Upon request, the ESS shall return the assessment of the visibility situation. The assessment may be made through automated processes, or if it is a staffed station, manually.

3.5.2.12.4 Retrieve Cloud Situation

Upon request, the ESS shall return the amount of cloud cover in the sky, measured in oktas, as defined in WMO code table 2700. The assessment may be made through automated processes, or if it is a staffed station, manually.

3.5.2.12.5 Retrieve Ground State

Upon request, the ESS shall return the assessment of the ground state next to the roadway (the roadside, and not the roadway pavement or shoulders). The assessment is made from a staffed station.

3.5.2.12.6 Retrieve Pavement State

Upon request, the ESS shall return the assessment of the pavement surface. The assessment is made from a staffed station.

3.5.2.13 Manage Snapshot Cameras

Requirements for managing snapshot cameras follow.

3.5.2.13.1 Determine Number of Snapshot Cameras

Upon request, the ESS shall return the number of snapshot cameras connected to the ESS.

3.5.2.13.2 Retrieve Snapshot Camera Identity

Upon request, the ESS shall return the entity identifier of the specified snapshot camera so that the management station is able to properly understand its capabilities.

3.5.2.13.3 Determine Supported Image Storage Formats

Upon request, the ESS shall return the image storage formats that are supported by the specified snapshot camera.

3.5.2.13.4 Configure Snapshot Camera

Upon request, the ESS shall store a textual description of the location and direction to which the specified camera points along with the filename and file format to be used when storing new snapshots from the specified camera.

3.5.2.13.5 Retrieve Snapshot Camera Configuration

Upon request, the ESS shall return the following information for the specified snapshot camera:
a) the textual description of the location to which the camera points;
b) the file path where new snapshots are stored;
c) the filename to be used when storing new snapshots; and
d) the file format to be used when storing new snapshots.

3.5.2.13.6 Capture Snapshot Image

Upon request, the ESS shall capture the current image (snapshot) from the specified attached camera and store it per the configured storage path, filename, and format. The ESS shall report any errors in performing this task.

3.5.2.13.7 Retrieve Snapshot

Upon request, the ESS shall return a copy of the specified snapshot image.

3.5.2.13.8 Delete Snapshot

Upon request, the ESS shall delete the specified snapshot image.

3.5.3 PTS Manager Requirements

Requirements for managing a PTS manager follow.

3.5.3.1 PTS Configuration Requirements

Requirements for configuring a PTS manager follow.

3.5.3.1.1 Retrieve Pavement Treatment System Location

Upon request, the ESS shall return the following information for the pavement treatment system:
a) a textual description of the pavement treatment system location; and
b) the location of the pavement treatment system.

3.5.3.1.2 Retrieve Pavement Treatment System Identity

Upon request, the ESS shall return the entity identifier of the pavement treatment system so that the management station is able to properly interpret the capabilities of the pavement treatment system.

3.5.3.1.3 Configure Pavement Treatment System Location

Upon request, the ESS shall store the following information for a pavement treatment system:
a) a textual description of the pavement treatment system location; and
b) the location of the pavement treatment system.

3.5.3.1.4 Retrieve Stationary Pavement Treatment Configuration

Upon request, the PTS shall return the configuration data for a stationary pavement treatment system identifying:
a) the pavement sensors that the PTS monitors to determine when to trigger the sprayers;
b) the duration required for a signal to activate the sprayer;
c) the number of pavement treatment products that the PTS has been programmed for; and
d) for each pavement treatment product, the pavement treatment product type, pavement treatment form and the percentage mix (by weight).

A pavement treatment product is a chemical that can be applied to the roadway to de-ice or prevent icing of the pavement. This requirement allows a transportation system operator to determine what pavement treatments may be applied by the PTS.

3.5.3.1.5 Configure Stationary Pavement Treatment System

Upon request, the PTS shall change the configuration for a stationary pavement treatment system identifying:
a) the pavement sensors that the PTS monitors to determine when to trigger the sprayers;
b) the duration required for a signal to activate the sprayer;
c) the number of pavement treatment products that the PTS has been programmed for; and
d) for each pavement treatment product, the pavement treatment type, pavement treatment form and the percentage mix (by weight).

3.5.3.1.6 Configure Mobile Pavement Treatment System

Upon request, the PTS shall change the configuration for a mobile pavement treatment system identifying:
a) the quantity of treatment being applied;
b) the width of the spread of treatment;
c) the minimum amount of time the sprayer needs to detect a signal to activate and the duration to stay active; and

d) for each pavement treatment product that the PTS has been programmed for, the pavement treatment type, pavement treatment form and the percentage mix (by weight).

3.5.3.1.7 Retrieve Mobile Pavement Treatment Configuration

Upon request, the PTS shall return the configuration data for a mobile pavement treatment system identifying:
a) the quantity of pavement treatment being applied;
b) the width of the spread of treatment; and
c) for each pavement treatment product that the PTS has been programmed for, the pavement treatment type, pavement treatment form and the percentage mix (by weight).

A pavement treatment product is a chemical that can be applied to the roadway to de-ice or prevent icing of the pavement. This requirement allows a transportation system operator to determine what pavement treatments may be applied by the PTS.

3.5.3.2 PTS Status Monitoring Requirements

Requirements for monitoring the status of a PTS manager follow.

3.5.3.2.1 Retrieve Pavement Treatment Status

Upon request, the PTS shall return the current status of the sprayer and the number of spray events that have occurred on a pavement treatment system. The status consists of:

a) whether the sprayer is currently active (spraying);
b) a counter indicating the number of signal events that have occurred;
c) the date and time the sprayer last received a signal event;
d) a counter indicating the number of active events that have occurred;
e) a counter indicating the number of inactive events that have occurred;
f) the date and time the sprayer of the last active event;
g) the date and time the sprayer of the last inactive event; and
h) the state of readiness of the sprayer.

3.5.3.2.2 Retrieve PTS Operational Mode

Upon request, the stationary PTS shall return its current operational mode.

3.5.3.3 PTS Data Retrieval Requirements

There are no requirements for retrieving data from a PTS manager.

3.5.3.4 PTS Control Requirements

Requirements for controlling a PTS manager follow.

3.5.3.4.1 Set PTS Operational Mode

Upon request, the stationary PTS shall change its operational mode to that requested. Valid operational modes are:
a) Off, which shall prevent any operation of the sprayer;
b) Manual, which shall allow manual activation of the sprayer; and
c) Automatic, which shall allow either manual activation or activation based on internal logic per the configuration parameters.

3.5.3.4.2 Manually Activate PTS Sprayer

Upon request, the stationary PTS shall trigger the sprayer to spray its pavement treatment solution. The trigger shall be activated for the configured duration period.

3.6 Supplemental Non-Communications Requirements

Supplemental requirements for ESS follow. These requirements do not directly involve communications between the management station and the ESS, but, if the supplemental requirement is selected in the PRL, the ESS shall fulfill the stated requirement to claim conformance to this document.

3.6.1 Required Number of Atmospheric Pressure Sensors

The ESS shall support the number of atmospheric pressure sensors as defined by the agency specification. If the agency specification does not define the number of atmospheric pressure sensors, the number of atmospheric pressure sensors supported by the ESS is one (1).

3.6.2 Required Number of Wind Sensors

The ESS shall support the number of wind sensors as defined by the agency specification. If the agency specification does not define the number of wind sensors, the number of wind sensors supported by the ESS is one (1).

3.6.3 Required Number of Temperature Sensors

The ESS shall support the number of temperature sensors as defined by the agency specification. If the agency specification does not define the number of temperature sensors, the number of temperature sensors supported by the ESS is one (1).

3.6.4 Required Number of Humidity Sensors

The ESS shall support the number of humidity sensors as defined by the agency specification. If the agency specification does not define the number of humidity sensors, the number of humidity sensors supported by the ESS is one (1).

3.6.5 Required Number of Precipitation Sensors

The ESS shall support the number of precipitation sensors as defined by the agency specification. If the agency specification does not define the number of precipitation sensors, the number of precipitation sensors supported by the ESS is one (1).

3.6.6 Required Number of Solar Radiation Sensors

The communications interface only allows the ESS to return a single set of values for the solar radiation; however, these values may be derived from multiple sensors. The ESS shall support the number of solar radiation sensors as defined by the agency specification. If the agency specification does not define the number of solar radiation sensors, the number of solar radiation sensors supported by the ESS is one (1).

3.6.7 Required Number of Visibility Sensors

The communications interface only allows the ESS to return a single value for the visibility; however, this value may be derived from multiple sensors. The ESS shall support the number of visibility sensors as defined by the agency specification. If the agency specification does not define the number of visibility sensors, the number of visibility sensors supported by the ESS is one (1).

3.6.8 Required Number of Pavement Sensors

The ESS shall support the number of pavement sensors as defined by the agency specification. If the agency specification does not define the number of pavement sensors, the number of pavement sensors supported by the ESS is one (1).

3.6.9 Active Pavement Treatment Sensors

The ESS shall determine the predicted freeze-point of the pavement by actively freezing a portion of the mixture on the roadway surface.

3.6.10 Passive Pavement Treatment Sensors

The ESS shall determine the freeze point of the pavement through an algorithm that does not require the freezing of the chemical mixture on the roadway surface.

Note: Different makes and models of equipment may use different algorithms for a variety of reasons. To overcome problems that may result from this variation, this document links each pavement sensor with a row of the module table so that a system can identify the make and model of the specific pavement sensor.

3.6.11 Required Number of Subsurface Sensors

The ESS shall support the number of subsurface sensors as defined by the agency specification. If the agency specification does not define the number of subsurface sensors, the number of subsurface sensors supported by the ESS is one (1).

3.6.12 Required Number of Pavement Treatment Products

The ESS shall support the number of pavement treatment products as defined by the agency specification. If the agency specification does not define the number of pavement treatment products, the number of pavement treatment products supported by the ESS is one (1).

3.6.13 Required Number of Carbon Monoxide Sensors

The communications interface only allows the ESS to return a single value for carbon monoxide; however, this value may be derived from multiple sensors. The ESS shall support the number of carbon monoxide sensors as defined by the agency specification. If the agency specification does not define the number of carbon monoxide sensors, the number of carbon monoxide sensors supported by the ESS is one (1).

3.6.14 Required Number of Carbon Dioxide Sensors

The communications interface only allows the ESS to return a single value for carbon dioxide; however, this value may be derived from multiple sensors. The ESS shall support the number of carbon dioxide sensors as defined by the agency specification. If the agency specification does not define the number of carbon dioxide sensors, the number of carbon dioxide sensors supported by the ESS is one (1).

3.6.15 Required Number of Nitric Oxide Sensors

The communications interface only allows the ESS to return a single value for nitric oxide; however, this value may be derived from multiple sensors. The ESS shall support the number of nitric oxide sensors as defined by the agency specification. If the agency specification does not define the number of nitric oxide sensors, the number of nitric oxide sensors supported by the ESS is one (1).

3.6.16 Required Number of Nitrogen Dioxide Sensors

The communications interface only allows the ESS to return a single value for nitrogen dioxide; however, this value may be derived from multiple sensors. The ESS shall support the number of nitrogen dioxide sensors as defined by the agency specification. If the agency specification does not define the number of nitrogen dioxide sensors, the number of nitrogen dioxide sensors supported by the ESS is one (1).

3.6.17 Required Number of Sulfur Dioxide Sensors

The communications interface only allows the ESS to return a single value for sulfur dioxide; however, this value may be derived from multiple sensors. The ESS shall support the number of sulfur dioxide sensors as defined by the agency specification. If the agency specification does not define the number of sulfur dioxide sensors, the number of sulfur dioxide sensors supported by the ESS is one (1).

3.6.18 Required Number of Ozone Sensors

The communications interface only allows the ESS to return a single value for ozone; however, this value may be derived from multiple sensors. The ESS shall support the number of ozone sensors as defined by the agency specification. If the agency specification does not define the number of ozone sensors, the number of ozone sensors supported by the ESS is one (1).

3.6.19 Required Number of Small (10) Particulate Matter Sensors

The communications interface only allows the ESS to return a single value for small particulate matter; however, this value may be derived from multiple sensors. The ESS shall support the number of small

particulate matter sensors as defined by the agency specification. If the agency specification does not define the number of small particulate matter sensors, the number of small particulate matter sensors supported by the ESS is one (1).

3.6.20 Required Number of Small (2.5) Particulate Matter Sensors

The communications interface only allows the ESS to return a single value for small particulate matter 2.5 microns or less in diameter; however, this value may be derived from multiple sensors. The ESS shall support the number of small particulate matter (≤ 2.5 microns diameter) sensors as defined by the agency specification. If the agency specification does not define the number of small particulate matter (≤ 2.5 microns diameter) sensors, the number of small particulate matter (2.5) sensors supported by the ESS is one (1).

3.6.21 Required Number of Small (1.0) Particulate Matter Sensors

The communications interface only allows the ESS to return a single value for small particulate matter 1.0 microns or less in diameter; however, this value may be derived from multiple sensors. The ESS shall support the number of small particulate matter (≤ 1.0 microns diameter) sensors as defined by the agency specification. If the agency specification does not define the number of small particulate matter (≤ 1.0 microns diameter) sensors, the number of small particulate matter (1.0) sensors supported by the ESS is one (1).

3.6.22 Required Number of Water Level Sensors

The ESS shall support the number of water level sensors as defined by the agency specification. If the agency specification does not define the number of water level sensors, the number of water level sensors supported by the ESS is one (1).

3.6.23 Required Number of Snapshot Cameras

The ESS shall support the number of snapshot cameras as defined by the agency specification. If the agency specification does not define the number of snapshot cameras, the number of snapshot cameras supported by the ESS is one (1).

3.6.24 Support Camera Number in Filename

The ESS shall support the ability to specify a field in the filename parameter that is replaced by the camera number when a snapshot is saved. This is the '<camera>' field as defined in Section **Error! Reference source not found.**.

3.6.25 Support Sequence Number in Filename

The ESS shall support the ability to specify a field in the filename parameter that is replaced by the current sequence number when a snapshot is saved. This is the '<sequence>' field as defined in Section **Error! Reference source not found.**.

3.6.26 Support Date in Filename

The ESS shall support the ability to specify a field in the filename parameter that is replaced by the current UTC date when a snapshot is saved. This is the '<date>' field as defined in Section **Error! Reference source not found.**.

3.6.27 Support Time in Filename

The ESS shall support the ability to specify a field in the filename parameter that is replaced by the current UTC time when a snapshot is saved. This is the '<time>' field as defined in Section **Error! Reference source not found.**.

3.6.28 Support Long Filenames

The ESS shall support the ability to specify filenames up to 255 characters in length minus the length of the filename extension minus 1.

3.6.29 Maximum Response Time for Requests

The ESS shall process each received request in accordance with all of the rules of the relevant base standards (e.g., NTCIP 2301 v03), including updating the value the RPU is storing internally and producing the response PDU within the maximum response time. If the agency specification does not indicate the maximum response time, the maximum response time for any standardized request shall be 100 ms.
The maximum response time for any non-standard request shall be calculated as follows:

a) Identify the minimum number of standardized request messages that contain all the objects included in the request for which the calculation is being made.
b) The maximum response time for a non-standard request shall be the product of the maximum response time specified for a standardized request multiplied by the number of standardized requests identified in Step a.

3.6.30 Maximum Transmission Start Time

Upon satisfying a condition that triggers a transmission (exception-based reporting), the device shall generate the notification PDU for that specified condition within the defined maximum transmission start time. Unless the agency specification indicates otherwise, the maximum transmission start time shall be 100 milliseconds.

3.7 Security Requirements

3.7.1 Conformant Security

To claim "conformance" with this document, an ESS shall only support protocols providing equivalent security to SNMPv3 per the rules of NTCIP 2301 v03. Implementations should support the communications stack defined in NTCIP 2301 v03 for the exchanged of data defined by this document.

NOTE—This excludes support for less secure protocols, such as SNMP versions prior to SNMPv3. In other words, conformant devices do not have the installed code to activate prior versions of SNMP.

3.7.2 Consistent Security

To claim "consistency" with this document, an ESS shall:

a) Support protocols providing equivalent security to SNMPv3 per the rules of NTCIP 2301 v03,
b) Support less secure protocols (e.g., prior versions of SNMP), and
c) Allow users to disable all protocols that are less secure than SNMPv3 according to NTCIP 2301 v03.

Implementations should support the communications stack defined in NTCIP 2301 v03 for the exchanged of data defined by this document.

NOTE—Consistent devices are defined to allow agencies to start procuring and deploying SNMPv3-ready devices immediately, before their management station has been updated to support SNMPv3.

Section 4
Dialogs [Normative]

Section 4 defines the dialogs (i.e., sequence of data exchanges) that fulfill various Data Exchange requirements defined in Section 3.5. As SNMP communications are largely driven by the management station, most of the requirements define how the device shall respond to the various possible actions a management station might take.

The NTCIP standards effort is based on SNMP. This protocol offers a high degree of flexibility as to how the management station structures its requests. For example, with SNMP, the management station can do any of the following:

a) Send only those requests that are critical at the current time, whereas a standardized dialog typically sends requests relating to all associated data, regardless of whether it is critical for current purposes
b) Combine a number of requests in a single packet, whereas a standardized dialog dictates the exact contents of each packet
c) Separate a group of requests into multiple packets, whereas a standardized dialog dictates the exact contents of each packet
d) Interweave requests from multiple dialogs, whereas a standardized dialog dictates the exact ordering of messages, which are not interrupted with other messages

This flexibility can be a powerful tool allowing a management station to optimize the use of communication facilities, which is the primary reason that SNMP was chosen as the core NTCIP protocol. However, the flexibility also means that there are numerous allowable variations in the management process that a management station may choose to use and that an agent shall support to conform to NTCIP 1204.

Unfortunately, this flexibility presents a challenge to ensuring interoperability.

To overcome this complication, Section 4 defines a lowest common denominator approach to communications between a management station and a device. It defines the standardized dialog for each Data Exchange Requirement. Management stations may support other dialogs to fulfill these same requirements, as long as these dialogs are consistent with the rules defined in this document. Such a management station is termed a “consistent management station.” A consistent management station interoperates with any “conformant” device.

A “conformant management station” is required to offer a mode in which it only uses the standardized dialogs as defined in Section 4. With this limited definition, there is relatively little variability in what constitutes a conformant management station. Thus, fully testing a management station for conformance is a relatively straight forward process that can be done within the practical constraints faced by most procuring agencies. Thus, a conformant management station provides an agency with a much greater chance of achieving interoperability with off-the-shelf devices that have been tested against NTCIP 2104 v03, and the designation of such a system is intended to provide a guaranteed base level of interoperability.

The rules for the standardized dialogs follow:

a) The dialogs are defined by a sequence of GET or SET requests. These requests shall equate to the GET and SET operations defined by SNMPv3 (specifically in RFC 3416) and shall be transmitted as a single message.
b) The contents of each request are identified by an object name. Each object name consists of an object type and an instance identifier. Definitions of each object type are provided in Section 5 and NTCIP 1201 v03. The meaning of the instance identifier is provided by these same definitions coupled with standard SNMP rules (see RFC 1212).

c) Each message shall contain all of the objects as shown, unless otherwise indicated
d) A message shall not contain any other objects
e) The contents of each message sent by the management station may appear in any order
   Note: Ideally, the order of objects should match the order as shown in this document to provide the highest probability of interoperability. However, it is recognized that many implementations may use off-the-shelf software, which may prevent the designation of an exact ordering of objects and as a result, this ordering is not a requirement of this document.
f) After sending a message, the management station shall not transmit any other data across the communications channel until the earlier of:
   1) The management station receiving a response from the device; or
   2) The expiration of the maximum response time.
g) If the response indicates an error occurred in the operation, the management station shall exit the process, unless specific error-handling rules are specified by the dialog.
h) Dialogs containing a sequence of only GET requests may request objects in any order.

However, since consistent management stations can alter the order of requests, this standard defines rules for when certain data exchanges are allowed. Unless otherwise indicated, a conformant device shall allow an object to be retrieved (through a GET request) or altered (through a SET request, if the object is writable) at any time. However, the access to some data is associated with a state machine, and Section 4.3 defines the various rules that apply to these state machines.

Finally, Section 4.4 presents an overview of all of the data defined by this standard, prior to presenting the complete definition for each piece of data in Section 5.

4.1 Tutorial [Informative]

The Requirements Traceability Matrix (RTM) in Annex A identifies the standardized dialog that can be used to achieve each of the data exchange requirements defined in Section 3.5. Simple data exchange requirements reference one of the generic SNMP dialogs along with a list of data elements. These equate to a single message being sent (e.g., a GET request) containing the referenced data elements followed by the appropriate response per the generic dialog specification.

Section 4 defines the standardized dialogs for the more complicated data exchange requirements. Each of these dialogs is defined by a number of steps. Many of the steps reference data elements that are defined in Section 5. These data elements are also shown in the corresponding row of the RTM along with their precise section number.

The dialogs may also be accompanied by an informative figure that provides a graphical depiction of the normative text. The figures conform to the Unified Modeling Language and depict the management station as an outside actor sending a series of messages to the device and the device returning responses. If there is any conflict between the figure and the text, the text takes precedence.

4.2 Specified Dialogs

4.2.1 Capture Snapshot Image

The standardized dialog for a management station to capture a snapshot image shall be:

a) The management station shall SET essSnapshotCameraCommand.x to the value of *captureSnapshot (2)*.
b) The ESS shall take the picture with camera x.
c) The ESS shall store the captured picture to the directory essSnapshotCameraStoragePath.x and to the file essSnapshotCameraFilename.x.
d) The management station shall repeatedly GET essSnapshotCameraCommand.x until it equals *ready (1)*.
e) The management station shall GET essSnapshotCameraError.x to verify the picture was successful.
f) The ESS shall respond with the indicated value.

This process is depicted in the UML diagram in Figure 7.

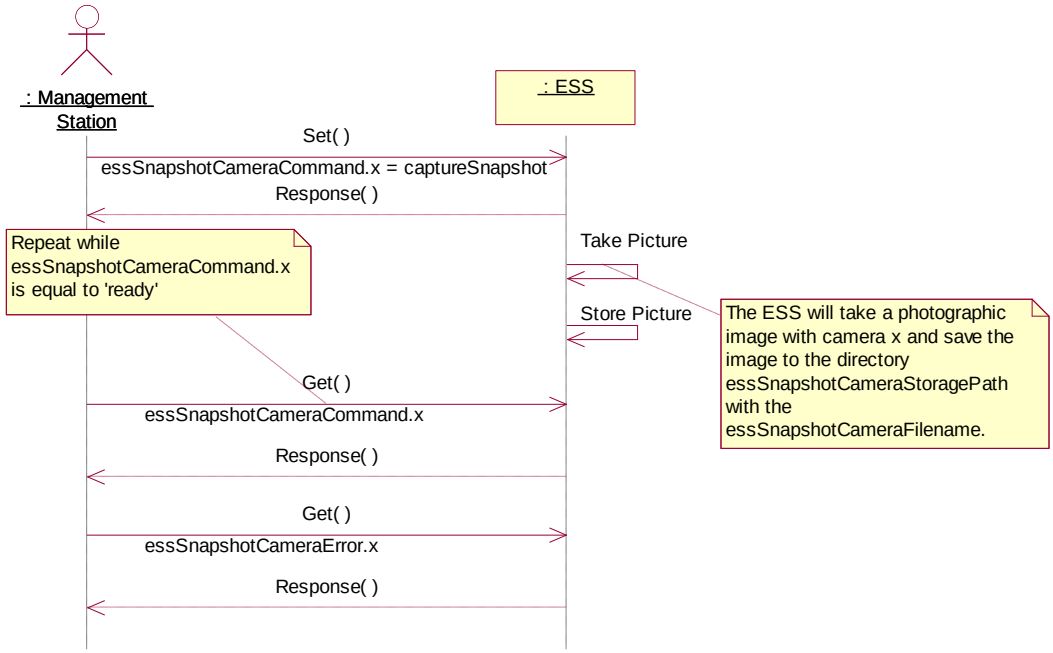

Figure 7 Dialog for Capture Snapshot Image

4.2.2 Retrieve Snapshot

The standardized dialog for a management station to retrieve a snapshot image shall conform to SFTP v3 as specified in https://datatracker.ietf.org/doc/html/draft-ietf-secsh-filexfer-02 over SSH as specified in RFC 4250-4256.

The device shall adhere to the following rules:

a) The login directory is the root directory and a user cannot traverse to any parent directories.
b) Subdirectories may be used.
c) Zero or one SFTP login session with the specification username shall exist at any given time.

Implementations of this document may also support the retrieval of files using HTTPS, as defined in RFC 9110.

NOTE—It is expected that future NTCIP documents will detail precise requirements for using SFTP and HTTPS.

4.2.3 Delete Snapshot

The standardized dialog for a management station to delete a snapshot image shall conform to SFTP v3 as specified in https://datatracker.ietf.org/doc/html/draft-ietf-secsh-filexfer-02 over SSH as specified in RFC 4250-4256. The device shall adhere to the additional rules defined in Section 4.2.2.

4.2.4 Retrieve Stationary Pavement Treatment Configuration

The standardized dialog for a management station to retrieve the pavement treatment configuration for a stationary ESS shall be as follows:

a) The management station shall GET numEssTreatments.0.
b) For each treatment from 1 to the number of treatments, the management station shall GET the following objects:
   1) essPaveTreatProductType.x
   2) essPaveTreatProductForm.x
   3) essPercentProductMix.x
c) The management station shall GET the following objects:
   1) ptsSignalDuration
   2) ptsMonitoringDetectors

Where,
x = the index of the treatment

4.2.5 Retrieve Icing Conditions—Passive

The standardized dialog for a management station to retrieve the current and predicted icing conditions from a passive sensor shall be as follows:

a) (Precondition) The management station is aware of the sensor from which data is desired.
b) The management station shall GET the following objects:
   1) essSurfaceTemperature.x
   2) essPavementTemperature.x
   3) essSurfaceSalinity.x
   4) essSurfaceFreezePoint.x
   5) essSurfaceBlackIceSignal.x
   6) essPavementSensorError.x
c) The management station shall GET the following objects:
   1) essSurfaceIceOrWaterDepth.x
   2) essSurfaceConductivityV2.x
   3) pavementSensorTemperatureDepth.x
   Note: These are NTCIP 1204 v02 objects that may result in a noSuchName error.
d) The management station shall GET numEssTreatments.0.
e) For each treatment from 1 to the number of treatments, the management station shall GET the following objects:
   1) essPaveTreatProductType.y
   2) essPaveTreatProductForm.y
   3) essPercentProductMix.y

Where,
x = the sensor index,
y = the index of the treatment

4.2.6 Configure Stationary Pavement Treatment System

The standardized dialog for a management station to configure a stationary pavement treatment system shall be as follows:

a) The management station shall GET numEssTreatments.0.
b) For each treatment from 1 to the number of treatments, the management station shall SET the following objects to the desired values:
   1) essPaveTreatProductType.x
   2) essPaveTreatProductForm.x
c) The management station shall SET every instance of essPercentProductMix.x to the desired values such that the total of all instances shall equal 100.
d) The management station shall SET the following objects to their desired values:
   1) ptsSignalDuration.0
   2) ptsMonitoringDetectors.0

Where,
x = the index of the treatment

4.2.7 Configure Passive Ice Detection Logic

The standardized dialog for a management station to configure the passive ice detection logic shall be as follows:

a) The management station shall GET numEssTreatments.0.
b) For each treatment from 1 to the number of treatments, the management station shall SET the following objects to the desired values:
   1) essPaveTreatProductType.x
   2) essPaveTreatProductForm.x
   3) essPercentProductMix.x

The management station shall set every instance of essPercentProductMix.x to the desired value such that the total of all instances shall equal 100.

Where,
x = the index of the treatment

4.2.8 Configure Mobile Pavement Treatment System

The standardized dialog for a management station to configure a mobile pavement treatment system shall be as follows:

a) The management station shall GET numEssTreatments.0.
b) For each treatment from 1 to the number of treatments, the management station shall SET the following objects to the desired values:
   1) essPaveTreatProductType.x
   2) essPaveTreatProductForm.x
c) The management station shall SET every instance of essPercentProductMix.x to the desired values such that the total of all instances shall equal 100.
d) The management station shall SET the following objects to their desired values:
   1) essPaveTreatmentAmount.0
   2) essPaveTreatmentWidth.0
   3) ptsSignalDuration.0

Where,
x = the index of the treatment

4.2.9 Retrieve Solar Radiation

The standardized dialog for a management station to retrieve solar radiation shall be as follows:

a) The management station shall GET radiationSensorTableNumSensors.0.
b) For each sensor from 1 to the number of solar radiation sensors, the management station shall GET the following objects:
   1) essTotalSunV4.x
   2) essInstantaneousTerrestrialRadiationV4.x.
   3) essInstantaneousSolarRadiationV4.x.
   4) essTotalRadiationV4.x.
c) The management station shall GET essTotalRadiationPeriod.0.

Where,
x = the index of the solar radiation sensor

4.2.10 Retrieve Mobile Pavement Treatment System

The standardized dialog for a management station to retrieve the configuration of a mobile pavement treatment system shall be as follows:

a) The management station shall GET numEssTreatments.0.
b) For each treatment from 1 to the number of treatments, the management station shall GET the following objects:
   1) essPaveTreatProductType.x
   2) essPaveTreatProductForm.x
   3) essPercentProductMix.x
c) The management station shall GET the following objects:
   1) essPaveTreatmentAmount.0
   2) essPaveTreatmentWidth.0
   3) ptsSignalDuration

Where,

x = the index of the treatment

4.3 State Transition Diagrams

The following define the states for various object classes that may be supported by the device.

4.3.1 Pavement Treatment System State Transition Diagram

Figure 8 depicts the state transition diagram for the Pavement Treatment System class.

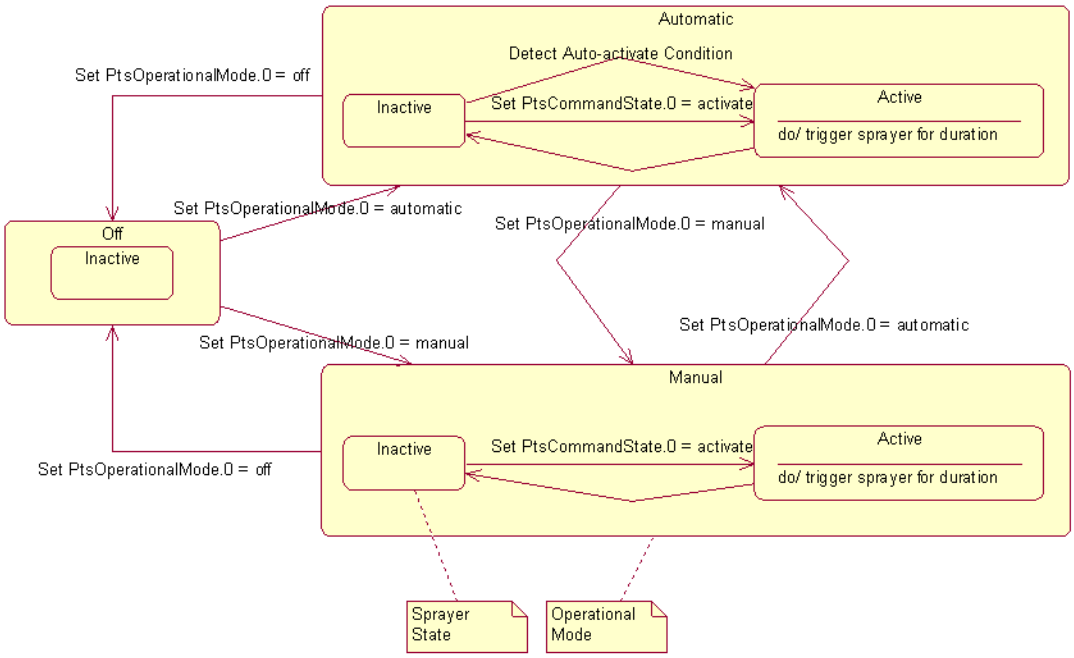

Figure 8 Pavement Treatment System State Machine Diagram

4.3.1.1 Off

When in the "off" state, the PTS shall not trigger the sprayer even if commanded to do so and shall always be inactive. The PTS shall transition to the requested operational mode, upon request.

4.3.1.2 Automatic

When in the "automatic" state, the PTS shall monitor conditions and trigger the sprayer based on a manufacturer specific algorithm. The algorithm shall only consider input from the detectors selected in the ptsMonitoringDetectors object. The PTS shall also trigger the sprayer if commanded to do so via the ptsCommandStateV3 object. The PTS shall transition to the requested operational mode, upon request.

4.3.1.3 Manual

When in the "manual" state, the PTS shall trigger the sprayer if commanded to do so via the ptsCommandStateV3 object. The PTS shall transition to the requested operational mode, upon request.

4.3.1.4 Inactive

When in the "inactive" state, the PTS shall not be spraying.

4.3.1.5 Active

Upon entering the "active" state, the PTS shall trigger the sprayer and spray the chemical for a duration as defined by the ptsSignalDuration object. Upon expiration of this duration, the PTS shall automatically transition back to the "inactive" state.

4.4 Class Diagrams

The relationships between data elements are described through the use of UML class diagrams. The class diagrams shown in this document are produced by PlantUML and only show current objects defined in this document. Figure 9 provides a sample class diagram.

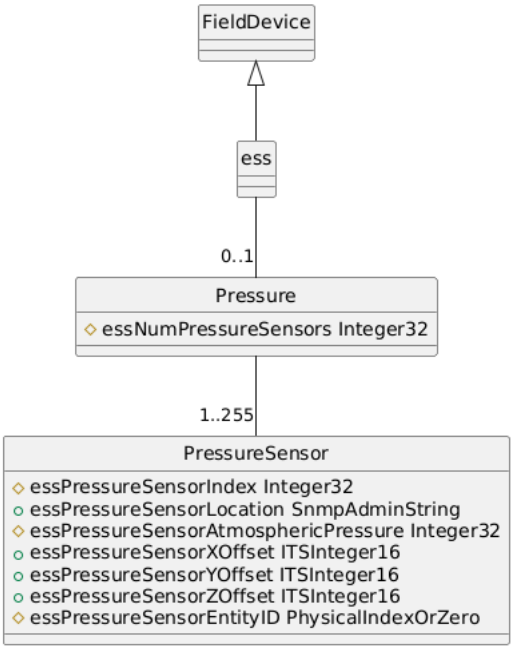

Figure 9 Sample Class Diagram for Temperature Sensors

Each box represents a logical class (grouping) of data. The box contains a name in the upper compartment and a list of any applicable attributes (i.e., individual pieces of information to describe the class) in the lower compartment along with its datatype. Lines between classes indicate that the classes have a relationship.

A number at the end of a relationship line indicates the number of instances of the class that may exist in relation to one instance of the other class. An asterisk (*) indicates an infinite number. A range of values may be indicated in the format of a number followed by two periods followed by another number.

A green circle next to an attribute indicates that it has a maximum access or read-write while a yellow diamond indicates a maximum access of read-only. A red square indicates that the attribute is not accessible.

An open arrow indicates that the class from which the arrow originates is a type of the class to which the arrow points (i.e., an ESS is a type of FieldDevice).

The complete definition of each attribute identified in the diagram is provided in Section 5.

4.4.1 ESS Characteristics

As depicted in the UML class diagram provided in Figure 10, an ESS is a type of FieldDevice, which is defined in ISO 26048-1 and can be characterized by its type of station. A MobilePlatform is a special type of ESS that is able to collect information while in motion. While MobilePlatforms are relatively new to the industry, this standard provides a basic level of support for obtaining data from such devices, in addition to any base sensor information that might be available.

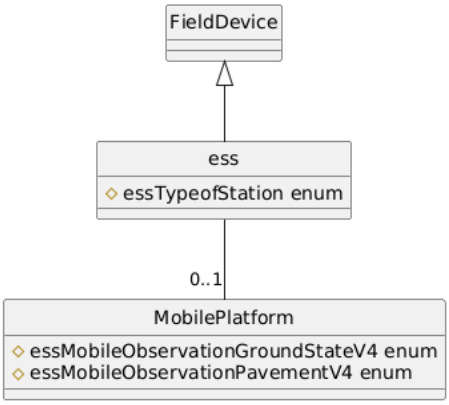

Figure 10 ESS Characteristics Class Diagram

4.4.2 Pressure Sensor

The ESS can support atmospheric pressure sensors as indicated in Figure 11.

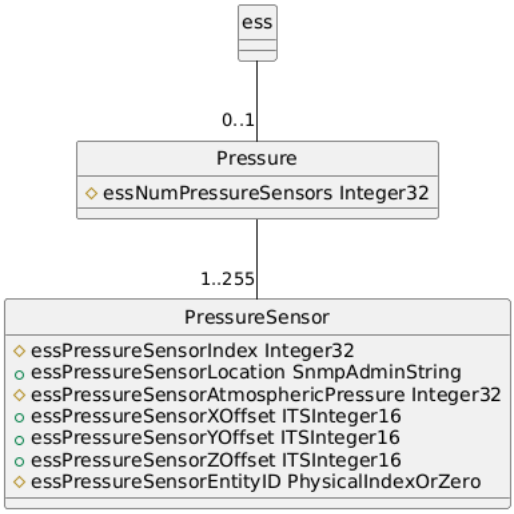

Figure 11 Pressure Sensor Class Diagram

4.4.3 Wind Data

The ESS can support wind sensors as indicated in Figure 12.

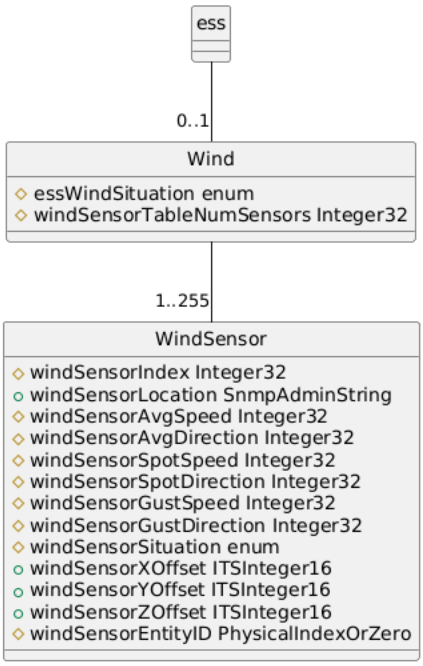

Figure 12 Wind Sensor Class Diagram

4.4.4 Temperature

The ESS can support temperature sensors as depicted in Figure 13.

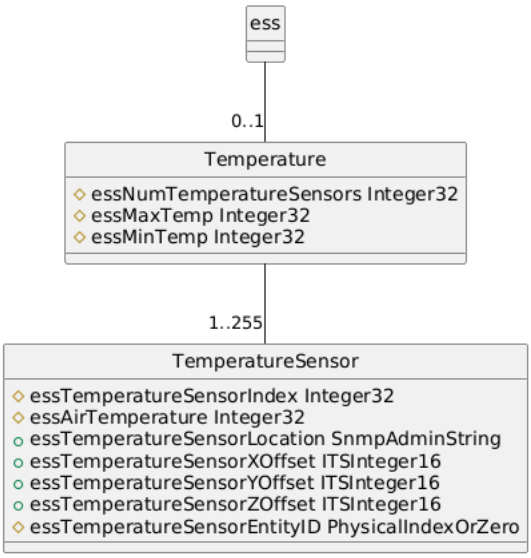

Figure 13 Temperature Sensor Class Diagram

4.4.5 Precipitation

ESS can support precipitation sensors as depicted in Figure 14.

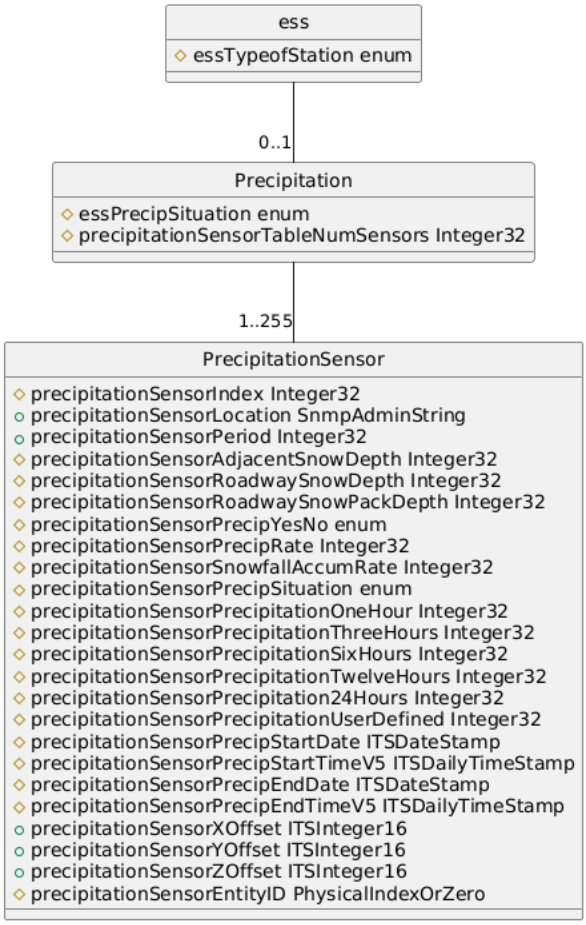

Figure 14 Precipitation Sensor Class Diagram

4.4.6 Water Level Class Diagram

The ESS can support water level sensors as depicted in Figure 16 .

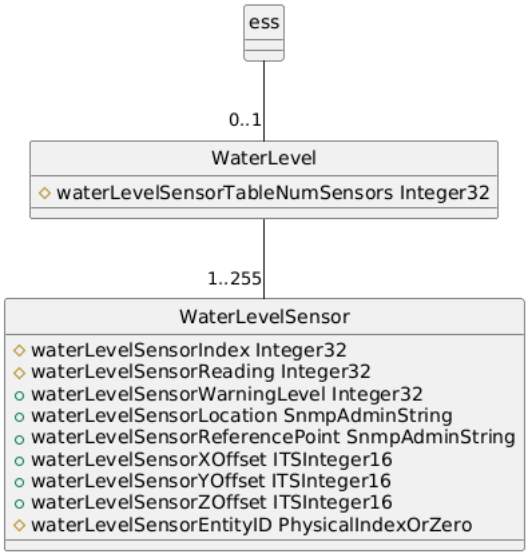

Figure 15 Water Level Sensor Class Diagram

4.4.7 Humidity Class Diagram

The ESS can support humidity sensors as depicted in Figure 16.

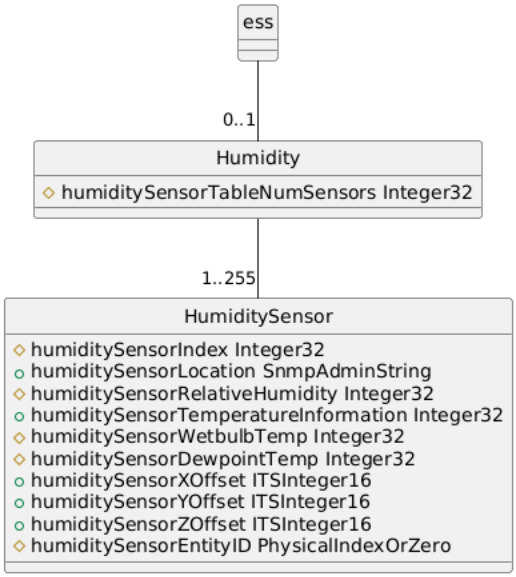

Figure 16 Humidity Sensor Class Diagram

4.4.8 Radiation

The ESS can support radiation sensors as depicted in Figure 17.

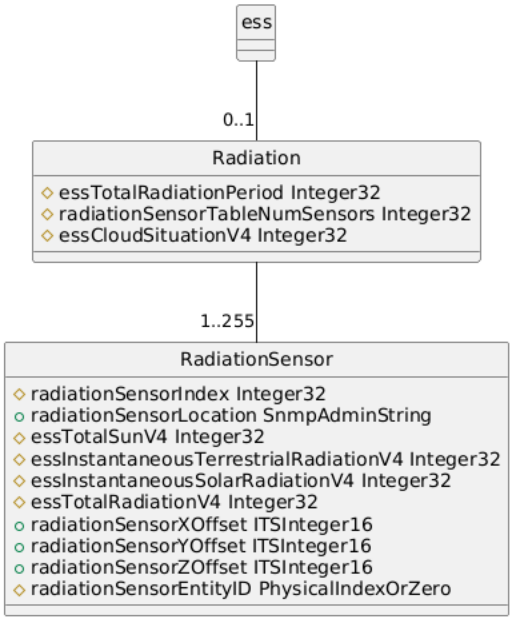

Figure 17 Radiation Sensor Class Diagram

4.4.9 Visibility

The ESS can support visibility sensors as depicted in Figure 18.

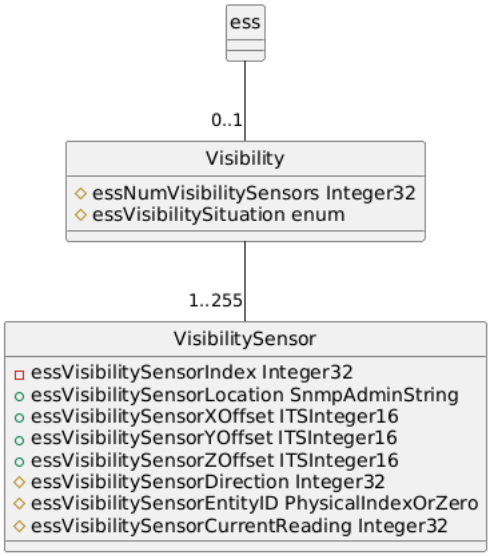

Figure 18 Visibility Sensor Class Diagram

4.4.10 Pavement Sensor Data

The ESS can support pavement sensors as depicted in Figure 19.

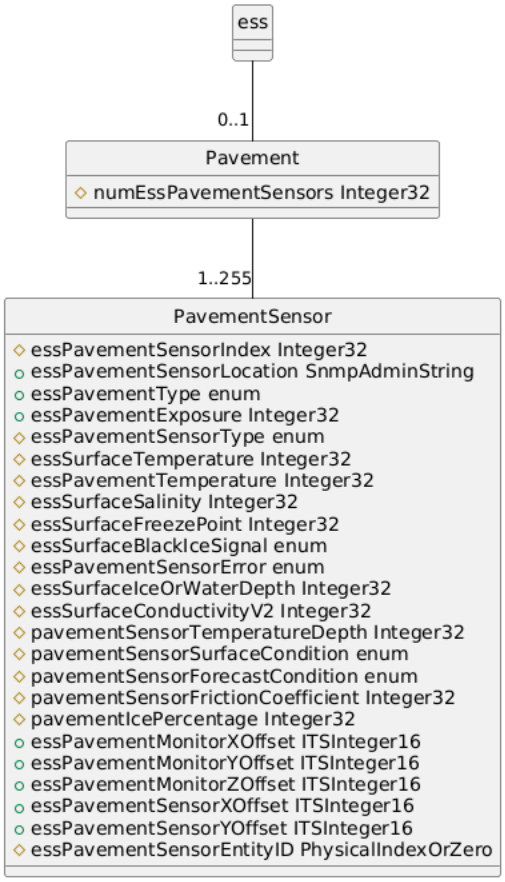

Figure 19 Pavement Sensor Class Diagram

4.4.11 Subsurface Data

The ESS can support subsurface sensors as depicted in Figure 20.

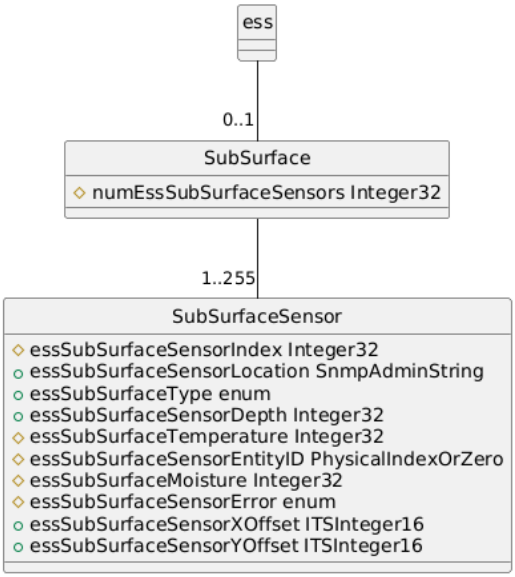

Figure 20 Subsurface Sensor Class Diagram

4.4.12 Air Quality Data

The ESS can support air quality sensors as depicted in Figure 21.

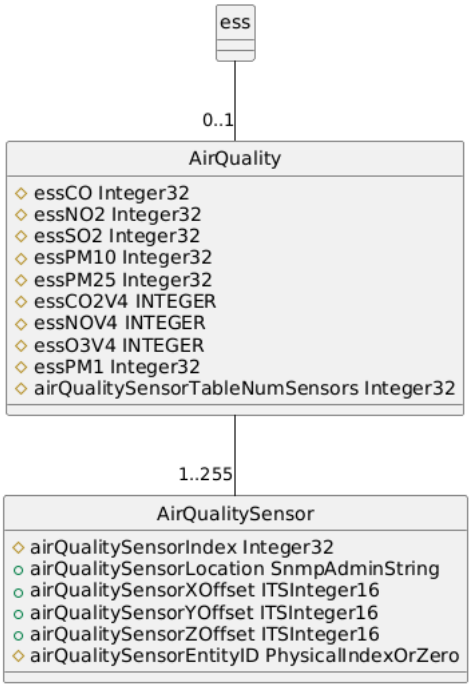

Figure 21 Air Quality Sensor Class Diagram

4.4.13 Snapshot Data

The ESS can support snapshot cameras and associated snapshots as depicted in Figure 22. The snapshots are accessed using SFTP or a similar protocol and are not accessible through SNMP.

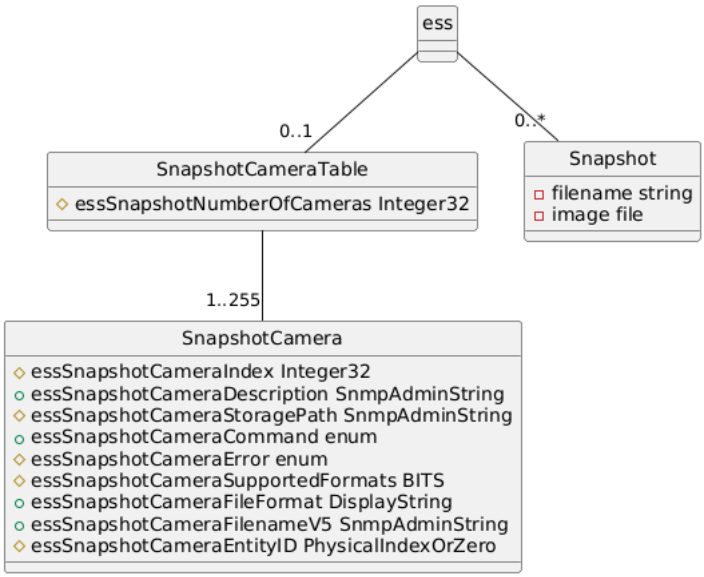

Figure 22 Snapshot Class Diagram

4.4.14 Pavement Treatment System

The ESS can support a pavement treatment system as depicted in Figure 23.

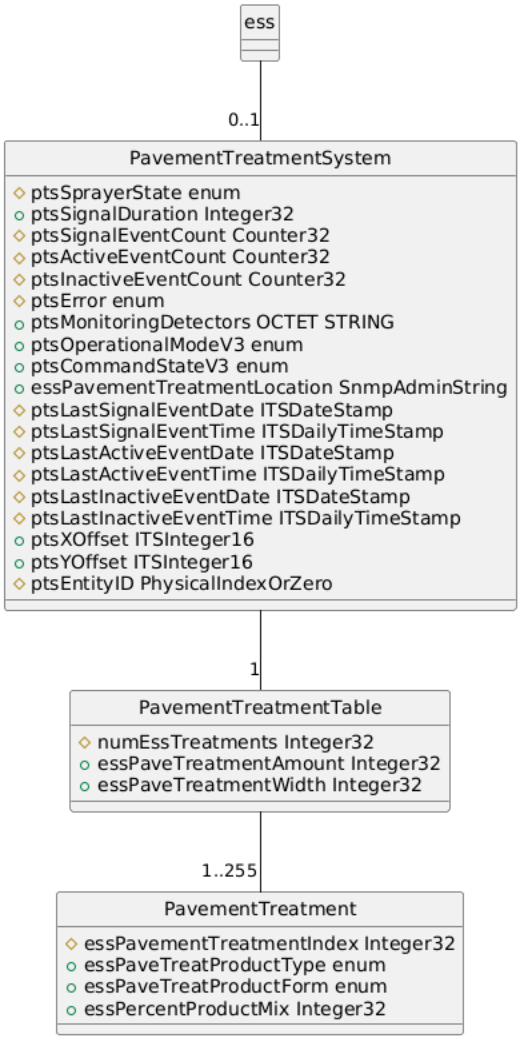

Figure 23 Pavement Treatment Class Diagram

Section 5
Management Information Base (MIB) [Normative]

This section defines those objects which are specific to ESS. The objects are defined using the OBJECT-TYPE macro as specified in NTCIP 8004, which is based on RFC 2578 and related standards. The text provided from Section 5.1 through the end of Section 5 (except the section headings) constitutes the NTCIP1204-Ess MIB.

This section generally presents the objects in lexicographical order of their OBJECT IDENTIFIERS, which correspond to their physical location within the global naming tree. Most of the objects defined in this document reside under the “ess” node of the global naming tree. To aid in object management, the “ess” node has been subdivided into logical categories, each defined by a node under the “ess” node. The individual objects are then located under the appropriate node.

Conformance requirements for any object is determined by the use of the Requirements Traceability Matrix (RTM) in Annex A. To support any defined Requirement, an implementation shall support all objects to which the Requirement traces in the RTM. An implementation shall support the full standardized range of each supported object, unless otherwise noted in the object refinement table in Annex A. An implementation shall indicate their level of conformance to this standard through the use of an AGENT-CAPABILITIES statement, as defined by RFC 2580, which indicates supported OBJECT-GROUPs and object ranges.

This MIB is managed by the NTCIP ESS Working Group and proprietary features should be defined through vendor-specific nodes in vendor-specific extensions to this MIB. All values not explicitly defined (e.g., enumerated values not listed, bits not defined, etc.) are reserved for future use by the ESS Working Group and shall not be used by implementations until defined by the ESS WG.

A computer readable format of this information, called a Management Information Base, is available from https://github.com/ite-org/NTCIP1203. The MIB has been verified using https://www.simpleweb.org/ietf/mibs/validate/.

Previous versions of this document defined data elements that have been replaced to resolve ambiguities; however, central systems may need to interoperate with older equipment and support such data elements. These replaced objects have a status of 'deprecated' or 'obsolete' and indicate the version in which they were deprecated; Annex D documents the reason that the ESS WG decided to deprecate various objects within the current version.

5.1 MIB Header

```
NTCIP1204-Ess DEFINITIONS ::= BEGIN
IMPORTS
MODULE-IDENTITY, OBJECT-IDENTITY, OBJECT-TYPE,
Integer32, Unsigned32, Counter32
                                                FROM SNMPv2-SMI
                                                  -- RFC 2578
DisplayString
                                                FROM SNMPv2-TC
                                                  -- RFC 2579
OBJECT-GROUP
                                                FROM SNMPv2-CONF
                                                  -- RFC 2580
SnmpAdminString
                                                FROM SNMP-FRAMEWORK-MIB
                                                  -- RFC 3411
PhysicalIndexOrZero
                                                FROM ENTITY-MIB
```



```
                                                    -- RFC 6933
ITSDailyTimeStamp, ITSDateStamp, ITSInteger16, ITSOerString
                                                   FROM ISO26048-1-FieldDevice-TC
devices
                                                   FROM NTCIP8004-Transportation;

ess MODULE-IDENTITY
  LAST-UPDATED  "202307260500Z"
  ORGANIZATION  "NTCIP ESSS WG"
  CONTACT-INFO
   "name: NTCIP Coordinator
    email: ntcip@nema.org
    postal: National Electrical Manufacturers Association
            1300 North 17th Street, Suite 1752
            Rosslyn, Virginia 22209-3801"
  DESCRIPTION
   "<Definition> This MIB defines the environmental sensor station (ESS)
      objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5"
  REVISION     "202307260500Z"
  DESCRIPTION
    "<Definition> NTCIP 1204 v05 - Upgraded to SMIv2 format and incorporated
      objects from the ISO 26048 series into design."
  REVISION     "202204010500Z"
  DESCRIPTION
    "<Definition> NTCIP 1204 v04 - Improved 1) support for multiple sensors
      of the same type, 2) support for infrared sensors that collect
      multiple parameters from the same sensor, and 3) support for metadata.
      Other edits as needed."
  REVISION     "200910300500Z"
  DESCRIPTION
    "<Definition> NTCIP 1204 v03 - Added test procedures to Annex C and
      other edits."
  REVISION     "200507230500Z"
  DESCRIPTION
    "<Definition> NTCIP 1204 v02 - Added systems engineering content,
      including Section 2(Concept of Operations), Section 3 (Requirements),
      Section 4 (Dialogs), and Annex A (Requirements Traceability Table)
      along with other refinements based on lessons learned."
  REVISION     "200111230500Z"
  DESCRIPTION
    "<Definition> NTCIP 1204 v01A1 - Corrected typos and other issues in the
      original document."
  REVISION     "199809280500Z"
  DESCRIPTION
    "<Definition> NTCIP 1204 v01 - Initial version of NTCIP 1204."
::= { devices 5 }

essBufr OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> This node contains objects that describe BUFR information
      based on the BUFR Standards.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1"
::= {ess 1}

essNtcip OBJECT-IDENTITY
```



```
  STATUS       current
  DESCRIPTION
    "<Definition> This node contains objects that describe surface
      transportation environmental information which deviates from the BUFR
      Standards.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2"
::= {ess 2}
```

5.2 Identification Objects

```
essNtcipIdentification OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> These are objects used to describe the identification of
      the environmental sensor station.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.1"
::= {essNtcip 1 }
```

5.2.1 Station Category

```
-- This object has been deprecated.
essNtcipCategory OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    permanent (2),
    transportable (3),
    mobile (4) }
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the category of station as it relates to
      mobility.
    <Format>
      value          description
      other          of a design not listed in this standard.
      permanent      not designed to be relocated.
      transportable  able to be relocated, but does not take readings while
                     moving.
      mobile         capable of taking readings while moving.
    <Parameter Type> status
    <Superseded by> ISO26048-1-FieldDevice:fdMobility (ISO 26048-1)
    <Informative> This object was deprecated in NTCIP 1204 v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.1.1"
::= { essNtcipIdentification 1 }
```

5.2.2 Site Description

```
-- This object has been deprecated.
essNtcipSiteDescription OBJECT-TYPE
  SYNTAX       DisplayString (SIZE (0..255))
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> A textual description of the station's location.
    <Parameter Type> configuration
    <Supplanted by> sysLocation (RFC 3418)
    <Informative> Version 02 of the standard incorrectly defined a
      SetConstraint of read-only, even though the object has always been
      defined with an access of read-write. This was corrected in version
```



```
      03. This object was deprecated in NTCIP 1204 v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.1.2"
::= { essNtcipIdentification 2 }
```

5.3 Data Instrumentation Objects

```
essBufrInstrumentation OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects used to describe the type of data and the type of
      instrumentation used to collect the data being received from the ess
      when the data has a BUFR equivalent.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.2"
::= { essBufr 2 }

essNtcipInstrumentation OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects used to describe the type of data and the type of
      instrumentation used to collect the data being received from the ESS
      when there is not a BUFR equivalent to the data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.15"
::= { essNtcip 15 }

-- It is also recognized that there would be a great value of an object to
-- indicate the quality of data; however, this is a very complex topic and
-- thus we have not determined an appropriate mechanism.
```

5.3.1 Type of Station

```
essTypeofStation OBJECT-TYPE
  SYNTAX       INTEGER {
    automatic (0),
    staffed (1),
    reserved (2),
    missingValue (3) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Integer value that indicates the type of station. If the
      station is a hybrid station, it should be represented with two SNMP
      contexts, one would report automatic and report all automatic readings
      while the other would report staffed and provide only the human
      readings.
    <Format>
      value               description
      0 - automatic      the data is collected electronically/mechanically
      1 - staffed        the data is collected by humans
      2 - reserved
      3 - missingValue   the type of station is unknown.
    <Parameter Type> status
    <Informative> The value of 2 has been explicitly defined as being
      reserved. To be defined as two stations (e.g., for a hybrid), a
      station needs to have two addresses and two instances of this MIB.
      The syntax was changed from INTEGER (0..3) to an enumeration in version
05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.2.1"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 02 001"
::= { essBufrInstrumentation 1 }
```


5.3.2 Door Status

```
-- This object has been deprecated.
essDoorStatus OBJECT-TYPE
  SYNTAX       Integer32 (0..1)
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates whether any of the doors attached to the station
      are open. If the value is one (1), at least one door is open; if the
      value is zero (0), all doors associated with the ESS are closed.
    <Parameter Type> status
    <Superseded by> fdSrsaTypeWarning.FDO
    <Informative> This object was deprecated in v05 to migrate to a more
      generic SRSA design that allow reporting the status of each door
      associated with the ESS.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.15.1"
::= { essNtcipInstrumentation 1 }
```

5.3.3 Battery Status

```
-- This object has been deprecated.
essBatteryStatus OBJECT-TYPE
  SYNTAX       Integer32 (0..101)
  UNITS        "percent"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the current charge stored in the battery.
    <Format>
      Values 0 to 100 indicate percent of full charge. The value 101
indicates
      an error in determining the percent of charge.
    <Parameter Type> status
    <Superseded by> fdSrsaPortValue.FBC
    <Informative> This object was deprecated in v05 to migrate to a more
      generic SRSA design.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.15.2"
::= { essNtcipInstrumentation 2 }
```

5.3.4 Line Volts

```
-- This object has been deprecated.
essLineVolts OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "*2 Volts Root Mean Squared (Vrms)"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the voltage measured on the incoming power line
      for the controller. The value reported indicates one-half of the
      actual voltage; thus, this object indicates a value of 55 when the
      voltage is 110 Vrms. This object shall only be used to indicate A/C
      power conditions. If the line power is DC, this object shall not apply
      (i.e., either is not supported or has a value of 255) and the
      essBatteryStatus object shall indicate the status of the batteries.
    <Format>
      Values 0 through 254 shall indicate valid values. The value 254 shall
      mean a voltage of 508 Vrms or greater. The value of 255 shall indicate
```



```
      an error condition or missing value.
    <Parameter Type> status
    <Superseded by> fdSrsaPortValue.FLV
    <Informative> This object was deprecated in v05 to migrate to a more
      generic SRSA design.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.15.3"
::= { essNtcipInstrumentation 3 }
```

5.3.5 Station Meta Data Block

```
-- This object has been deprecated.
essStationMetaDataBlock OBJECT-TYPE
  SYNTAX       ITSOerString
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> An OER encoded string of the EssStationMetaData structure
      as defined below.
      This object is used for uploading configuration data from the ESS in a
      bandwidth efficient manner.

      The OPTIONAL fields shall be present if the data is supported by the
      implementation and is valid. The OPTIONAL fields shall be omitted for
      any data that is invalid or not supported by the implementation.

      EssStationMetaData ::= SEQUENCE {
      essNtcipCategory.0       OPTIONAL,  -- @NTCIP1204-Ess
      essTypeOfStation.0       OPTIONAL,  -- @NTCIP1204-Ess
      essLatitude.0         OPTIONAL,  -- @NTCIP1204-Ess
      essLongitude.0         OPTIONAL,  -- @NTCIP1204-Ess
      essReferenceHeight.0       OPTIONAL,  -- @NTCIP1204-Ess
      essPressureHeight.0       OPTIONAL,  -- @NTCIP1204-Ess
      essWindSensorHeight.0       OPTIONAL,  -- @NTCIP1204-Ess
      temperatureMetaData  SEQUENCE OF TemperatureMetaData  OPTIONAL,
      pavementMetaData    SEQUENCE OF PavementMetaData    OPTIONAL,
      subSurfaceMetaData  SEQUENCE OF SubSurfaceMetaData  OPTIONAL,
      treatmentMetaData    SEQUENCE OF TreatmentMetaData    OPTIONAL
      }

      TemperatureMetaData ::= SEQUENCE {
      essTemperatureSensorIndex.x    OPTIONAL,  -- @NTCIP1204-Ess
      essTemperatureSensorHeight.x    OPTIONAL  -- @NTCIP1204-Ess
      }

      PavementMetaData ::= SEQUENCE {
      essPavementSensorIndex.x    OPTIONAL,  -- @NTCIP1204-Ess
      essPavementType.x        OPTIONAL,  -- @NTCIP1204-Ess
      essPavementElevation.x      OPTIONAL,  -- @NTCIP1204-Ess
      essPavementExposure.x      OPTIONAL,  -- @NTCIP1204-Ess
      essPavementSensorType.x      OPTIONAL  -- @NTCIP1204-Ess
      }

      SubSurfaceMetaData ::= SEQUENCE {
      essSubSurfaceSensorIndex.x    OPTIONAL,  -- @NTCIP1204-Ess
      essSubSurfaceType.x      OPTIONAL,  -- @NTCIP1204-Ess
      essSubSurfaceSensorDepth.x    OPTIONAL  -- @NTCIP1204-Ess
      }
```



```
      TreatmentMetaData ::= SEQUENCE {
      essPavementTreatmentIndex.x    OPTIONAL,  -- @NTCIP1204-Ess
      essPaveTreatProductType.x    OPTIONAL,  -- @NTCIP1204-Ess
      essPaveTreatProductForm.x    OPTIONAL,  -- @NTCIP1204-Ess
      essPercentProductMix.x      OPTIONAL  -- @NTCIP1204-Ess
      }
    <Parameter Type> status
    <Superseded by> essStationMetaDataV3Block (See 5.3.8)
    <Informative> This object was deprecated in version 03.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.15.4"
::= { essNtcipInstrumentation 4 }
```

5.3.6 Weather Block

```
-- This object has been deprecated.
essWeatherBlock OBJECT-TYPE
  SYNTAX       ITSOerString
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> An OER encoded string of the EssWeatherData structure as
      defined in Section 4.
      This object is used for uploading current weather data from the ESS in
      a bandwidth efficient manner.

      The OPTIONAL fields shall be present if the data is supported by the
      implementation and is valid. The OPTIONAL fields shall be omitted for
      any data that is invalid or not supported by the implementation.

      EssWeatherData ::= SEQUENCE {
      essAtmosphericPressure.0    OPTIONAL,  -- @NTCIP1204-Ess
      essWindData          EssWindData      OPTIONAL,
      essTemperatureData      EssTemperatureData  OPTIONAL,
      essPrecipData        EssPrecipData    OPTIONAL,
      essVisibilityData         EssVisibilityData    OPTIONAL
      }

      EssWindData ::= SEQUENCE {
      essAvgWindDirection.0      OPTIONAL,  -- @NTCIP1204-Ess
      essAvgWindSpeed.0        OPTIONAL,  -- @NTCIP1204-Ess
      essWindSituation.0      OPTIONAL,  -- @NTCIP1204-Ess
      essMaxWindGustSpeed.0      OPTIONAL,  -- @NTCIP1204-Ess
      essMaxWindGustDir.0      OPTIONAL,  -- @NTCIP1204-Ess
      essSpotWindDirection.0      OPTIONAL,  -- @NTCIP1204-Ess
      essSpotWindSpeed.0      OPTIONAL  -- @NTCIP1204-Ess
      }

      EssTemperatureData ::= SEQUENCE {
      essWetBulbTemp.0        OPTIONAL,  -- @NTCIP1204-Ess
      essDewpointTemp.0        OPTIONAL,  -- @NTCIP1204-Ess
      essMaxTemp.0        OPTIONAL,  -- @NTCIP1204-Ess
      essMinTemp.0        OPTIONAL,  -- @NTCIP1204-Ess
      essRelativeHumidity.0      OPTIONAL,  -- @NTCIP1204-Ess
        -- for (
      --   x = 1;
      --   x < essNumTemperatureSensors.0;
      --   x++)
      temperatureTable      SEQUENCE OF Temperature  OPTIONAL
```

```
      }

      Temperature ::= SEQUENCE {
      essTemperatureSensorIndex.x    OPTIONAL,  -- @NTCIP1204-Ess
      essAirTemperature.x      OPTIONAL  -- @NTCIP1204-Ess
      }

      EssPrecipData ::= SEQUENCE {
      essWaterDepth.0        OPTIONAL,  -- @NTCIP1204-Ess
      essAdjacentSnowDepth.0      OPTIONAL,  -- @NTCIP1204-Ess
      essRoadwaySnowDepth.0      OPTIONAL,  -- @NTCIP1204-Ess
      essRoadwaySnowPackDepth.0    OPTIONAL,  -- @NTCIP1204-Ess
      essPrecipYesNo.0        OPTIONAL,  -- @NTCIP1204-Ess
      essPrecipRate.0        OPTIONAL,  -- @NTCIP1204-Ess
      essSnowfallAccumRate.0      OPTIONAL,  -- @NTCIP1204-Ess
      essPrecipSituation.0      OPTIONAL,  -- @NTCIP1204-Ess
      essIceThickness.0        OPTIONAL,  -- @NTCIP1204-Ess
      essPrecipitationStartTime.0    OPTIONAL,  -- @NTCIP1204-Ess
      essPrecipitationEndTime.0    OPTIONAL  -- @NTCIP1204-Ess
      essPrecipitationOneHour.0    OPTIONAL,  -- @NTCIP1204-Ess
      essPrecipitationThreeHours.0    OPTIONAL,  -- @NTCIP1204-Ess
      essPrecipitationSixHours.0    OPTIONAL,  -- @NTCIP1204-Ess
      essPrecipitationTwelveHours.0    OPTIONAL,  -- @NTCIP1204-Ess
      essPrecipitation24Hours.0    OPTIONAL  -- @NTCIP1204-Ess
      }

      EssVisibilityData ::= SEQUENCE {
      essSolarRadiation.0      OPTIONAL,  -- @NTCIP1204-Ess
      essTotalSun.0        OPTIONAL,  -- @NTCIP1204-Ess
      essCloudSituation.0      OPTIONAL,  -- @NTCIP1204-Ess
      essVisibility.0        OPTIONAL,  -- @NTCIP1204-Ess
      essVisibilitySituation.0    OPTIONAL  -- @NTCIP1204-Ess
      }
    <Parameter Type> status
    <Superseded by> essWeatherV3Block (See 5.3.9)
    <Informative> This object was deprecated in NTCIP 1204 v03.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.15.5"
::= { essNtcipInstrumentation 5 }
```

5.3.7 Mobile Block

```
-- This object has been deprecated.
essMobileBlock OBJECT-TYPE
  SYNTAX       ITSOerString
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> An OER encoded string of the EssMobileData structure as
      defined below. This object is used for uploading current mobile station
      data from the ESS in a bandwidth efficient manner.

      The OPTIONAL fields shall be present if the data is supported by the
      implementation and is valid. The OPTIONAL fields shall be omitted for
      any data that is invalid or not supported by the implementation.

      EssMobileData ::= SEQUENCE {
        essLatitude.0         OPTIONAL, -- @NTCIP1204-Ess
        essLongitude.0         OPTIONAL, -- @NTCIP1204-Ess
```



```
        essReferenceHeight.0      OPTIONAL, -- @NTCIP1204-Ess
        essVehicleSpeed.0        OPTIONAL, -- @NTCIP1204-Ess
        essVehicleBearing.0      OPTIONAL, -- @NTCIP1204-Ess
        essVehicleOdometer.0      OPTIONAL, -- @NTCIP1204-Ess
        essMobileFriction.0      OPTIONAL, -- @NTCIP1204-Ess
        essMobileObservationGroundState.0  OPTIONAL, -- @NTCIP1204-Ess
        essMobileObservationPavement.0  OPTIONAL, -- @NTCIP1204-Ess
        essPaveTreatmentAmount.0    OPTIONAL, -- @NTCIP1204-Ess
        essPaveTreatmentWidth.0      OPTIONAL  -- @NTCIP1204-Ess
        }
    <Parameter Type> status
    <Informative> This object was deprecated and withdrawn in version 04 as
      the associated requirement was deemed to be no longer necessary.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.15.6"
::= { essNtcipInstrumentation 6 }
```

5.3.8 Station Meta Data Block Version 3

```
-- This object has been deprecated.
essStationMetaDataV3Block OBJECT-TYPE
  SYNTAX       ITSOerString
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> An OER encoded string of the EssStationMetaDataV3
      structure as defined below.
      This object is used for uploading configuration data from the ESS in a
      bandwidth efficient manner.

      The OPTIONAL fields shall be present if the data is supported by the
      implementation and is valid. The OPTIONAL fields shall be omitted for
      any data that is invalid or not supported by the implementation.

      EssStationMetaDataV3 ::= SEQUENCE {
      essNtcipCategory.0,       OPTIONAL,  -- @NTCIP1204-Ess
      essTypeOfStation.0,       OPTIONAL,  -- @NTCIP1204-Ess
      essLatitude.0,         OPTIONAL,  -- @NTCIP1204-Ess
      essLongitude.0,         OPTIONAL,  -- @NTCIP1204-Ess
      essReferenceHeight.0,       OPTIONAL,  -- @NTCIP1204-Ess
      essPressureHeight.0,       OPTIONAL,  -- @NTCIP1204-Ess
      precipitationSensorModelInformation.0  OPTIONAL -- @NTCIP1204-Ess
      windMetaData.0,     SEQUENCE OF WindMetaData    OPTIONAL,
      temperatureMetaData  SEQUENCE OF TemperatureMetaData  OPTIONAL,
      pavementMetaData    SEQUENCE OF PavementMetaData    OPTIONAL,
      subSurfaceMetaData  SEQUENCE OF SubSurfaceMetaData  OPTIONAL,
      treatmentMetaData    SEQUENCE OF TreatmentMetaData    OPTIONAL,
      }

      WindMetaData ::= SEQUENCE {
      windSensorIndex.x        OPTIONAL,  -- @NTCIP1204-Ess
      windSensorHeight.x      OPTIONAL,  -- @NTCIP1204-Ess
      }

      TemperatureMetaData ::= SEQUENCE {
      essTemperatureSensorIndex.x    OPTIONAL,  -- @NTCIP1204-Ess
      essTemperatureSensorHeight.x    OPTIONAL,  -- @NTCIP1204-Ess
      }
```



```
      PavementMetaData ::= SEQUENCE {
      essPavementSensorIndex.x,    OPTIONAL,  -- @NTCIP1204-Ess
      essPavementType.x,      OPTIONAL,  -- @NTCIP1204-Ess
      essPavementElevation.x      OPTIONAL,  -- @NTCIP1204-Ess
      essPavementExposure.x      OPTIONAL,  -- @NTCIP1204-Ess
      essPavementSensorType.x      OPTIONAL,  -- @NTCIP1204-Ess
      pavementSensorModelInformation.x  OPTIONAL,   -- @NTCIP1204-Ess
      pavementSensorTemperatureDepth.x  OPTIONAL  -- @NTCIP1204-Ess
      }

      SubSurfaceMetaData ::= SEQUENCE {
      essSubSurfaceSensorIndex.x    OPTIONAL,  -- @NTCIP1204-Ess
      essSubSurfaceType.x      OPTIONAL,  -- @NTCIP1204-Ess
      essSubSurfaceSensorDepth.x    OPTIONAL,  -- @NTCIP1204-Ess
      }

      TreatmentMetaData ::= SEQUENCE {
      essPavementTreatmentIndex.x    OPTIONAL,  -- @NTCIP1204-Ess
      essPaveTreatProductType.x    OPTIONAL,  -- @NTCIP1204-Ess
      essPaveTreatProductForm.x    OPTIONAL,  -- @NTCIP1204-Ess
      essPercentProductMix.x      OPTIONAL,  -- @NTCIP1204-Ess
      }
    <Parameter Type> status
    <Informative> This object was deprecated and withdrawn in NTCIP 1204 v04
      as the associated requirement was deemed to be no longer necessary.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.15.7"
::= { essNtcipInstrumentation 7 }
```

5.3.9 Weather Block Version 3

```
-- This object has been deprecated.
essWeatherV3Block OBJECT-TYPE
  SYNTAX       ITSOerString
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> An OER encoded string of the EssWeatherDataV3 structure as
      defined below. This object is used for uploading current weather data
      from the ESS in a bandwidth efficient manner.

      The OPTIONAL fields shall be present if the data is supported by the
      implementation and is valid. The OPTIONAL fields shall be omitted for
      any data that is invalid or not supported by the implementation.

      EssWeatherDataV3 ::= SEQUENCE {
      essAtmosphericPressure.0  OPTIONAL,  -- @NTCIP1204-Ess
      essWindData               SEQUENCE OF EssWindDataV3  OPTIONAL,
      essTemperatureData        EssTemperatureData         OPTIONAL,
      essPrecipData             EssPrecipDataV3            OPTIONAL,
      essVisibilityData         EssVisibilityDataV3        OPTIONAL,
      essRadiationData          EssRadiationData           OPTIONAL
      }

      EssWindDataV3 ::= SEQUENCE {
      windSensorIndex.x         OPTIONAL,  -- @NTCIP1204-Ess
      windSensorAvgSpeed.x      OPTIONAL,  -- @NTCIP1204-Ess
      windSensorAvgDirection.x  OPTIONAL,  -- @NTCIP1204-Ess
      windSensorSpotSpeed.x     OPTIONAL,  -- @NTCIP1204-Ess
```



```
  windSensorSpotDirection.x OPTIONAL,  -- @NTCIP1204-Ess
  windSensorGustSpeed.x     OPTIONAL,  -- @NTCIP1204-Ess
  windSensorGustDirection.x OPTIONAL,  -- @NTCIP1204-Ess
  windSensorSituation.x     OPTIONAL,  -- @NTCIP1204-Ess
  }

  EssTemperatureData ::= SEQUENCE {
  essWetBulbTemp.0          OPTIONAL,  -- @NTCIP1204-Ess
  essDewpointTemp.0         OPTIONAL,  -- @NTCIP1204-Ess
  essMaxTemp.0              OPTIONAL,  -- @NTCIP1204-Ess
  essMinTemp.0              OPTIONAL,  -- @NTCIP1204-Ess
  essRelativeHumidity.0     OPTIONAL,  -- @NTCIP1204-Ess
    -- for (
    --   x = 1;
    --   x < essNumTemperatureSensors.0;
    --   x++)
  temperatureTable          SEQUENCE OF Temperature  OPTIONAL,
  }

  Temperature ::= SEQUENCE {
  essTemperatureSensorIndex.x  OPTIONAL,  -- @NTCIP1204-Ess
  essAirTemperature.x          OPTIONAL,  -- @NTCIP1204-Ess
  }

  EssPrecipDataV3 ::= SEQUENCE {
  waterLevelSensorTable       SEQUENCE OF WaterLevel  OPTIONAL,
  essAdjacentSnowDepth.0      OPTIONAL,  -- @NTCIP1204-Ess
  essRoadwaySnowDepth.0       OPTIONAL,  -- @NTCIP1204-Ess
  essRoadwaySnowPackDepth.0   OPTIONAL,  -- @NTCIP1204-Ess
  essPrecipYesNo.0            OPTIONAL,  -- @NTCIP1204-Ess
  essPrecipRate.0             OPTIONAL,  -- @NTCIP1204-Ess
  essSnowfallAccumRate.0      OPTIONAL,  -- @NTCIP1204-Ess
  essPrecipSituation.0        OPTIONAL,  -- @NTCIP1204-Ess
  essIceThickness.0           OPTIONAL,  -- @NTCIP1204-Ess
  essPrecipitationStartTime.0 OPTIONAL,  -- @NTCIP1204-Ess
  essPrecipitationEndTime.0   OPTIONAL,  -- @NTCIP1204-Ess
  }

  WaterLevel ::= SEQUENCE {
  waterLevelSensorIndex.x      OPTIONAL,  -- @NTCIP1204-Ess
  waterLevelSensorReading.x    OPTIONAL,  -- @NTCIP1204-Ess
  }

  EssVisibilityDataV3 ::= SEQUENCE {
  essVisibility.0             OPTIONAL,  -- @NTCIP1204-Ess
  essVisibilitySituation.0    OPTIONAL,  -- @NTCIP1204-Ess
  }

  EssRadiationData ::= SEQUENCE {
  essTotalSun.0                            OPTIONAL,  -- @NTCIP1204-Ess
  essInstantaneousTerrestrialRadiation.0   OPTIONAL,  -- @NTCIP1204-Ess
  essInstantaneousSolarRadiation.0         OPTIONAL,  -- @NTCIP1204-Ess
  essTotalRadiation.0                      OPTIONAL,  -- @NTCIP1204-Ess
  essTotalRadiationPeriod.0                OPTIONAL,  -- @NTCIP1204-Ess
  essCloudSituation.0                      OPTIONAL,  -- @NTCIP1204-Ess
  }
<Parameter Type> status
```



```
    <Informative> This object was deprecated and withdrawn in NTCIP 1204 v04
      as the associated requirement was deemed to be no longer necessary.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.15.8"
::= { essNtcipInstrumentation 8 }
```

5.3.10 ESS Status

```
-- This object has been deprecated.
essStatus OBJECT-TYPE
  SYNTAX       Integer32 (0..3)
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Integer value that indicates whether an error condition
      has been detected in the ESS hardware or software.
    <Format>
      value                description
      0 - noError         no error is reported
      1 - watchdogFailure     the watchdog has failed
      2 - powerError  irregular occurrence detected with primary power source
      3 - sensorFailure  condition detected preventing proper reporting or a
          sensor value is deemed invalid or suspect
    <Parameter Type> status
    <Superseded by> fdControllerStatus (ISO 26048-1)
    <Informative> The object was deprecated in NTCIP 1204 v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.15.9"
::= { essNtcipInstrumentation 9 }
```

5.4 Location Objects

```
essNtcipLocation OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Contains objects used to describe the location of the ESS
      that is
      transmitting the collected data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.2"
::= {essNtcip 2 }
```

5.4.1 Latitude

```
-- This object has been deprecated.
essLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees of latitude"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the ESS station, per
      WGS-84 datum.
    <Format>
      The essLatitude at the North Pole is 90,000,000. The essLatitude at the
      South Pole is -90,000,000. The value 90,000,001 shall indicate a
      missing value.
    <Parameter Type> status
    <Superseded by> ISO26048-1-FieldDevice:fdConfiguredLatitude
    <Informative> This object was deprecated in NTCIP 1204 v05 to use the
      more generic object and to be consistent with preferred units used in
      ITS (i.e., 10^-7 degrees).
```



```
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.2.1"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { essNtcipLocation 1 }
```

5.4.2 Longitude

```
-- This object has been deprecated.
essLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees of longitude"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS location.
    <Format>
      The essLongitude of 180 degrees West shall be -180,000,000. The
      essLongitude of 180 degrees East shall be 180,000,000. The value
      180,000,001 shall indicate a missing value.
    <Parameter Type> status
    <Superseded by> ISO26048-1-FieldDevice:fdConfiguredLongitude
    <Informative> This object was deprecated in NTCIP 1204 v05 to use the
      more generic object and to be consistent with preferred units used in
      ITS (i.e., 10^-7 degrees).
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.2.2"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { essNtcipLocation 2 }
```

5.4.3 Vehicle Speed

```
-- This object has been deprecated.
essVehicleSpeed OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "kilometers per hour"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the current speed being reported by the vehicle
      in kilometers per hour.
    <Format>
      The value 255 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> ISO26048-1-FieldDevice:fdSpeed
    <Informative> This object was deprecated in NTCIP 1204 v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.2.3"
::= { essNtcipLocation 3 }
```

5.4.4 Vehicle Bearing

```
-- This object has been deprecated.
essVehicleBearing OBJECT-TYPE
  SYNTAX       Integer32 (0..361)
  UNITS        "compass degrees"
  MAX-ACCESS   read-only
  STATUS       deprecated
```

```
  DESCRIPTION
    "<Definition> Indicates the current bearing of the vehicle in degrees,
      measured clockwise from True North.
    <Format>
      The value 0 shall indicate that the vehicle is stopped. The value 361
      shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> ISO26048-1-FieldDevice:fdBearing
    <Informative> This object was deprecated in NTCIP 1204 v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.2.4"
::= { essNtcipLocation 4 }
```

5.4.5 Odometer

```
-- This object has been deprecated.
essOdometer OBJECT-TYPE
  SYNTAX       Unsigned32
  UNITS        "meters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the distance traveled, in meters, by the vehicle
      from a reference point. Could be a vehicle odometer reading or a
      calculation from the vehicle's GPS.
    <Parameter Type> status
    <Superseded by> ISO26048-1-FieldDevice:fdOdometer
    <Informative> This object was deprecated in NTCIP 1204 v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.2.5"
::= { essNtcipLocation 5 }
```

5.5 Station Elevation Objects

```
essNtcipHeight OBJECT-IDENTITY
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Objects used to describe the elevation at the ESS that is
      transmitting
      the collected data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.3"
::= {essNtcip 3 }

essBufrLocationVertical OBJECT-IDENTITY
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Objects used to describe the atmospheric pressure at the
      ESS.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.7"
::= {essBufr 7 }

essNtcipPressure OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects used to describe the atmospheric pressure reported
      by each ESS pressure sensor.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16"
::= {essNtcip 16 }
```


5.5.1 Reference Height

```
-- This object has been deprecated.
essReferenceHeight OBJECT-TYPE
  SYNTAX       Integer32 (-400..8001)
  UNITS        "meters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The reference elevation of the ESS in meters above mean
      sea level. For a permanent station, this height shall be measured to
      the base of the structure; for transportable stations, this height
      shall be measured to the ground surface upon which the station
      resides; and for mobile, this height shall be measured to the surface
      under the vehicle.
    <Format>
      The value of 8001 shall indicate a missing value.
    <Parameter Type> status
    <Superseded by> ISO26048-1-FieldDevice:fdConfiguredElevation
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.3.1"
  REFERENCE "Resolution based on WMO Binary Code Form FM 94 BUFR Table B
      item 0 07 001."
::= { essNtcipHeight 1 }
```

5.5.2 Pressure Height

```
-- This object has been deprecated.
essPressureHeight OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The height of the pressure sensor with respect to the
      essReferenceHeight in meters.
    <Format>
      The value of 1001 shall indicate a missing value.
    <Parameter Type> status
    <Superseded by> essPressureSensorHeight.1 (See 5.5.7.2)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.3.2"
  REFERENCE "essReferenceHeight plus this value equals the WMO Binary Code
      Form FM 94 BUFR Table B item 0 07 001."
::= { essNtcipHeight 2 }
```

5.5.3 Wind Sensor Height

```
-- This object has been deprecated.
essWindSensorHeight OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The height of the primary wind sensor with respect to the
      essReferenceHeight in meters.
    <Format>
      The value of 1001 shall indicate a missing value.
```

```
    <Parameter Type> status
    <Superseded by> windSensorHeight.1 (See 5.6.10.2)
    <Informative> This object was deprecated in version 02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.3.3"
::= { essNtcipHeight 3 }
```

5.5.4 Atmospheric Pressure

```
-- This object has been deprecated.
essAtmosphericPressure OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "decapascal"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The force per unit area exerted by the atmosphere in
      1/10ths of millibars, a.k.a. tenths of hectoPascals.
    <Format>
      A value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> essPressureSensorAtmosphericPressure.1 (See 5.5.7.7)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.7.4"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 07 004."
::= { essBufrLocationVertical 4 }
```

5.5.5 Number of Pressure Sensors

```
essNumPressureSensors OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "sensors"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the pressure sensor
      table.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a sensor; however, the table is still defined as a
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.1"
::= { essNtcipPressure 1 }
```

5.5.6 Pressure Sensor Table

```
essPressureSensorTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF EssPressureSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Table containing the pressure sensor data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2"
::= { essNtcipPressure 2 }
```

5.5.7 Pressure Sensor

```
essPressureSensorEntry OBJECT-TYPE
  SYNTAX       EssPressureSensorEntry
  MAX-ACCESS   not-accessible
```



```
  STATUS       current
  DESCRIPTION
    "<Definition> A pressure sensor is a sensor that reports the atmospheric
      pressure. It can be described through a number of attributes as
      indicated by the following subclauses."
  INDEX { essPressureSensorIndex }
::= { essPressureSensorTable 1 }

EssPressureSensorEntry ::= SEQUENCE {
  essPressureSensorIndex                Integer32,
  essPressureSensorHeight               Integer32,
  essPressureSensorLatitude             Integer32,
  essPressureSensorLongitude            Integer32,
  essPressureSensorLocation             SnmpAdminString,
  essPressureSensorModelInformation     Integer32,
  -- SENSOR READINGS
  essPressureSensorAtmosphericPressure  Integer32,
  essPressureSensorXOffset              ITSInteger16,
  essPressureSensorYOffset              ITSInteger16,
  essPressureSensorZOffset              ITSInteger16,
  essPressureSensorEntityID             PhysicalIndexOrZero}
```

5.5.7.1 Pressure Sensor Index

```
essPressureSensorIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide atmospheric
      pressure sensor data.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.1"
::= { essPressureSensorEntry 1 }
```

5.5.7.2 Pressure Sensor Height

```
-- This object has been deprecated.
essPressureSensorHeight OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The height of the pressure sensor with respect to the
      essReferenceHeight in meters.
    <Format>
      The value of 1001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essPressureSensorZOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.2"
  REFERENCE "essReferenceHeight plus this value equals the WMO Binary Code
      Form FM 94 BUFR Table B item 0 07 001."
::= { essPressureSensorEntry 2 }
```

5.5.7.3 Pressure Sensor Latitude

```
-- This object has been deprecated.
```



```
essPressureSensorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees of latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the ESS pressure sensor,
      per WGS-84 datum.
    <Format>
      The essPressureLatitude at the North Pole is 90,000,000. The
      essPressureLatitude at the South Pole is -90,000,000. The value
      90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essPressureSensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.3"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { essPressureSensorEntry 3 }
```

5.5.7.4 Pressure Sensor Longitude

```
-- This object has been deprecated.
essPressureSensorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees of longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS pressure sensor location.
    <Format>
      The essPressureLongitude of 180 degrees West shall be -180,000,000. The
      essPressureLongitude of 180 degrees East shall be 180,000,000. The
      value 180,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essPressureSensorXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.4"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { essPressureSensorEntry 4 }
```

5.5.7.5 Pressure Sensor Location

```
essPressureSensorLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the pressure
      sensor.
    <Parameter Type> configuration
    <Informative> Implementations are only required to support the NVT-ASCII
      character set but may support additional UTF-8 characters.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.5"
::= { essPressureSensorEntry 5 }
```


5.5.7.6 Pressure Sensor Model Information

```
-- This object has been deprecated.
essPressureSensorModelInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the row in the Module Table (See NTCIP 1201)
      that contains information about the make, model, and version number of
      the sensor associated with this row of the Pressure Sensor Table.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Supplanted by> essPressureSensorEntityID
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.6"
::= { essPressureSensorEntry 6 }
```

5.5.7.7 Pressure Sensor Atmospheric Pressure

```
essPressureSensorAtmosphericPressure OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "decapascal"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The force per unit area exerted by the atmosphere in
      1/10ths of millibars, a.k.a. tenths of hectoPascals.
    <Format>
      A value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.7"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 07 004."
::= { essPressureSensorEntry 7 }
```

5.5.7.8 Pressure Sensor X Offset

```
essPressureSensorXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The X offset of the pressure sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.8"
::= { essPressureSensorEntry 8 }
```

5.5.7.9 Pressure Sensor Y Offset

```
essPressureSensorYOffset OBJECT-TYPE
```

```
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the pressure sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.9"
::= { essPressureSensorEntry 9 }
```

5.5.7.10 Pressure Sensor Z Offset

```
essPressureSensorZOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset elevation of the pressure sensor from the
      fdConfiguredElevation in centimeters.
    <Format>
      Upward offsets shall be positive and downward offsets shall be
negative.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.10"
::= { essPressureSensorEntry 10 }
```

5.5.7.11 Pressure Sensor Entity ID

```
essPressureSensorEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.11"
::= { essPressureSensorEntry 11 }
```

5.6 Wind Data Section

```
essBufrWind OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
```



```
    "<Definition> Objects used to describe the wind data that is collected
      at the ESS in a
      format that is consistent with BUFR.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.11"
::= {essBufr 11 }

essNtcipWind OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition>  Objects used to describe the wind data that is collected
      at the ESS in a
      format that is not defined by BUFR.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4"
::= {essNtcip 4 }
```

5.6.1 Average Wind Direction

```
-- This object has been deprecated.
essAvgWindDirection OBJECT-TYPE
  SYNTAX       Integer32 (0..361)
  UNITS        "compass degrees"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> A two-minute average of the direction from which the wind
      is blowing measured clockwise in degrees from true North and measured
      at a height as indicated by essWindSensorHeight. A value of 361 shall
      indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> windSensorAvgDirection.1 (See 5.6.10.5)
    <Informative> This object was deprecated in version 02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.11.1"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 11 001."
::= { essBufrWind 1 }
```

5.6.2 Average Wind Speed

```
-- This object has been deprecated.
essAvgWindSpeed OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of meters per second"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> A two-minute average of the wind speed in tenths of meters
      per second as measured by the primary wind sensor.
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> windSensorAvgSpeed.1 (See 5.6.10.4)
    <Informative> This object was deprecated in version 02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.11.2"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 11 002."
::= { essBufrWind 2 }
```

5.6.3 Spot Wind Direction

```
-- This object has been deprecated.
essSpotWindDirection OBJECT-TYPE
```



```
  SYNTAX       Integer32 (0..361)
  UNITS        "compass degrees"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The direction from which the wind is blowing measured in
      degrees clockwise from true North and measured at a height as
      indicated by essWindSensorHeight. A value of 361 shall indicate an
      error condition or missing value. For mobile platforms, the wind
      direction shall be corrected for vehicle movement.
    <Parameter Type> status
    <Superseded by> windSensorSpotDirection.1 (See 5.6.10.7)
    <Informative> This object was deprecated in version 02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.1"
::= { essNtcipWind 1 }
```

5.6.4 Spot Wind Speed

```
-- This object has been deprecated.
essSpotWindSpeed OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of meters per second"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The wind speed in tenths of meters per second measured by
      the primary wind sensor. For mobile platforms, the wind speed shall be
      corrected for vehicle movement.
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> windSensorSpotSpeed.1 (See 5.6.10.6)
    <Informative> This object was deprecated in version 02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.1"
::= { essNtcipWind 2 }
```

5.6.5 Wind Situation

```
essWindSituation OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    unknown (2),
    calm (3),
    lightBreeze (4),
    moderateBreeze (5),
    strongBreeze (6),
    gale (7),
    moderateGale (8),
    strongGale (9),
    stormWinds (10),
    hurricaneForceWinds (11),
    gustyWinds (12) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Describes the weather and travel situation in terms of
      wind from staffed stations only. Specific ranges for these values are
      defined in the Glossary of Meteorology.
    <Format>
```



```
      Range               Meaning
      other               not defined within this standard, see manufacturers
                          documentation
      unknown             Unknown conditions
      calm                Calm
      lightBreeze         Light breeze
      moderateBreeze      Moderate breeze
      strongBreeze        Strong breeze
      gale                Gale
      moderateGale        Moderate gale
      strongGale          Strong gale
      stormWinds          Storm winds
      hurricaneForceWinds Hurricane force winds
      gustyWinds          defined by a peak and a lull of greater than 46.3
                          tenths of meters per second within a 2 minute
period.
    <Parameter Type> status
    <Superseded by> windSensorSituation.1 (See 5.6.10.10)
    <Informative> This object was deprecated in version 02 and migrated to
      the wind sensor table. It was reinstated in v05 specifically for
      staffed stations.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.3"
::= { essNtcipWind 3 }
```

5.6.6 Wind Gust Speed

```
-- This object has been deprecated.
essMaxWindGustSpeed OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of meters per second"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The maximum wind gust recorded by the primary wind sensor
      during the 10 minutes preceding the observation measured in tenths of
      meters per second.
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> windSensorGustSpeed.1 (See 5.6.10.8)
    <Informative> This object was deprecated in version 02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.11.41"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 11 041."
::= { essBufrWind 41 }
```

5.6.7 Wind Gust Direction

```
-- This object has been deprecated.
essMaxWindGustDir OBJECT-TYPE
  SYNTAX       Integer32 (0..361)
  UNITS        "compass degrees"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The direction of the maximum wind gust recorded during the
      10 minutes preceding the observation at a height as indicated by
      essWindSensorHeight; measured in degrees clockwise from true North.
      The value 361 shall indicate an error condition or missing value.
    <Parameter Type> status
```

```
    <Superseded by> windSensorGustDirection.1 (See 5.6.10.9)
    <Informative> This object was deprecated in version 02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.11.43"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 11 043."
::= { essBufrWind 43 }
```

5.6.8 Number of Wind Sensors

```
windSensorTableNumSensors OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "sensors"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the wind sensor table.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a sensor; however, the table is still defined as a
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.7"
::= { essNtcipWind 7 }
```

5.6.9 Wind Sensor Table

```
windSensorTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF WindSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Table containing the wind sensor data fields.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8"
::= { essNtcipWind 8 }
```

5.6.10 Wind Sensor

```
windSensorEntry OBJECT-TYPE
  SYNTAX       WindSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Parameters for specific wind sensor data fields."
  INDEX { windSensorIndex }
::= { windSensorTable 1 }

WindSensorEntry ::= SEQUENCE {
  windSensorIndex             Integer32,
  windSensorHeight            Integer32,
  windSensorLocation          SnmpAdminString,
  windSensorAvgSpeed          Integer32,
  windSensorAvgDirection      Integer32,
  windSensorSpotSpeed         Integer32,
  windSensorSpotDirection     Integer32,
  windSensorGustSpeed         Integer32,
  windSensorGustDirection     Integer32,
  windSensorSituation         INTEGER,
  windSensorLatitude          Integer32,
  windSensorLongitude         Integer32,
  windSensorModelInformation  Integer32,
```



```
  windSensorXOffset           ITSInteger16,
  windSensorYOffset           ITSInteger16,
  windSensorZOffset           ITSInteger16,
  windSensorEntityID          PhysicalIndexOrZero
}
```

5.6.10.1 Wind Sensor Index

```
windSensorIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide wind sensor
      data. The first entry shall be that of the primary wind sensor.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.1"
::= { windSensorEntry 1 }
```

5.6.10.2 Wind Sensor Height

```
-- This object has been deprecated.
windSensorHeight OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The height of the wind sensor with respect to the
      essReferenceHeight in meters.
    <Format>
      The value of 1001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> windSensorZOffset
    <Informative> Changed to read-write from read-only in version 04. This
      object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.2"
::= { windSensorEntry 2 }
```

5.6.10.3 Wind Sensor Location

```
windSensorLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the wind
      sensor.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.3"
::= { windSensorEntry 3 }
```

5.6.10.4 Wind Sensor Average Speed

```
windSensorAvgSpeed OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of meters per second"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
```

```
    "<Definition> A two-minute average of the wind speed in tenths of meters
      per second as measured by the wind sensor.
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.4"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 11 002."
::= { windSensorEntry 4 }
```

5.6.10.5 Wind Sensor Average Direction

```
windSensorAvgDirection OBJECT-TYPE
  SYNTAX       Integer32 (0..361)
  UNITS        "compass degrees"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> A two minute mode (average) of the direction from which
      the wind is blowing measured clockwise in degrees from true north as
      measured by the wind sensor.
    <Format>
      The value of zero (0) shall indicate 'calm', when the associated speed
      is zero (0), or 'light and variable,' when the associated speed is
      greater than zero (0). Normal observations, as defined by the WMO,
      shall report a wind direction in the range of 1 to 360 with 90 meaning
      from the east and 360 meaning from the north. The value of 361 shall
      indicate an error condition and shall always be reported if the
      associated speed indicates error.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.5"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 11 001."
::= { windSensorEntry 5 }
```

5.6.10.6 Wind Sensor Spot Speed

```
windSensorSpotSpeed OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of meters per second"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The wind speed in tenths of meters per second measured by
      the wind sensor. For mobile platforms, the wind speed shall be
      corrected for vehicle movement.
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.6"
::= { windSensorEntry 6 }
```

5.6.10.7 Wind Sensor Spot Direction

```
windSensorSpotDirection OBJECT-TYPE
  SYNTAX       Integer32 (0..361)
  UNITS        "compass degrees"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The direction from which the wind is blowing measured in
```



```
      degrees clockwise from true North as measured by the wind sensor. For
      mobile platforms, the wind direction shall be corrected for vehicle
      movement.
    <Format>
      The value of zero (0) shall indicate 'calm', when the associated speed
      is zero (0), or 'light and variable,' when the associated speed is
      greater than zero (0). Normal observations, as defined by the WMO,
      shall report a wind direction in the range of 1 to 360 with 90 meaning
      from the east and 360 meaning from the north. The value of 361 shall
      indicate an error condition and shall always be reported if the
      associated speed indicates error.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.7"
::= { windSensorEntry 7 }
```

5.6.10.8 Wind Sensor Gust Speed

```
windSensorGustSpeed OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of meters per second"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The maximum wind gust recorded by the wind sensor during
      the 10 minutes preceding the observation measured in tenths of meters
      per second.
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.8"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 11 041."
::= { windSensorEntry 8 }
```

5.6.10.9 Wind Sensor Gust Direction

```
windSensorGustDirection OBJECT-TYPE
  SYNTAX       Integer32 (0..361)
  UNITS        "compass degrees"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The direction of the maximum wind gust recorded during the
      10 minutes preceding the observation measured in degrees clockwise
      from true North by the wind sensor.
    <Format>
      The value of zero (0) shall indicate 'calm', when the associated speed
      is zero (0), or 'light and variable,' when the associated speed is
      greater than zero (0). Normal observations, as defined by the WMO,
      shall report a wind direction in the range of 1 to 360 with 90 meaning
      from the east and 360 meaning from the north. The value of 361 shall
      indicate an error condition and shall always be reported if the
      associated speed indicates error.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.9"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 11 043."
::= { windSensorEntry 9 }
```

5.6.10.10 Wind Sensor Situation

```
windSensorSituation OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    unknown (2),
    calm (3),
    lightBreeze (4),
    moderateBreeze (5),
    strongBreeze (6),
    gale (7),
    moderateGale (8),
    strongGale (9),
    stormWinds (10),
    hurricaneForceWinds (11),
    gustyWinds (12) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The assessment of the wind situation from the sensor as
      defined by the Beaufort Wind Scale in the Glossary of Meteorology.
      Specific ranges for these values are defined in the Glossary of
      Meteorology.
    <Format>
      Range               Meaning (WMO Classification)
      other               not defined within this standard, see
                          manufacturer's documentation
      unknown             Unknown conditions
      calm                Calm - Light air
      lightBreeze         Light breeze - Gentle breeze
      moderateBreeze      Moderate breeze - Fresh breeze
      strongBreeze        Strong breeze
      gale                Near Gale
      moderateGale        Gale
      strongGale          Strong gale
      stormWinds          Storm
      hurricaneForceWinds Violent Storm - Hurricane
      gustyWinds          defined by a peak and a lull of greater than 46.3
                          tenths of meters per second within a 2-minute
                          period.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.10"
::= { windSensorEntry 10 }
```

5.6.10.11 Wind Sensor Latitude

```
-- This object has been deprecated.
windSensorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the ESS wind sensor, per
      WGS-84 datum.
    <Format>
      The windSensorLatitude at the North Pole is 90,000,000. The
      windSensorLatitude at the South Pole is -90,000,000. The value
```



```
      90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> windSensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.11"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { windSensorEntry 11 }
```

5.6.10.12 Wind Sensor Longitude

```
-- This object has been deprecated.
windSensorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS wind sensor location.
    <Format>
      The windSensorLongitude of 180 degrees West shall be -180,000,000. The
      windSensorLongitude of 180 degrees East shall be 180,000,000. The
      value 180,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> windSensorXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.12"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { windSensorEntry 12 }
```

5.6.10.13 Wind Sensor Model Information

```
-- This object has been deprecated.
windSensorModelInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the row in the Module Table (See NTCIP 1201)
      that contains information about the make, model, and version number of
      the sensor associated with this row of the Wind Sensor Table.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Supplanted by> windSensorEntityID
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.13"
::= { windSensorEntry 13 }
```

5.6.10.14 Wind Sensor X Offset

```
windSensorXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
```

```
  STATUS       current
  DESCRIPTION
    "<Definition> The X offset of the wind sensor from the field device's
      reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.14"
::= { windSensorEntry 14 }
```

5.6.10.15 Wind Sensor Y Offset

```
windSensorYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the wind sensor from the field device's
      reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.15"
::= { windSensorEntry 15 }
```

5.6.10.16 Wind Sensor Z Offset

```
windSensorZOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset elevation of the wind sensor from the
      fdConfiguredElevation in centimeters.
    <Format>
      Upward offsets shall be positive and downward offsets shall be
      negative.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.16"
::= { windSensorEntry 16 }
```

5.6.10.17 Wind Sensor Entity ID

```
windSensorEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
```



```
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.4.8.1.17"
::= { windSensorEntry 17 }
```

5.7 Temperature Data Objects

```
essNtcipTemperature OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects used to describe the temperature data that is
      collected at the ESS.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5"
::= {essNtcip 5}
```

5.7.1 Number of Temperature Sensors

```
essNumTemperatureSensors OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "sensors"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the temperature sensor
      table.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a sensor; however, the table is still defined as a
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.1"
::= { essNtcipTemperature 1 }
```

5.7.2 Temperature Sensor Table

```
essTemperatureSensorTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF EssTemperatureSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Table containing the temperature sensor data fields.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2"
::= { essNtcipTemperature 2 }
```

5.7.3 Temperature Sensor

```
essTemperatureSensorEntry OBJECT-TYPE
  SYNTAX       EssTemperatureSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Parameters for specific temperature sensor as described
```



```
      through a number of attributes as indicated by the following
      subclauses."
  INDEX { essTemperatureSensorIndex }
::= { essTemperatureSensorTable 1 }

EssTemperatureSensorEntry ::= SEQUENCE {
  essTemperatureSensorIndex             Integer32,
  essTemperatureSensorHeight            Integer32,
  essAirTemperature                     Integer32,
  essTemperatureSensorLatitude          Integer32,
  essTemperatureSensorLongitude         Integer32,
  essTemperatureSensorLocation          SnmpAdminString,
  essTemperatureSensorModelInformation  Integer32,
  essTemperatureSensorXOffset           ITSInteger16,
  essTemperatureSensorYOffset           ITSInteger16,
  essTemperatureSensorZOffset           ITSInteger16,
  essTemperatureSensorEntityID          PhysicalIndexOrZero}
```

5.7.3.1 Temperature Sensor Index

```
essTemperatureSensorIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide temperature
      sensor data.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.1"
::= { essTemperatureSensorEntry 1 }
```

5.7.3.2 Temperature Sensor Height

```
-- This object has been deprecated.
essTemperatureSensorHeight OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The height of the temperature sensor as measured in meters
      above essReferenceHeight.
    <Format>
      The value 1001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essTemperatureSensorZOffset
    <Informative> Changed to read-write from read-only in version 04. This
      object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.2"
::= { essTemperatureSensorEntry 2 }
```

5.7.3.3 Air Temperature

```
essAirTemperature OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "tenths of degrees Celsius"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
```



```
    "<Definition> The dry-bulb temperature in tenths of degrees Celsius. The
      temperature is an instantaneous reading at the height specified by
      essTemperatureSensorHeight.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.3"
  REFERENCE "Resolution is based on WMO Binary Code Form FM 94 BUFR Table B
      item 0 12 001; temperature in Kelvin is determined by adding 273.15 to
      this value."
::= { essTemperatureSensorEntry 3 }
```

5.7.3.4 Temperature Sensor Latitude

```
-- This object has been deprecated.
essTemperatureSensorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the ESS temperature
      sensor, per WGS-84 datum.
    <Format>
      The essTemperatureSensorLatitude at the North Pole is 90,000,000. The
      essTemperatureSensorLatitude at the South Pole is -90,000,000. The
      value 90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essTemperatureSensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.4"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { essTemperatureSensorEntry 4 }
```

5.7.3.5 Temperature Sensor Longitude

```
-- This object has been deprecated.
essTemperatureSensorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS temperature sensor location.
    <Format>
      The essTemperatureSensorLongitude of 180 degrees West shall be
      -180,000,000. The essTemperatureSensorLongitude  of 180 degrees East
      shall be 180,000,000. The value 180,000,001 shall indicate a missing
      value.
    <Parameter Type> configuration
    <Superseded by> essTemperatureSensorXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.5"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
```

```
::= { essTemperatureSensorEntry 5 }
```

5.7.3.6 Temperature Sensor Location

```
essTemperatureSensorLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the
      temperature sensor.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.6"
::= { essTemperatureSensorEntry 6 }
```

5.7.3.7 Temperature Sensor Model Information

```
-- This object has been deprecated.
essTemperatureSensorModelInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the row in the Module Table (See NTCIP 1201)
      that contains information about the make, model, and version number of
      the sensor associated with this row of the Temperature Sensor Table.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Supplanted by> essTemperatureSensorEntityID
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.7"
::= { essTemperatureSensorEntry 7 }
```

5.7.3.8 Temperature Sensor X Offset

```
essTemperatureSensorXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The lateral offset of the temperature sensor from the
      field device's reference location as defined by fdConfiguredLatitude
      and fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.8"
::= { essTemperatureSensorEntry 8 }
```

5.7.3.9 Temperature Sensor Y Offset

```
essTemperatureSensorYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
```



```
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the temperature sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.9"
::= { essTemperatureSensorEntry 9 }
```

5.7.3.10 Temperature Sensor Z Offset

```
essTemperatureSensorZOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset elevation of the temperature sensor from the
      fdConfiguredElevation in centimeters.
    <Format>
      Upward offsets shall be positive and downward offsets shall be
negative.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.10"
::= { essTemperatureSensorEntry 10 }
```

5.7.3.11 Temperature Sensor Entity ID

```
essTemperatureSensorEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.11"
::= { essTemperatureSensorEntry 11 }
```

5.7.4 Wetbulb Temperature

```
-- This object has been deprecated.
essWetbulbTemp OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "tenths of degrees Celsius"
  MAX-ACCESS   read-only
```

```
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The wet-bulb temperature in tenths of degrees Celsius. The
      temperature is an instantaneous reading by the temperature sensor
      specified in the first row of the essTemperatureTable.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Supplanted by> humiditySensorWetbulbTemp
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.3"
  REFERENCE "is based on WMO Binary Code Form FM 94 BUFR Table B item 0 12
      002; temperature in Kelvin is determined by adding 273.15 to this
      value."
::= { essNtcipTemperature 3 }
```

5.7.5 Dewpoint Temperature

```
-- This object has been deprecated.
essDewpointTemp OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "tenths of degrees Celsius"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The dewpoint temperature in tenths of degrees Celsius. The
      temperature is an instantaneous reading by the temperature sensor
      specified in the first row specified of the essTemperatureSensorTable.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Supplanted by> humiditySensorDewpointTemp
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.4"
  REFERENCE "Resolution is based on WMO Binary Code Form FM 94 BUFR Table B
      item 0 12 003; temperature in Kelvin is determined by adding 273.15 to
      this value."
::= { essNtcipTemperature 4 }
```

5.7.6 Maximum Temperature

```
essMaxTemp OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "tenths of degrees Celsius"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The maximum temperature in tenths of degrees Celsius
      recorded during the 24 hours preceding the observation by the
      temperature sensor specified in the first row of the
      essTemperatureSensorTable.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.5"
  REFERENCE "Resolution is based on WMO Binary Code Form FM 94 BUFR Table B
      item 0 12 011; temperature in Kelvin is determined by adding 273.15 to
      this value."
::= { essNtcipTemperature 5 }
```


5.7.7 Minimum Temperature

```
essMinTemp OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "tenths of degrees Celsius"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The minimum temperature in tenths of degrees Celsius
      recorded during the 24 hours preceding the observation by the
      temperature sensor specified in the first row of the
      essTemperatureSensorTable.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.6"
  REFERENCE "Resolution is based on WMO Binary Code Form FM 94 BUFR Table B
      item 0 12 012; temperature in Kelvin is determined by adding 273.15 to
      the Celsius value."
::= { essNtcipTemperature 6 }
```

5.8 Humidity and Precipitation Data Objects

```
essBufrPrecip OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects used to describe the humidity and precipitation
      data collected by the ESS and presented in BUFR-equivalent formats.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.13"
::= {essBufr 13 }

essNtcipPrecip OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects used to describe the humidity and precipitation
      data collected by the ESS and presented in a format not defined by
      BUFR.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6"
::= {essNtcip 6 }
```

5.8.1 Relative Humidity

```
-- This object has been deprecated.
essRelativeHumidity OBJECT-TYPE
  SYNTAX       Integer32 (0..101)
  UNITS        "percent humidity"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The relative humidity in percent.
    <Format>
      The value of 101 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> humiditySensorRelativeHumidity.1 (See 5.8.27.7)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.13.3"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 003."
::= { essBufrPrecip 3 }
```

5.8.2 Water Depth

```
-- This object has been deprecated.
essWaterDepth OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "centimeters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the depth of the water from a user-defined point
      in centimeters. The value of 65535 shall indicate an error condition
      or missing value. This may be used for stream depth, depth of water
      over a roadway, reservoir depth, or other such uses.
    <Parameter Type> status
    <Superseded by> waterLevelSensorReading.1 (See 5.8.21.2)
    <Informative> This object was deprecated in version 02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.1"
::= { essNtcipPrecip 1 }
```

5.8.3 Adjacent Snow Depth

```
-- This object has been deprecated.
essAdjacentSnowDepth OBJECT-TYPE
  SYNTAX       Integer32 (0..3001)
  UNITS        "centimeters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The depth of snow in centimeters on representative areas
      other than the highway pavement, avoiding drifts and plowed areas.
    <Format>
      The value 3001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> precipitationSensorAdjacentSnowDepth.1 (See 5.8.24.8)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.2"
::= { essNtcipPrecip 2 }
```

5.8.4 Roadway Snow Depth

```
-- This object has been deprecated.
essRoadwaySnowDepth OBJECT-TYPE
  SYNTAX       Integer32 (0..3001)
  UNITS        "centimeters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The current depth of unpacked snow in centimeters on the
      driving surface.
    <Format>
      The value 3001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> precipitationSensorRoadwaySnowDepth.1 (See 5.8.24.9)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.3"
::= { essNtcipPrecip 3 }
```

5.8.5 Roadway Snow Pack Depth

```
-- This object has been deprecated.
```



```
essRoadwaySnowPackDepth OBJECT-TYPE
  SYNTAX       Integer32 (0..3001)
  UNITS        "centimeters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The current depth of packed snow in centimeters on the
      roadway surface.
    <Format>
      The value 3001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> precipitationSensorRoadwaySnowPackDepth.1 (See
      5.8.24.10)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.4"
::= { essNtcipPrecip 4 }
```

5.8.6 Precipitation Indicator

```
-- This object has been deprecated.
essPrecipYesNo OBJECT-TYPE
  SYNTAX       INTEGER {
    precip (1),
    noPrecip (2),
    error (3) }
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates whether or not moisture is detected by the
      sensor.
    <Format>
      precip - Moisture is currently being detected by the precipitation
sensor
      noPrecip - Moisture is not currently being detected by the
precipitation
          sensor
      error - The sensor is either not connected, not reporting, or is
          indicating an error
    <Parameter Type> status
    <Superseded by> precipitationSensorPrecipYesNo.1 (See 5.8.24.11)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.5"
::= { essNtcipPrecip 5 }
```

5.8.7 Rainfall or Water Equivalent of Snow

```
-- This object has been deprecated.
essPrecipRate OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of grams per square meter per second"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The rainfall, or water equivalent of snow, rate in tenths
      of grams per square meter per second (for rain, this is approximately
      to 0.36 mm/hr).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
```



```
    <Superseded by> precipitationSensorPrecipRate.1 (See 5.8.24.12)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.13.14"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 014."
::= { essBufrPrecip 14 }
```

5.8.8 Snowfall Accumulation Rate

```
-- This object has been deprecated.
essSnowfallAccumRate OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "10^-7 meters per second"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The snowfall accumulation rate in 10^-7 meters per second
      (this is equivalent to 0.36 mm/hr).
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> precipitationSensorSnowfallAccumRate.1 (See 5.8.24.13)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.13.15"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 015."
::= { essBufrPrecip 15 }
```

5.8.9 Precipitation Situation

```
essPrecipSituation OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    unknown (2),
    noPrecipitation (3),
    unidentifiedSlight (4),
    unidentifiedModerate (5),
    unidentifiedHeavy (6),
    snowSlight (7),
    snowModerate (8),
    snowHeavy (9),
    rainSlight (10),
    rainModerate (11),
    rainHeavy (12),
    frozenPrecipitationSlight (13),
    frozenPrecipitationModerate (14),
    frozenPrecipitationHeavy (15) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Describes the weather situation in terms of precipitation.
      For automated stations, describes the intensity and precipitation type
      as specified in the first row of the precipitationSensorTable.
    <Format>
      Intensity     Meaning
      slight      < 2mm/h water equivalent
      moderate    >= 2 and < 8 mm/h water equivalent
      heavy       >= 8 mm/h water equivalent If one exists, the corresponding
                  BUFR value is indicated for staffed (BUFRs) and automated
                  (BUFRa) stations. The indicated value can be found in the
                  BUFR Table referenced below. Defined values are:
```



```
      Range   BUFRa   BUFRs  Meaning
      1                      other
      2                      unknown
      3                      no precipitation
      4                      unidentified slight
      5                      unidentified moderate
      6                      unidentified heavy
      7       171      85    snow slight
      8       172      86    snow moderate
      9       173      86    snow heavy
      10               61    rain slight
      11      165      63    rain moderate
      12      163      65    rain heavy
      13                     frozen precipitation slight
      14                     frozen precipitation moderate
      15                     frozen precipitation heavy
    <Parameter Type> status
    <Informative> Starting in NTCIP 1204 v05; this object should only report
      human readings; automated sensors should use
      precipitationSensorPrecipSituation (See 5.8.24.14).
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.6"
  REFERENCE "The values identified in the above table for BUFRa and BUFRs
      can be found in WMO Binary Code Form FM 94 BUFR Table B item 0 20 003."
::= { essNtcipPrecip 6 }
```

5.8.10 Ice Deposit (Thickness)

```
-- This object has been deprecated.
essIceThickness OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "millimeters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the thickness of the ice in millimeters.
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> precipitationSensorIceThickness.1 (See 5.8.24.15)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.7"
::= { essNtcipPrecip 7 }
```

5.8.11 Precipitation Start Time

```
-- This object has been deprecated.
essPrecipitationStartTime OBJECT-TYPE
  SYNTAX       Unsigned32
  UNITS        "seconds"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The time at which the most recent precipitation event
      began, measured in seconds since 00:00:00 January 1, 1970 UTC.
    <Format>
      As this standard has been developed long after 1970, a value of 0 for
      time should indicate to the management station that the data received
      is suspect.
    <Parameter Type> status
```



```
    <Superseded by> precipitationSensorPrecipitationStartTime.1 (See
      5.8.24.16)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.8"
::= { essNtcipPrecip 8 }
```

5.8.12 Precipitation End Time

```
-- This object has been deprecated.
essPrecipitationEndTime OBJECT-TYPE
  SYNTAX       Unsigned32
  UNITS        "seconds"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The time at which the most recently completed
      precipitation event ended, measured in seconds since 00:00:00 January
      1, 1970 UTC.
    <Format>
      As this standard has been developed long after 1970, a value of 0 for
      the time should indicate to the management station that the data
      received is suspect.
    <Parameter Type> status
    <Superseded by> precipitationSensorPrecipitationEndTime.1 (See
      5.8.24.17)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.9"
::= { essNtcipPrecip 9 }
```

5.8.13 Total Precipitation Past One Hour

```
-- This object has been deprecated.
essPrecipitationOneHour OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of kilograms per square meter"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The total water equivalent precipitation over the hour
      preceding the observation in tenths of kilograms per square meter (for
      rain, this is approximately tenths of millimeters).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> precipitationSensorPrecipitationOneHour.1 (See
      5.8.24.18)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.13.19"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 019."
::= { essBufrPrecip 19 }
```

5.8.14 Total Precipitation Past Three Hours

```
-- This object has been deprecated.
essPrecipitationThreeHours OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of kilograms per square meter"
  MAX-ACCESS   read-only
  STATUS       deprecated
```



```
  DESCRIPTION
    "<Definition> The total water equivalent precipitation over the three
      hours preceding the observation in tenths of kilograms per square
      meter (for rain, this is approximately tenths of millimeters).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> precipitationSensorPrecipitationThreeHours.1 (See
      5.8.24.19)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.13.20"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 020."
::= { essBufrPrecip 20 }
```

5.8.15 Total Precipitation Past Six Hours

```
-- This object has been deprecated.
essPrecipitationSixHours OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of kilograms per square meter"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The total water equivalent precipitation over the six
      hours preceding the observation in tenths of kilograms per square
      meter (for rain, this is approximately tenths of millimeters).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> precipitationSensorPrecipitationSixHours.1 (See
      5.8.24.20)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.13.21"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 021."
::= { essBufrPrecip 21 }
```

5.8.16 Total Precipitation Past Twelve Hours

```
-- This object has been deprecated.
essPrecipitationTwelveHours OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of kilograms per square meter"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The total water equivalent precipitation over the twelve
      hours preceding the observation in tenths of kilograms per square
      meter (for rain, this is approximately to tenths of millimeters).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> precipitationSensorPrecipitationTwelveHours.1 (See
      5.8.24.21)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.13.22"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 022."
::= { essBufrPrecip 22 }
```

5.8.17 Total Precipitation Past Twenty-Four Hours

```
-- This object has been deprecated.
essPrecipitation24Hours OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of kilograms per square meter"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The total water equivalent precipitation over the
      twenty-four hours preceding the observation in tenths of kilograms per
      square meter (for rain, this is equivalent to tenths of millimeters).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> precipitationSensorPrecipitation24Hours.1 (See
      5.8.24.22)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.13.23"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 023."
::= { essBufrPrecip 23 }
```

5.8.18 Precipitation Sensor Model Information

```
-- This object has been deprecated.
precipitationSensorModelInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> A reference to the row in the Module Table (See NTCIP
      1201) that indicates the manufacturer, model, and version number of
      the precipitation sensor.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Superseded by> precipitationSensorModelInformationV4.1 (See 5.8.24.6)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.10"
::= { essNtcipPrecip 10 }
```

5.8.19 Number of Water Level Sensors

```
waterLevelSensorTableNumSensors OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "sensors"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the water level sensor
      table.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a sensor; however, the table is still defined as a
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.11"
::= { essNtcipPrecip 11 }
```

5.8.20 Water Level Sensor Table

```
waterLevelSensorTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF WaterLevelSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Table containing the water level sensor data fields.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.12"
::= { essNtcipPrecip 12 }
```

5.8.21 Water Level Sensor

```
waterLevelSensorEntry OBJECT-TYPE
  SYNTAX       WaterLevelSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Parameters for a specific water level sensor as described
      through a number of attributes as indicated by the following
      subclauses."
  INDEX { waterLevelSensorIndex }
::= { waterLevelSensorTable 1 }

WaterLevelSensorEntry ::= SEQUENCE {
  waterLevelSensorIndex               Integer32,
  waterLevelSensorReading             Integer32,
  waterLevelSensorWarningLevel        Integer32,
  waterLevelSensorHeight              Integer32,
  waterLevelSensorLatitude            Integer32,
  waterLevelSensorLongitude           Integer32,
  waterLevelSensorLocation            SnmpAdminString,
  waterLevelSensorModelInformation    Integer32,
  waterLevelSensorReferencePoint      SnmpAdminString,
  waterLevelSensorXOffset             ITSInteger16,
  waterLevelSensorYOffset             ITSInteger16,
  waterLevelSensorZOffset             ITSInteger16,
  waterLevelSensorEntityID            PhysicalIndexOrZero }
```

5.8.21.1 Water Level Sensor Index

```
waterLevelSensorIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide water level
      sensor data.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.12.1.1"
::= { waterLevelSensorEntry 1 }
```

5.8.21.2 Water Level Sensor Reading

```
waterLevelSensorReading OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "centimeters"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
```



```
    "<Definition> Indicates the depth of the water from a user-defined point
      in centimeters. This may be used for stream depth, depth of water over
      a roadway for flooding, reservoir depth, or other such uses.
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.12.1.2"
::= { waterLevelSensorEntry 2 }
```

5.8.21.3 Water Level Sensor Warning Level

```
waterLevelSensorWarningLevel OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the depth of the water from a user defined point
      in centimeters, that the water level is of concern.
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.12.1.3"
::= { waterLevelSensorEntry 3 }
```

5.8.21.4 Water Level Sensor Height

```
-- This object has been deprecated.
waterLevelSensorHeight OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The height of the water level sensor with respect to the
      essReferenceHeight in meters.
    <Format>
      The value of 1001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> waterLevelSensorZOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.12.1.4"
::= { waterLevelSensorEntry 4 }
```

5.8.21.5 Water Level Sensor Latitude

```
-- This object has been deprecated.
waterLevelSensorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the ESS water level
      sensor, per WGS-84 datum.
    <Format>
      The waterLevelSensorLatitude at the North Pole is 90,000,000. The
      waterLevelSensorLatitude at the South Pole is -90,000,000. The value
      90,000,001 shall indicate a missing value.
```



```
    <Parameter Type> configuration
    <Superseded by> waterLevelSensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.12.1.5"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { waterLevelSensorEntry 5 }
```

5.8.21.6 Water Level Sensor Longitude

```
-- This object has been deprecated.
waterLevelSensorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS water level sensor location.
    <Format>
      The waterLevelSensorLongitude of 180 degrees West shall be -
180,000,000.
      The waterLevelSensorLongitude of 180 degrees East shall be
      180,000,000. The value 180,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> waterLevelSensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.12.1.6"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { waterLevelSensorEntry 6 }
```

5.8.21.7 Water Level Sensor Location

```
waterLevelSensorLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the water
      level sensor., including a description of the reference point that the
      water depth is measured against.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.12.1.7"
::= { waterLevelSensorEntry 7 }
```

5.8.21.8 Water Level Sensor Model Information

```
-- This object has been deprecated.
waterLevelSensorModelInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the row in the Module Table (See NTCIP 1201)
      that contains information about the make, model, and version number of
      the sensor associated with this row of the Water Level Sensor Table.
```



```
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Supplanted by> waterLevelSensorEntityID
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.12.1.8"
::= { waterLevelSensorEntry 8 }
```

5.8.21.9 Water Level Sensor Reference Point

```
waterLevelSensorReferencePoint OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string describing the location of the reference
      point that the water depth is measured against.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.12.1.9"
::= { waterLevelSensorEntry 9 }
```

5.8.21.10 Water Level Sensor X Offset

```
waterLevelSensorXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The X offset of the water level sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.10"
::= { waterLevelSensorEntry 10 }
```

5.8.21.11 Water Level Sensor Y Offset

```
waterLevelSensorYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the water level sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
```



```
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.11"
::= { waterLevelSensorEntry 11 }
```

5.8.21.12 Water Level Sensor Z Offset

```
waterLevelSensorZOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset elevation of the water level sensor from the
      fdConfiguredElevation in centimeters.
    <Format>
      Upward offsets shall be positive and downward offsets shall be
negative.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.5.2.1.12"
::= { waterLevelSensorEntry 12 }
```

5.8.21.13 Water Level Sensor Entity Identifier

```
waterLevelSensorEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.12.1.13"
::= { waterLevelSensorEntry 13 }
```

5.8.22 Number of Precipitation Sensors

```
precipitationSensorTableNumSensors OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "sensors"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the precipitation
      sensor table.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a sensor; however, the table is still defined as a
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.13"
::= { essNtcipPrecip 13 }
```

5.8.23 Precipitation Sensor Table

```
precipitationSensorTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF PrecipitationSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Table containing the precipitation sensor data fields.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14"
::= { essNtcipPrecip 14 }
```

5.8.24 Precipitation Sensor

```
precipitationSensorEntry OBJECT-TYPE
  SYNTAX       PrecipitationSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Parameters for a specific precipitation sensor as
      described through a number of attributes as indicated by the following
      subclauses."
  INDEX { precipitationSensorIndex }
::= { precipitationSensorTable 1 }

PrecipitationSensorEntry ::= SEQUENCE {
    precipitationSensorIndex                    Integer32,
    precipitationSensorHeight                   Integer32,
    precipitationSensorLatitude                 Integer32,
    precipitationSensorLongitude                Integer32,
    precipitationSensorLocation                 SnmpAdminString,
    precipitationSensorModelInformationV4       Integer32,
    precipitationSensorPeriod                   Integer32,
    precipitationSensorAdjacentSnowDepth        Integer32,
    precipitationSensorRoadwaySnowDepth         Integer32,
    precipitationSensorRoadwaySnowPackDepth     Integer32,
    precipitationSensorPrecipYesNo              INTEGER,
    precipitationSensorPrecipRate               Integer32,
    precipitationSensorSnowfallAccumRate        Integer32,
    precipitationSensorPrecipSituation          INTEGER,
    precipitationSensorIceThickness             Integer32,
    precipitationSensorPrecipitationStartTime   Unsigned32,
    precipitationSensorPrecipitationEndTime     Unsigned32,
    precipitationSensorPrecipitationOneHour     Integer32,
    precipitationSensorPrecipitationThreeHours  Integer32,
    precipitationSensorPrecipitationSixHours    Integer32,
    precipitationSensorPrecipitationTwelveHours Integer32,
    precipitationSensorPrecipitation24Hours     Integer32,
    precipitationSensorPrecipitationUserDefined Integer32,
    precipitationSensorPrecipStartDate          ITSDateStamp,
    precipitationSensorPrecipStartTimeV5        ITSDailyTimeStamp,
    precipitationSensorPrecipEndDate            ITSDateStamp,
    precipitationSensorPrecipEndTimeV5          ITSDailyTimeStamp,
    precipitationSensorXOffset                  ITSInteger16,
    precipitationSensorYOffset                  ITSInteger16,
    precipitationSensorZOffset                  ITSInteger16,
    precipitationSensorEntityID                 PhysicalIndexOrZero }
```


5.8.24.1 Precipitation Sensor Index

```
precipitationSensorIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide precipitation
      sensor data.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.1"
::= { precipitationSensorEntry 1 }
```

5.8.24.2 Precipitation Sensor Height

```
-- This object has been deprecated.
precipitationSensorHeight OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The height of the precipitation sensor with respect to the
      essReferenceHeight in meters.
    <Format>
      The value of 1001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> precipitationSensorZOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.2"
  REFERENCE "essReferenceHeight plus this value equals the WMO Binary Code
      Form FM 94 BUFR Table B item 0 07 001."
::= { precipitationSensorEntry 2 }
```

5.8.24.3 Precipitation Sensor Latitude

```
-- This object has been deprecated.
precipitationSensorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the ESS precipitation
      sensor, per WGS-84 datum.
    <Format>
      The precipitationSensorLatitude at the North Pole is 90,000,000. The
      precipitationSensorLatitude at the South Pole is -90,000,000. The
      value 90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> precipitationSensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.3"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { precipitationSensorEntry 3 }
```


5.8.24.4 Precipitation Sensor Longitude

```
-- This object has been deprecated.
precipitationSensorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS precipitation sensor location.
    <Format>
      The precipitationSensorLongitude of 180 degrees West shall be
      -180,000,000. The precipitationSensorLongitude of 180 degrees East
      shall be 180,000,000. The value 180,000,001 shall indicate a missing
      value.
    <Parameter Type> configuration
    <Superseded by> precipitationSensorXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.4"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { precipitationSensorEntry 4 }
```

5.8.24.5 Precipitation Sensor Location

```
precipitationSensorLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the
      precipitation sensor.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.5"
::= { precipitationSensorEntry 5 }
```

5.8.24.6 Precipitation Sensor Model Information Version 4

```
-- This object has been deprecated.
precipitationSensorModelInformationV4 OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> A reference to the row in the Module Table (See NTCIP
      1201) that indicates the manufacturer, model, and version number of
      the precipitation sensor.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Supplanted by> precipitationSensorEntityID (See 5.8.24.24)
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.6"
::= { precipitationSensorEntry 6 }
```

5.8.24.7 Total Precipitation Period

```
precipitationSensorPeriod OBJECT-TYPE
```



```
  SYNTAX       Integer32 (0..86400)
  UNITS        "seconds"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The period, in seconds, that corresponds to the length of
      time that the total water equivalent is measured in
      precipitationSensorPrecipitationUserDefined.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.7"
::= { precipitationSensorEntry 7 }
```

5.8.24.8 Adjacent Snow Depth

```
precipitationSensorAdjacentSnowDepth OBJECT-TYPE
  SYNTAX       Integer32 (0..3001)
  UNITS        "centimeters"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The depth of snow in centimeters on representative areas
      other than the highway pavement, avoiding drifts and plowed areas.
    <Format>
      The value 3001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.8"
::= { precipitationSensorEntry 8 }
```

5.8.24.9 Roadway Snow Depth

```
precipitationSensorRoadwaySnowDepth OBJECT-TYPE
  SYNTAX       Integer32 (0..3001)
  UNITS        "centimeters"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The current depth of unpacked snow in centimeters on the
      driving surface.
    <Format>
      The value 3001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.9"
::= { precipitationSensorEntry 9 }
```

5.8.24.10 Roadway Snow Pack Depth

```
precipitationSensorRoadwaySnowPackDepth OBJECT-TYPE
  SYNTAX       Integer32 (0..3001)
  UNITS        "centimeters"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The current depth of packed snow in centimeters on the
      roadway surface.
    <Format>
      The value 3001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.10"
::= { precipitationSensorEntry 10 }
```

5.8.24.11 Precipitation Indicator

```
precipitationSensorPrecipYesNo OBJECT-TYPE
  SYNTAX       INTEGER {
    precip (1),
    noPrecip (2),
    error (3) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates whether or not moisture is detected by the
      sensor.
    <Format>
      precip - Moisture is currently being detected by the precipitation
      sensor.
          0.01 inches of liquid water equivalent is to be detected.
      noPrecip - Moisture is not currently being detected by the
precipitation
          sensor
      error - The sensor is either not connected, not reporting, or is
          indicating an error
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.11"
::= { precipitationSensorEntry 11 }
```

5.8.24.12 Rainfall or Water Equivalent of Snow

```
precipitationSensorPrecipRate OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of grams per square meter per second"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The rainfall, or water equivalent of snow, rate in tenths
      of grams per square meter per second (for rain, this is approximately
      to 0.36 mm/hr).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.12"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 014."
::= { precipitationSensorEntry 12 }
```

5.8.24.13 Snowfall Accumulation Rate

```
precipitationSensorSnowfallAccumRate OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "10^-7 meters per second"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The snowfall accumulation rate in 10^-7 meters per second
      (this is equivalent to 0.36 mm/hr).
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.13"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 015."
::= { precipitationSensorEntry 13 }
```


5.8.24.14 Precipitation Situation

```
precipitationSensorPrecipSituation OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    unknown (2),
    noPrecipitation (3),
    unidentifiedSlight (4),
    unidentifiedModerate (5),
    unidentifiedHeavy (6),
    snowSlight (7),
    snowModerate (8),
    snowHeavy (9),
    rainSlight (10),
    rainModerate (11),
    rainHeavy (12),
    frozenPrecipitationSlight (13),
    frozenPrecipitationModerate (14),
    frozenPrecipitationHeavy (15) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Describes the weather situation in terms of precipitation.
      For automated stations, describes the intensity and precipitation type
      as specified in the first row of the precipitationSensorTable.
    <Format>
      Intensity     Meaning
      slight      < 2mm/h water equivalent
      moderate    >= 2 and < 8 mm/h water equivalent
      heavy       >= 8 mm/h water equivalent If one exists, the corresponding
                  BUFR value is indicated for staffed (BUFRs) and automated
                  (BUFRa) stations. The indicated value can be found in the
                  BUFR Table referenced below. Defined values are:

      Range   BUFRa   BUFRs  Meaning
      1                      other
      2                      unknown
      3                      no precipitation
      4                      unidentified slight
      5                      unidentified moderate
      6                      unidentified heavy
      7       171      85    snow slight
      8       172      86    snow moderate
      9       173      86    snow heavy
      10               61    rain slight
      11      165      63    rain moderate
      12      163      65    rain heavy
      13                     frozen precipitation slight
      14                     frozen precipitation moderate
      15                     frozen precipitation heavy
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.14"
  REFERENCE "The values identified in the above table for BUFRa and BUFRs
      can be found in WMO Binary Code Form FM 94 BUFR Table B item 0 20 003."
::= { precipitationSensorEntry 14 }
```


5.8.24.15 Ice Deposit (Thickness)

```
-- This object has been deprecated.
precipitationSensorIceThickness OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "millimeters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the thickness of the ice in millimeters.
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> essSurfaceIceOrWaterDepth
    <Informative> This object was deprecated in v05 because the thickness of
      ice can vary by location, especially with the addition of chemicals.
      As such, the superseding object is associated with a pavement sensor
      rather than a precipitation sensor.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.15"
::= { precipitationSensorEntry 15 }
```

5.8.24.16 Precipitation Start Time

```
-- This object has been deprecated.
precipitationSensorPrecipitationStartTime OBJECT-TYPE
  SYNTAX       Unsigned32
  UNITS        "seconds"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The time at which the most recent precipitation event
      began, measured in seconds since 00:00:00 January 1, 1970 UTC. The
      precipitation event begins when 0.01 inches of liquid water equivalent
      is detected.
    <Format>
      As this standard has been developed long after 1970, a value of 0 for
      time should indicate to the management station that the data received
      is suspect.
    <Parameter Type> status
    <Superseded by> precipitationSensorPrecipStartDate  and
      precipitationSensorPrecipStartTimeV5
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.16"
::= { precipitationSensorEntry 16 }
```

5.8.24.17 Precipitation End Time

```
-- This object has been deprecated.
precipitationSensorPrecipitationEndTime OBJECT-TYPE
  SYNTAX       Unsigned32
  UNITS        "seconds"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The time at which the most recently completed
      precipitation event ended, measured in seconds since 00:00:00 January
      1, 1970 UTC.
    <Format>
      As this standard has been developed long after 1970, a value of 0 for
```



```
      the time should indicate to the management station that the data
      received is suspect.
    <Parameter Type> status
    <Superseded by> precipitationSensorPrecipEndDate  and
      precipitationSensorPrecipEndTimeV5
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.17"
::= { precipitationSensorEntry 17 }
```

5.8.24.18 Total Precipitation Past One Hour

```
precipitationSensorPrecipitationOneHour OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of kilograms per square meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The total water equivalent precipitation over the hour
      preceding the observation in tenths of kilograms per square meter (for
      rain, this is approximately tenths of millimeters).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.18"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 019."
::= { precipitationSensorEntry 18 }
```

5.8.24.19 Total Precipitation Past Three Hours

```
precipitationSensorPrecipitationThreeHours OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of kilograms per square meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The total water equivalent precipitation over the three
      hours preceding the observation in tenths of kilograms per square
      meter (for rain, this is approximately tenths of millimeters).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.19"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 020."
::= { precipitationSensorEntry 19 }
```

5.8.24.20 Total Precipitation Past Six Hours

```
precipitationSensorPrecipitationSixHours OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of kilograms per square meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The total water equivalent precipitation over the six
      hours preceding the observation in tenths of kilograms per square
      meter (for rain, this is approximately tenths of millimeters).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
```

```
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.20"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 021."
::= { precipitationSensorEntry 20 }
```

5.8.24.21 Total Precipitation Past Twelve Hours

```
precipitationSensorPrecipitationTwelveHours OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of kilograms per square meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The total water equivalent precipitation over the twelve
      hours preceding the observation in tenths of kilograms per square
      meter (for rain, this is approximately to tenths of millimeters).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.21"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 022."
::= { precipitationSensorEntry 21 }
```

5.8.24.22 Total Precipitation Past Twenty-Four Hours

```
precipitationSensorPrecipitation24Hours OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of kilograms per square meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The total water equivalent precipitation over the
      twenty-four hours preceding the observation in tenths of kilograms per
      square meter (for rain, this is equivalent to tenths of millimeters).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.22"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 023."
::= { precipitationSensorEntry 22 }
```

5.8.24.23 Total Precipitation User Defined Period

```
precipitationSensorPrecipitationUserDefined OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of kilograms per square meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The total water equivalent precipitation over the
      precipitationSensorPeriod preceding the observation in tenths of
      kilograms per square meter (for rain, this is equivalent to tenths of
      millimeters).
    <Format>
      The value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.23"
::= { precipitationSensorEntry 23 }
```


5.8.24.24 Precipitation Start Date

```
precipitationSensorPrecipStartDate OBJECT-TYPE
  SYNTAX       ITSDateStamp
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The UTC date on which the most recent precipitation event
      began. The precipitation event begins when 0.254 mm of liquid water
      equivalent is detected.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.24"
  DEFVAL { '00000000'H }
::= { precipitationSensorEntry 24 }
```

5.8.24.25 Precipitation Start Time Version 05

```
precipitationSensorPrecipStartTimeV5 OBJECT-TYPE
  SYNTAX       ITSDailyTimeStamp
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The UTC time at which the most recent precipitation event
      began on the precipitationSensorPrecipStartDate. The precipitation
      event begins when 0.254 mm of liquid water equivalent is detected.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.25"
  DEFVAL { 86401001 }
::= { precipitationSensorEntry 25 }
```

5.8.24.26 Precipitation End Date

```
precipitationSensorPrecipEndDate OBJECT-TYPE
  SYNTAX       ITSDateStamp
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The UTC date on which the most recently completed
      precipitation event ended.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.26"
  DEFVAL { '00000000'H }
::= { precipitationSensorEntry 26 }
```

5.8.24.27 Precipitation End Time Version 05

```
precipitationSensorPrecipEndTimeV5 OBJECT-TYPE
  SYNTAX       ITSDailyTimeStamp
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The UTC time at which the most recently completed
      precipitation event ended on the precipitationSensorPrecipEndDate.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.27"
  DEFVAL { 86401001 }
::= { precipitationSensorEntry 27 }
```

5.8.24.28 Precipitation Sensor X Offset

```
precipitationSensorXOffset OBJECT-TYPE
```



```
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The X offset of the precipitation sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.28"
::= { precipitationSensorEntry 28 }
```

5.8.24.29 Precipitation Sensor Y Offset

```
precipitationSensorYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the precipitation sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.29"
::= { precipitationSensorEntry 29 }
```

5.8.24.30 Precipitation Sensor Z Offset

```
precipitationSensorZOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset elevation of the precipitation sensor from the
      fdConfiguredElevation in centimeters.
    <Format>
      Upward offsets shall be positive and downward offsets shall be
negative.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.30"
::= { precipitationSensorEntry 30 }
```

5.8.24.31 Precipitation Sensor Entity Identifier

```
precipitationSensorEntityID OBJECT-TYPE
```



```
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.14.1.31"
::= { precipitationSensorEntry 31 }
```

5.8.25 Number of Humidity Sensors

```
humiditySensorTableNumSensors OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "sensors"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the humidity sensor
      table.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a sensor; however, the table is still defined as a
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.15"
::= { essNtcipPrecip 15 }
```

5.8.26 Humidity Sensor Table

```
humiditySensorTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF HumiditySensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Table containing the humidity sensor data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16"
::= { essNtcipPrecip 16 }
```

5.8.27 Humidity Sensor

```
humiditySensorEntry OBJECT-TYPE
  SYNTAX       HumiditySensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> A humidity sensor is a sensor that reports the relative
      humidity. It can be described through a number of attributes as
      indicated by the following subclauses."
  INDEX { humiditySensorIndex }
::= { humiditySensorTable 1 }

HumiditySensorEntry ::= SEQUENCE {
```



```
    humiditySensorIndex                   Integer32,
    humiditySensorHeight                  Integer32,
    humiditySensorLatitude                Integer32,
    humiditySensorLongitude               Integer32,
    humiditySensorLocation                SnmpAdminString,
    humiditySensorModelInformation        Integer32,
    humiditySensorRelativeHumidity        Integer32,
    humiditySensorTemperatureInformation  Integer32,
    humiditySensorWetbulbTemp             Integer32,
    humiditySensorDewpointTemp            Integer32,
    humiditySensorXOffset                 ITSInteger16,
    humiditySensorYOffset                 ITSInteger16,
    humiditySensorZOffset                 ITSInteger16,
    humiditySensorEntityID                PhysicalIndexOrZero}
```

5.8.27.1 Humidity Sensor Index

```
humiditySensorIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide humidity
      sensor data.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.1"
::= { humiditySensorEntry 1 }
```

5.8.27.2 Humidity Sensor Height

```
-- This object has been deprecated.
humiditySensorHeight OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The height of the humidity sensor with respect to the
      essReferenceHeight in meters.
    <Format>
      The value of 1001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> humiditySensorZOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.2"
  REFERENCE "essReferenceHeight plus this value equals the WMO Binary Code
      Form FM 94 BUFR Table B item 0 07 001."
::= { humiditySensorEntry 2 }
```

5.8.27.3 Humidity Sensor Latitude

```
-- This object has been deprecated.
humiditySensorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the ESS humidity sensor,
```



```
      per WGS-84 datum.
    <Format>
      The humiditySensorLatitude at the North Pole is 90,000,000. The
      humiditySensorLatitude at the South Pole is -90,000,000. The value
      90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> humiditySensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.3"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { humiditySensorEntry 3 }
```

5.8.27.4 Humidity Sensor Longitude

```
-- This object has been deprecated.
humiditySensorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS humidity sensor location.
    <Format>
      The humiditySensorLongitude of 180 degrees West shall be -180,000,000.
      The humiditySensorLongitude of 180 degrees East shall be 180,000,000.
      The value 180,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> humiditySensorXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.4"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { humiditySensorEntry 4 }
```

5.8.27.5 Humidity Sensor Location

```
humiditySensorLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the humidity
      sensor.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.5"
::= { humiditySensorEntry 5 }
```

5.8.27.6 Humidity Sensor Model Information

```
-- This object has been deprecated.
humiditySensorModelInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
```



```
    "<Definition> Indicates the row in the Module Table (See NTCIP 1201)
      that contains information about the make, model, and version number of
      the sensor associated with this row of the Humidity Sensor Table.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Supplanted by> humiditySensorEntityID
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.6"
::= { humiditySensorEntry 6 }
```

5.8.27.7 Relative Humidity

```
humiditySensorRelativeHumidity OBJECT-TYPE
  SYNTAX       Integer32 (0..101)
  UNITS        "percent humidity"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The relative humidity in percent.
    <Format>
      The value of 101 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.7"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 13 003."
::= { humiditySensorEntry 7 }
```

5.8.27.8 Humidity Sensor Temperature Information

```
humiditySensorTemperatureInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the essTemperatureSensorTable that
      contains the temperature associated with this row of the Humidity
      Sensor Table. If a SetRequest-PDU attempts to set this object to a
      value that does not reference an existing EssTemperatureSensorEntry,
      the ESS shall respond with an inconsistentValue error. The ESS shall
      automatically update this value if the index of the referenced temp
      sensor changes (e.g., due to another temperature sensor being
      disconnected and the index numbers being updated).
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.8"
  DEFVAL {1}
::= { humiditySensorEntry 8 }
```

5.8.27.9 Wetbulb Temperature

```
humiditySensorWetbulbTemp OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "tenths of degrees Celsius"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The wet-bulb temperature in tenths of degrees Celsius for
      the row of the essTemperatureSensorTable as specified by
```



```
      humiditySensorTemperatureInformation for this humidity sensor. The
      temperature is an instantaneous reading.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.9"
  REFERENCE "is based on WMO Binary Code Form FM 94 BUFR Table B item 0 12
      002; temperature in Kelvin is determined by adding 273.15 to this
      value."
::= { humiditySensorEntry 9 }
```

5.8.27.10 Dewpoint Temperature

```
humiditySensorDewpointTemp OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "tenths of degrees Celsius"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The dewpoint temperature in tenths of degrees Celsius for
      the row of the essTemperatureSensorTable as specified by
      humiditySensorTemperatureInformation. The temperature is an
      instantaneous reading.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.10"
  REFERENCE "Resolution is based on WMO Binary Code Form FM 94 BUFR Table B
      item 0 12 003; temperature in Kelvin is determined by adding 273.15 to
      this value."
::= { humiditySensorEntry 10 }
```

5.8.27.11 Humidity Sensor X Offset

```
humiditySensorXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The X offset of the humidity sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.11"
::= { humiditySensorEntry 11 }
```

5.8.27.12 Humidity Sensor Y Offset

```
humiditySensorYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
```



```
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the humidity sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.12"
::= { humiditySensorEntry 12 }
```

5.8.27.13 Humidity Sensor Z Offset

```
humiditySensorZOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset elevation of the humidity sensor from the
      fdConfiguredElevation in centimeters.
    <Format>
      Upward offsets shall be positive and downward offsets shall be
negative.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.13"
::= { humiditySensorEntry 13 }
```

5.8.27.14 Humidity Sensor Entity Identifier

```
humiditySensorEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.6.16.1.14"
::= { humiditySensorEntry 14 }
```

5.9 Radiation Objects

```
essBufrRadiation OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects used to describe the data that is collected by the
      pavement surface sensor and recorded in a format consistent with BUFR.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.14"
```



```
::= {essBufr 14 }

essNtcipRadiation OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects used to describe the data that is collected by the
      pavement surface sensor and recorded in a format not directly derived
      from BUFR.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7"
::= {essNtcip 7}
```

5.9.1 Solar Radiation

```
-- This object has been deprecated.
essSolarRadiation OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "joules per square meter"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The direct solar radiation integrated over the 24 hours
      preceding the observation in Joules per square meter. The value of
      65535 shall indicate a missing value.
    <Parameter Type> status
    <Superseded by> essInstantaneousSolarRadiation (See 5.9.5)
    <Informative> This object was deprecated in version 02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.14.24"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 14 024."
::= { essBufrRadiation 24 }
```

5.9.2 Total Sun

```
-- This object has been deprecated.
essTotalSun OBJECT-TYPE
  SYNTAX       Integer32 (0..1441)
  UNITS        "minutes"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The total amount of sunshine in minutes over the 24 hour
      period preceding the observation.
    <Format>
      The value of 1441 shall indicate a missing value.
    <Parameter Type> status
    <Superseded by> essTotalSunV4 (See 5.9.10.7)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.14.31"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 14 031."
::= { essBufrRadiation 31 }
```

5.9.3 Cloud Cover Situation

```
-- This object has been deprecated.
essCloudSituation OBJECT-TYPE
  SYNTAX       INTEGER {
    overcast (1),
    cloudy (2),
    partlyCloudy (3),
    mostlyClear (4),
```



```
    clear (5) }
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Describes the amount of cloud cover. The associated
      percentages of cloud cover are indicated to identify the differences
      between the defined values.
    <Format>
      Defined values are:
      Value Meaning        Percent Cloud Cover
      1     Overcast       100%
      2     Mostly cloudy  62.5%-99%
      3     Partly cloudy  37.5%-62.4%
      4     Mostly sunny   1%-37.4%
      5     Clear skies    0%
    <Parameter Type> status
    <Superseded by> essCloudSituationV4 (See 5.9.11)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.1"
::= { essNtcipRadiation 1 }
```

5.9.4 Terrestrial Radiation

```
-- This object has been deprecated.
essInstantaneousTerrestrialRadiation OBJECT-TYPE
  SYNTAX       Integer32 (-2048..2049)
  UNITS        "watts per square meter"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The instantaneous infrared (wavelength of 3.5 - 50
      micrometers) radiation being emitted from the atmosphere in watts per
      square meter.
    <Format>
      The value of 2049 shall indicate a missing value.
    <Parameter Type> status
    <Superseded by> essInstantaneousTerrestrialRadiationV4 (See 5.9.10.8)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.14.17"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 14 017"
::= { essBufrRadiation 17 }
```

5.9.5 Solar Radiation—Version 2

```
-- This object has been deprecated.
essInstantaneousSolarRadiation OBJECT-TYPE
  SYNTAX       Integer32 (-2048..2049)
  UNITS        "watts per square meter"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The instantaneous ultraviolet, visible, and near-infrared
      (wavelength of less than 3.0 micrometers) radiation hitting the
      earth's surface in watts per square meter.
    <Format>
      The value of 2049 shall indicate a missing value.
    <Parameter Type> status
    <Superseded by> essInstantaneousSolarRadiationV4 (See 5.9.10.9)
    <Informative> This object was deprecated in version 04.
```



```
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.14.18"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 14 018"
::= { essBufrRadiation 18 }
```

5.9.6 Total Radiation

```
-- This object has been deprecated.
essTotalRadiation OBJECT-TYPE
  SYNTAX       Integer32 (-2048..2049)
  UNITS        "joules per square meter"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The average total radiation hitting the earth's surface in
      watts per square meter during the radiation period.
    <Format>
      The value of 2049 shall indicate a missing value.
    <Parameter Type> status
    <Superseded by> essTotalRadiationV4 (See 5.9.10.10)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.1.14.25"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 14 025"
::= { essBufrRadiation 25 }
```

5.9.7 Total Radiation Period

```
essTotalRadiationPeriod OBJECT-TYPE
  SYNTAX       Integer32 (0..86400)
  UNITS        "seconds"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The rolling period, in seconds, that corresponds to the
      length of time the essTotalRadiation is averaged.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.2"
::= { essNtcipRadiation 2 }
```

5.9.8 Number of Radiation Sensors

```
radiationSensorTableNumSensors OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "sensors"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the radiation sensor
      table.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a sensor; however, the table is still defined as a
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.3"
::= { essNtcipRadiation 3 }
```

5.9.9 Radiation Sensor Table

```
radiationSensorTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF RadiationSensorEntry
```

```
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Table containing the radiation sensor data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4"
::= { essNtcipRadiation 4 }
```

5.9.10 Radiation Sensor

```
radiationSensorEntry OBJECT-TYPE
  SYNTAX       RadiationSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> A radiation sensor is a sensor that reports the amount of
      radiation detected. It can be described through a number of attributes
      as indicated by the following subclauses."
  INDEX { radiationSensorIndex }
::= { radiationSensorTable 1 }

RadiationSensorEntry ::= SEQUENCE {
    radiationSensorIndex                    Integer32,
    radiationSensorHeight                   Integer32,
    radiationSensorLatitude                 Integer32,
    radiationSensorLongitude                Integer32,
    radiationSensorLocation                 SnmpAdminString,
    radiationSensorModelInformation         Integer32,
    essTotalSunV4                           Integer32,
    essInstantaneousTerrestrialRadiationV4  Integer32,
    essInstantaneousSolarRadiationV4        Integer32,
    essTotalRadiationV4                     Integer32,
    radiationSensorXOffset                  ITSInteger16,
    radiationSensorYOffset                  ITSInteger16,
    radiationSensorZOffset                  ITSInteger16,
    radiationSensorEntityID                 PhysicalIndexOrZero}
```

5.9.10.1 Radiation Sensor Index

```
radiationSensorIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide radiation
      sensor data.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.1"
::= { radiationSensorEntry 1 }
```

5.9.10.2 Radiation Sensor Height

```
-- This object has been deprecated.
radiationSensorHeight OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The height of the radiation sensor with respect to the
```



```
      essReferenceHeight in meters.
    <Format>
      The value of 1001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> radiationSensorZOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.2"
  REFERENCE "essReferenceHeight plus this value equals the WMO Binary Code
      Form FM 94 BUFR Table B item 0 07 001."
::= { radiationSensorEntry 2 }
```

5.9.10.3 Radiation Sensor Latitude

```
-- This object has been deprecated.
radiationSensorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the ESS radiation sensor,
      per WGS-84 datum.
    <Format>
      The radiationSensorLatitude at the North Pole is 90,000,000. The
      radiationSensorLatitude at the South Pole is -90,000,000. The value
      90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> radiationSensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.3"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { radiationSensorEntry 3 }
```

5.9.10.4 Radiation Sensor Longitude

```
-- This object has been deprecated.
radiationSensorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees of longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS radiation sensor location.
    <Format>
      The radiationSensorLongitude of 180 degrees West shall be -180,000,000.
      The radiationSensorLongitude of 180 degrees East shall be 180,000,000.
      The value 180,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> radiationSensorXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.4"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { radiationSensorEntry 4 }
```


5.9.10.5 Radiation Sensor Location

```
radiationSensorLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the radiation
      sensor.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.5"
::= { radiationSensorEntry 5 }
```

5.9.10.6 Radiation Sensor Model Information

```
-- This object has been deprecated.
radiationSensorModelInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the row in the Module Table (See NTCIP 1201)
      that contains information about the make, model, and version number of
      the sensor associated with this row of the Radiation Sensor Table.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Supplanted by> radiationSensorEntityID (See 5.9.10.11)
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.6"
::= { radiationSensorEntry 6 }
```

5.9.10.7 Total Sun V4

```
essTotalSunV4 OBJECT-TYPE
  SYNTAX       Integer32 (0..1441)
  UNITS        "minutes"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The total amount of sunshine in minutes over the 24 hour
      period preceding the observation.
    <Format>
      The value of 1441 shall indicate a missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.7"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 14 031."
::= { radiationSensorEntry 7 }
```

5.9.10.8 Terrestrial Radiation V4

```
essInstantaneousTerrestrialRadiationV4 OBJECT-TYPE
  SYNTAX       Integer32 (-2048..2049)
  UNITS        "watts per square meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The instantaneous infrared (wavelength of 3.5 - 50
      micrometers) radiation being emitted from the atmosphere in watts per
      square meter.
```



```
    <Format>
      The value of 2049 shall indicate a missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.8"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 14 017"
::= { radiationSensorEntry 8 }
```

5.9.10.9 Solar Radiation Version 4

```
essInstantaneousSolarRadiationV4 OBJECT-TYPE
  SYNTAX       Integer32 (-2048..2049)
  UNITS        "watts per square meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The instantaneous ultraviolet, visible, and near-infrared
      (wavelength of less than 3.0 micrometers) radiation hitting the
      earth's surface in watts per square meter.
    <Format>
      The value of 2049 shall indicate a missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.9"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 14 018"
::= { radiationSensorEntry 9 }
```

5.9.10.10 Total Radiation V4

```
essTotalRadiationV4 OBJECT-TYPE
  SYNTAX       Integer32 (-2048..2049)
  UNITS        "watts per square meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The average total radiation hitting the earth's surface in
      watts per square meter during the radiation period.
    <Format>
      The value of 2049 shall indicate a missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.10"
  REFERENCE "WMO Code Form FM 94 BUFR Table B item 0 14 025"
::= { radiationSensorEntry 10 }
```

5.9.10.11 Radiation Sensor X Offset

```
radiationSensorXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset latitude of the radiation sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
```

```
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.11"
::= { radiationSensorEntry 11 }
```

5.9.10.12 Radiation Sensor Y Offset

```
radiationSensorYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the radiation sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.12"
::= { radiationSensorEntry 12 }
```

5.9.10.13 Radiation Sensor Z Offset

```
radiationSensorZOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset elevation of the radiation sensor from the
      fdConfiguredElevation in centimeters.
    <Format>
      Upward offsets shall be positive and downward offsets shall be
negative.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.13"
::= { radiationSensorEntry 13 }
```

5.9.10.14 Radiation Sensor Entity Identifier

```
radiationSensorEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.4.1.14"
```



```
::= { radiationSensorEntry 14 }
```

5.9.11 Cloud Cover Situation V4

```
essCloudSituationV4 OBJECT-TYPE
  SYNTAX       Integer32 (0..8)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Describes the amount of cloud cover in the sky, measured
      in oktas, as defined in WMO code table 2700.
    <Format>
      Defined values are:
      Oktas  Category    Definition
      0     Fine      Sky clear
      1  Fine      1/8 of sky covered or less, but not zero
      2  Fine      2/8 of sky covered
      3     Partly Cloudy  3/8 of sky covered
      4     Partly Cloudy  4/8 of sky covered
      5     Partly Cloudy  5/8 of sky covered
      6     Cloudy    6/8 of sky covered
      7     Cloudy    7/8 of sky covered or more, but not 8/8
      8     Overcast    8/8 of sky completely covered, no breaks
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.7.5"
::= { essNtcipRadiation 5 }
```

5.10 Visibility Data Objects

```
essNtcipVisibility OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects used to describe the visibility data that is
      collected by the ESS.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8"
::= {essNtcip 8 }
```

5.10.1 Visibility

```
-- This object has been deprecated.
essVisibility OBJECT-TYPE
  SYNTAX       Integer32 (0..1000001)
  UNITS        "decimeters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Surface visibility measured in one tenth of a meter.
    <Format>
      The value 1000001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> essVisibilitySensorCurrentReading
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.1"
  REFERENCE "The value for WMO Code Form FM 94 BUFR Table B item 0 20 001 is
      given by this value divided by 100."
::= { essNtcipVisibility 1 }
```

5.10.2 Number of Visibility Sensors

```
essNumVisibilitySensors OBJECT-TYPE
```



```
  SYNTAX       Integer32 (0..255)
  UNITS        "sensors"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the visibility sensor
      table.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a sensor; however, the table is still defined as a
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.2"
::= { essNtcipVisibility 2 }
```

5.10.3 Visibility Situation

```
essVisibilitySituation OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    unknown (2),
    clear (3),
    fogNotPatchy (4),
    patchyFog (5),
    blowingSnow (6),
    smoke (7),
    seaSpray (8),
    vehicleSpray (9),
    blowingDustOrSand (10),
    sunGlare (11),
    swarmsOfInsects (12) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Describes the travel environment in terms of visibility.
      If one exists, the corresponding BUFR value is indicated for staffed
      (BUFRs) and automated (BUFRa) stations. The indicated value can be
      found in the BUFR Table referenced below.
    <Format>
      Range    BUFRs    BUFRa    Meaning
        1             other visibility anomaly
        2             unknown
        3    0    100    clear
        4    44    130    Fog - not patchy
        5    41    131    Patchy fog
        6    36    127    Blowing snow
        7    04    104    Smoke
        8    07    207    Sea Spray
        9             Vehicle Spray
        10    31    127    Blowing dust or sand
        11             sun glare
        12             Swarms of insects
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.3"
  REFERENCE "The values identified in the above table for BUFRa and BUFRs
      can be found in WMO Code Form FM 94 BUFR Table B item 0 20 003."
::= { essNtcipVisibility 3 }
```


5.10.4 Visibility Sensor Height

```
-- This object has been deprecated.
visibilitySensorHeight OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The height of the visibility sensor with respect to the
      essReferenceHeight in meters.
    <Format>
      The value of 1001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essVisibilitySensorZOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.4"
  REFERENCE "essReferenceHeight plus this value equals the WMO Binary Code
      Form FM 94 BUFR Table B item 0 07 001."
::= { essNtcipVisibility 4 }
```

5.10.5 Visibility Sensor Latitude

```
-- This object has been deprecated.
visibilitySensorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the ESS visibility
      sensor, per WGS-84 datum.
    <Format>
      The visibilitySensorLatitude at the North Pole is 90,000,000. The
      visibilitySensorLatitude at the South Pole is -90,000,000. The value
      90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essVisibilitySensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.5"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { essNtcipVisibility 5 }
```

5.10.6 Visibility Sensor Longitude

```
-- This object has been deprecated.
visibilitySensorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS visibility sensor location.
    <Format>
      The visibilitySensorLongitude of 180 degrees West shall be -
180,000,000.
```



```
      The visibilitySensorLongitude of 180 degrees East shall be
      180,000,000. The value 180,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essVisibilitySensorXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.6"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { essNtcipVisibility 6 }
```

5.10.7 Visibility Sensor Location

```
-- This object has been deprecated.
visibilitySensorLocation OBJECT-TYPE
  SYNTAX       DisplayString (SIZE (0..255))
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> A textual string indicating the location of the visibility
      sensor.
    <Parameter Type> configuration
    <Superseded by> essVisibilitySensorLocation
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.7"
::= { essNtcipVisibility 7 }
```

5.10.8 Visibility Sensor Model Information

```
-- This object has been deprecated.
visibilitySensorModelInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the row in the Module Table (See NTCIP 1201)
      that contains information about the make, model, and version number of
      the visibility sensor. If there is more than one visibility sensor,
      the row indicates the information for the primary visibility sensor.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Superseded by> essVisibilitySensorEntityID
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.8"
::= { essNtcipVisibility 8 }
```

5.10.9 Visibility Sensor Table

```
essVisibilitySensorTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF EssVisibilitySensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Table containing the visibility sensor data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.9"
::= { essNtcipVisibility 9 }
```


5.10.10 Visibility Sensor

```
essVisibilitySensorEntry OBJECT-TYPE
  SYNTAX       EssVisibilitySensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> A visibility sensor is a sensor that reports the surface
      visibility distance. It can be described through a number of
      attributes as indicated by the following subclauses.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.9.1"
  INDEX { essPressureSensorIndex }
::= { essVisibilitySensorTable 1 }

EssVisibilitySensorEntry ::= SEQUENCE {
  essVisibilitySensorIndex                Integer32,
  essVisibilitySensorLocation             SnmpAdminString,
  essVisibilitySensorXOffset              ITSInteger16,
  essVisibilitySensorYOffset              ITSInteger16,
  essVisibilitySensorZOffset              ITSInteger16,
  essVisibilitySensorDirection            Integer32,
  essVisibilitySensorEntityID             PhysicalIndexOrZero,
  essVisibilitySensorCurrentReading       Integer32 }
```

5.10.10.1 Visibility Sensor Index

```
essVisibilitySensorIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide visibility
      sensor data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.9.1.1"
::= { essVisibilitySensorEntry 1 }
```

5.10.10.2 Visibility Sensor Location

```
essVisibilitySensorLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the visibility
      sensor.
    <Parameter Type> configuration
    <Informative> Implementations are only required to support the NVT-ASCII
      character set but may support additional UTF-8 characters.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.9.1.2"
::= { essVisibilitySensorEntry 2 }
```

5.10.10.3 Visibility Sensor X Offset

```
essVisibilitySensorXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The lateral offset of the visibility sensor from the field
```



```
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.9.1.3"
::= { essVisibilitySensorEntry 3 }
```

5.10.10.4 Visibility Sensor Y Offset

```
essVisibilitySensorYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the visibility sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.9.1.4"
::= { essVisibilitySensorEntry 4 }
```

5.10.10.5 Visibility Sensor Z Offset

```
essVisibilitySensorZOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset elevation of the visibility sensor from the
      fdConfiguredElevation in centimeters.
    <Format>
      Upward offsets shall be positive and downward offsets shall be
negative.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.9.1.5"
::= { essVisibilitySensorEntry 5 }
```

5.10.10.6 Visibility Sensor Direction

```
essVisibilitySensorDirection OBJECT-TYPE
  SYNTAX       Integer32 (-3..359)
  UNITS        "compass degrees"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The direction in which the sensor measures visibility.
```



```
    <Format>
      Values 0..359 indicate degrees from true north (e.g., 90 indicates
east)
      for sensors that detect back scatter from a distance (e.g., LIDAR).
      The value -1 indicates an error condition. The value -2 shall indicate
      a missing or unknown value. The value -3 shall indicate that the
      sensor detects a localized extinction coefficient to calculate
      visibility range (e.g., forward scatter and transmissometer sensors).
      This format is consist with ITSDirection with the addition of the -3
      value.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.9.1.6"
::= { essVisibilitySensorEntry 6 }
```

5.10.10.7 Visibility Sensor Entity Identifier

```
essVisibilitySensorEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.8.9.1.7"
::= { essVisibilitySensorEntry 7 }
```

5.10.10.8 Visibility Sensor Current Reading

```
essVisibilitySensorCurrentReading OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "decimeters (1/10ths of meter)"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the current surface visibility reading.
    <Format>
      A value of 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.16.2.1.8"
  REFERENCE "WMO Binary Code Form FM 94 BUFR Table B item 0 07 004."
::= { essVisibilitySensorEntry 8 }
```

5.11 Pavement Sensor Objects

```
essNtcipPavement OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects used to describe the data that is collected by the
      pavement surface sensor.
```



```
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9"
::= {essNtcip 9}
```

5.11.1 Number of Pavement Sensors

```
numEssPavementSensors OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "sensors"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the pavement sensor
      table.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a sensor; however, the table is still defined as a
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.1"
::= { essNtcipPavement 1 }
```

5.11.2 Pavement Sensor Table

```
essPavementSensorTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF EssPavementSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Table containing the pavement sensor data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2"
::= { essNtcipPavement 2 }
```

5.11.3 Pavement Sensor

```
essPavementSensorEntry OBJECT-TYPE
  SYNTAX       EssPavementSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> A pavement sensor is a sensor that reports the temperature
      and moisture condition of the roadway pavement. It can be described
      through a number of attributes as indicated by the following
      subclauses."
  INDEX { essPavementSensorIndex }
::= { essPavementSensorTable 1 }

EssPavementSensorEntry ::= SEQUENCE {
    essPavementSensorIndex           Integer32,
    essPavementSensorLocation        SnmpAdminString,
    essPavementType                  INTEGER,
    essPavementElevation             Integer32,
    essPavementExposure              Integer32,
    essPavementSensorType            INTEGER,
    essSurfaceStatus                 INTEGER,
    essSurfaceTemperature            Integer32,
    essPavementTemperature           Integer32,
    essSurfaceWaterDepth             Integer32,
    essSurfaceSalinity               Integer32,
    essSurfaceConductivity           Integer32,
```



```
    essSurfaceFreezePoint             Integer32,
    essSurfaceBlackIceSignal          INTEGER,
    essPavementSensorError            INTEGER,
    essSurfaceIceOrWaterDepth         Integer32,
    essSurfaceConductivityV2          Integer32,
    pavementSensorModelInformation    Integer32,
    pavementSensorTemperatureDepth    Integer32,
    pavementSensorLatitude            Integer32,
    pavementSensorLongitude           Integer32,
    pavementSensorSurfaceCondition    INTEGER,
    pavementSensorForecastCondition   INTEGER,
    pavementSensorFrictionCoefficient Integer32,
    pavementMonitorLatitude           Integer32,
    pavementMonitorLongitude          Integer32,
    pavementIcePercentage             Integer32,
    essPavementMonitorXOffset         ITSInteger16,
    essPavementMonitorYOffset         ITSInteger16,
    essPavementMonitorZOffset         ITSInteger16,
    essPavementSensorXOffset          ITSInteger16,
    essPavementSensorYOffset          ITSInteger16,
    essPavementSensorEntityID         PhysicalIndexOrZero }
```

5.11.3.1 Pavement Sensor Index

```
essPavementSensorIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide surface sensor
      data.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.1"
::= { essPavementSensorEntry 1 }
```

5.11.3.2 Pavement Sensor Location

```
essPavementSensorLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the pavement
      sensor and the location of the pavement being monitored.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.2"
::= { essPavementSensorEntry 2 }
```

5.11.3.3 Pavement Type

```
essPavementType OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    unknown (2),
    asphalt (3),
    openGradedAsphalt (4),
    concrete (5),
    steelBridge (6),
    concreteBridge (7),
```



```
    asphaltOverlayBridge (8),
    timberBridge (9)}
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the type of pavement on the roadway.
    <Format>
      other                a different type of bridge deck
      unknown              the data was never recorded in the system or is a
                           mobile sensor
      asphalt              asphalt pavement on ground
      concrete             concrete pavement on ground
      steelBridgeconcrete  a concrete driving surface on a steel girder
bridge
      steelBridgeAsphalt   an asphalt driving surface on a steel girder
bridge
      steelBridge          a steel lattice driving surface on the bridge
      concreteBridge       a concrete driving surface on a concrete bridge
      concreteBridgeAsphalt an asphalt overlay driving surface on a concrete
                           bridge
      timberBridge         a wooden deck driving surface on the bridge
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.3"
::= { essPavementSensorEntry 3 }
```

5.11.3.4 Pavement Elevation

```
-- This object has been deprecated.
essPavementElevation OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The elevation of the street surface in meters with respect
      to the essReferenceHeight.
    <Format>
      The value 1001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essPavementZOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.4"
::= { essPavementSensorEntry 4 }
```

5.11.3.5 Pavement Exposure

```
essPavementExposure OBJECT-TYPE
  SYNTAX       Integer32 (0..101)
  UNITS        "percent exposure"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates a very rough percentage of the solar energy
      which is anticipated to directly hit the sensor.
    <Format>
      A value of 100 indicates a fully visible sky. A value of 101 shall
      indicate a missing value.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.5"
```



```
::= { essPavementSensorEntry 5 }
```

5.11.3.6 Pavement Sensor Type

```
essPavementSensorType OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    contactPassive (2),
    contactActive (3),
    infrared (4),
    radar (5),
    vibrating (6),
    microwave (7),
    laser (8),
    audio (9) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> A value indicating the type of pavement sensor.
    <Parameter Type> status
    <Informative> The value 'laser' was added in v02. The value 'audio' was
      added in v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.6"
::= { essPavementSensorEntry 6 }
```

5.11.3.7 Surface Status

```
-- This object has been deprecated.
essSurfaceStatus OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    error (2),
    dry (3),
    traceMoisture (4),
    wet (5),
    chemicallyWet (6),
    iceWarning (7),
    iceWatch (8),
    snowWarning (9),
    snowWatch (10),
    absorption (11),
    dew (12),
    frost (13),
    absorptionAtDewpoint (14) }
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> A value indicating the pavement surface status.
    <Format>
      other - The value reported by the sensor is not defined by the
standard.
          See the manufacturer's documentation for more information.
      noReport - The sensor is not providing any reading for surface status
and
          may not be responding
      errorReport - The sensor is providing a reading for surface status, but
          either the reading indicates an error code or the data has been
deemed
          invalid or suspect
```



```
      dry - The sensor does not detect any moisture or unusual conditions.
      trace - The sensor detects some moisture, but it is suspected to be
          isolated
      absorption - A salt chemical is present that is not fully dissolved in
          water. As a result, the conductivity readings result in erroneous
          calculations for amount of chemical in the mix.
      wet - The sensor detects a significant amount of moisture indicating a
wet
          roadway.
      chemically wet - The sensor detects a signaificant amount of moisture
          mixed with a de-icing or anti-icing chemical
      dew - The sensor detects moisture that is suspected to be from the
          formation of dew
      frost - The sensor detects the formation of frost
      freezeAdvisory - The risk of the formation of some sort of frozen
moisture
          on the roadway is elevated, but its occurrence, location, and/or
          timing is still uncertain
      slushAdvisory - The risk of the accumulation of snow or slush on the
          roadway is elevated, but its occurrence, location, and/or timing is
          still uncertain
      iceAdvisory - The risk of the formation of ice or black ice on the
roadway
          is elevated, but its occurrence, location, and/or timing is still
          uncertain
      freezeHazard - The sensor detects some sort of frozen moisture but is
          unable to classify as slush or ice.
      slush - The sensor detects snow or slush.
      ice - The sensor detects ice or black ice. (See
essSurfaceBlackIceSignal)
    <Parameter Type> status
    <Superseded by> pavementSesnsorSurfaceCondition (See 5.11.3.22) and
      pavementSensorForecastCondition (See 5.11.3.23)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.7"
::= { essPavementSensorEntry 7 }
```

5.11.3.8 Surface Temperature

```
essSurfaceTemperature OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "tenths of degrees Celsius"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The current pavement surface temperature in tenths of
      degrees Celsius.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.8"
::= { essPavementSensorEntry 8 }
```

5.11.3.9 Pavement Temperature

```
essPavementTemperature OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "tenths of degrees Celsius"
  MAX-ACCESS   read-only
```



```
  STATUS       current
  DESCRIPTION
    "<Definition> The current pavement temperature 2-10 cm below the
      pavement surface in tenths of degrees Celsius. The specific depth at
      which the reading is taken is defined by
      pavementSensorTemperatureDepth.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.9"
::= { essPavementSensorEntry 9 }
```

5.11.3.10 Surface Water Depth

```
-- This object has been deprecated.
essSurfaceWaterDepth OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "millimeters"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The current depth of water on the surface of the roadway
      measured in millimeters. The value 255 shall indicate an error
      condition or missing value.
    <Parameter Type> status
    <Superseded by> essSurfaceIceOrWaterDepth (See 5.11.3.16)
    <Informative> This object was deprecated in version 2.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.10"
::= { essPavementSensorEntry 10 }
```

5.11.3.11 Surface Salinity

```
essSurfaceSalinity OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "parts per 100,000 by weight"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The pavement salinity in parts per one hundred thousand by
      weight (i.e., grams of solute per 100,000 grams of solution).
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.11"
::= { essPavementSensorEntry 11 }
```

5.11.3.12 Surface Conductivity

```
-- This object has been deprecated.
essSurfaceConductivity OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "mhos"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the conductance of the ice/liquid mixture on the
      pavement as detected by the sensor, in mhos, which is the inverse of
      ohms. The value 65535 shall indicate an error condition or missing
      value.
```

```
    <Parameter Type> status
    <Superseded by> essSurfaceConductivityV2 (See 5.11.3.17)
    <Informative> This object was deprecated in version 2.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.12"
::= { essPavementSensorEntry 12 }
```

5.11.3.13 Surface Freezing Point

```
essSurfaceFreezePoint OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "tenths of degrees Celsius"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The temperature in tenths of degrees Celsius at which the
      existing solution on the roadway freezes.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.13"
::= { essPavementSensorEntry 13 }
```

5.11.3.14 Surface Black Ice Signal

```
essSurfaceBlackIceSignal OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    noIce (2),
    blackIce (3),
    detectorError (4) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> A value indicating if Black Ice is detected by the sensor.
    <Format>
      other - The sensor is reporting a value that is not defined by the
          standard. See the manufacturer's documentation for more
information.
      noIce - The sensor is not currently detecting black ice.
      blackIce - The sensor is currently detecting black ice.
      detectorError - The sensor is not connected, is not reporting, or is
          reporting an error.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.14"
::= { essPavementSensorEntry 14 }
```

5.11.3.15 Pavement Sensor Error

```
essPavementSensorError OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    none (2),
    noResponse (3),
    cutCable (4),
    shortCircuit (5),
    dirtyLens (6) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
```



```
    "<Definition> A value indicating the type of pavement sensor error.
    <Format>
      other - An error has been detected that is not defined by the standard;
          see the manufacturer's documentation for more information.
      none - No error is detected, the sensor appears to be working properly
      noResponse - The sensor is configured and is believed to be connected,
          but is not responding
      cutCable - The sensor is not configured, not present or not fully
          connected, perhaps because the cable was cut
      shortCircuit - The sensor input has detected a short-circuit.
      dirtyLens - The lens of the sensor appears to be dirty.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.15"
::= { essPavementSensorEntry 15 }
```

5.11.3.16 Surface Water Depth—Version 2

```
essSurfaceIceOrWaterDepth OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of millimeters"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The current thickness of ice or depth of water on the
      surface of the roadway measured in 1/10th of millimeters.
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.16"
::= { essPavementSensorEntry 16 }
```

5.11.3.17 Surface Conductivity—Version 2

```
essSurfaceConductivityV2 OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "tenths of milli-mhos/cm"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the conductivity of the ice/liquid mixture on
      the pavement as detected by the sensor, in 1/10ths of milli-mhos/cm
      (mhos is the inverse of ohms). This value is independent of the size
      or shape of the sensor and can be directly translated into a percent
      concentration of chemical (e.g. salinity) through look-up tables for a
      given chemical.
    <Format>
      The value  65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.17"
::= { essPavementSensorEntry 17 }
```

5.11.3.18 Pavement Sensor Model Information

```
-- This object has been deprecated.
pavementSensorModelInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
```



```
    "<Definition> Indicates the row in the Module Table (See NTCIP 1201)
      that contains information about the make, model, and version number of
      the sensor associated with this row of the Pavement Sensor Table.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Supplanted by> pavementSensorEntityID (See 5.11.3.28)
    <Informative> This object was deprecated in version 5.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.18"
::= { essPavementSensorEntry 18 }
```

5.11.3.19 Pavement Temperature Depth

```
pavementSensorTemperatureDepth OBJECT-TYPE
  SYNTAX       Integer32 (2..11)
  UNITS        "centimeters"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The depth at which the pavement temperature is detected.
    <Format>
      The value of 11 indicates that the information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.19"
::= { essPavementSensorEntry 19 }
```

5.11.3.20 Pavement Sensor Latitude

```
-- This object has been deprecated.
pavementSensorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the ESS pavement sensor,
      per WGS-84 datum.
    <Format>
      The pavementSensorLatitude at the North Pole is 90,000,000. The
      pavementSensorLatitude at the South Pole is -90,000,000. The value
      90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> pavementSensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.20"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { essPavementSensorEntry 20 }
```

5.11.3.21 Pavement Sensor Longitude

```
-- This object has been deprecated.
pavementSensorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees longitude"
```



```
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS pavement sensor location.
    <Format>
      The pavementSensorLongitude of 180 degrees West shall be -180,000,000.
      The pavementSensorLongitude of 180 degrees East shall be 180,000,000.
      The value 180,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> pavementSensorXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.21"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { essPavementSensorEntry 21 }
```

5.11.3.22 Pavement Surface Condition

```
pavementSensorSurfaceCondition OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    error (2),
    dry (3),
    moist (4),
    chemicallyMoist(5),
    wet (6),
    chemicallyWet (7),
    standingWater (8),
    frost (9),
    slush (10),
    snow (11),
    ice (12),
    noReport (13)  }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> A value indicating the pavement surface status.
    <Format>
      other: The value reported by the sensor is not defined by the standard.
          See the manufacturer's documentation for more information
      error: The sensor is providing a reading for surface status, but either
          the reading indicates an error code or the data has been deemed
          invalid or suspect
      dry: no humidity over the sensor (EN 15518-3)
      moist: from 0.01 mm to 0.2 mm water film thickness over the sensor
          (EN 15518-3)
      chemically moist: from 0.01 mm to 0.2 mm water film thickness over the
          sensor mixed with de-icing or anti-icing chemical
      wet: from 0.2 mm water film thickness to 2.0 mm water film thickness
over
          the sensor (EN 15518-3)
      chemically wet: from 0.2 mm water film thickness or greater mixed with
          de-icing or anti-icing chemical
      standing water: from 2.0 mm or greater water film thickness over the
          sensor (EN 15518-3)
      frost: formation of frost (ice crystals) is detected over the sensor
```

```
      slush: snow or ice that has been reduced to a soft water mixture by
rain,
          warm temperature, and/or chemical treatment (Glossary of
Meteorology)
      snow: snow is detected over the sensor
      ice: ice or black ice is detected (See essSurfaceBlackIceSignal)
      noReport: The sensor is not providing any reading for surface status
and
          may not be responding
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.22"
::= { essPavementSensorEntry 22 }
```

5.11.3.23 Pavement Forecasted Condition

```
pavementSensorForecastCondition OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    error (2),
    noAdvisory (3),
    iceAdvisory (4),
    slushAdvisory(5),
    freezeAdvisory (6),
    freezeHazard (7),
    noReport (8)  }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> A value indicating the pavement surface status.
    <Format>
      other: The value reported by the sensor is not defined by the standard.
          See the manufacturer's documentation for more information.
      error: The sensor is providing a reading for surface status, but either
          the reading indicates an error code or the data has been deemed
          invalid or suspect
      noAdvisory: No frozen moisture is detected and the risk of frozen
moisture
          is low.
      iceAdvisory: The risk of the formation of ice or black ice on the
roadway
          is elevated, but its occurrence, location, and/or timing is still
          uncertain
      slushAdvisory: The risk of the accumulation of snow or slush on the
          roadway is elevated, but its occurrence, location, and/or timing is
          still uncertain
      freezeAdvisory: The risk of the formation of some sort of frozen
moisture
          on the roadway is elevated, but its occurrence, location, and/or
          timing is still uncertain
      freezeHazard: The sensor detects some sort of frozen moisture but is
          unable to classify as slush or ice
      noReport: The sensor is not providing any reading for surface status
and
          may not be responding
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.23"
::= { essPavementSensorEntry 23 }
```


5.11.3.24 Pavement Surface Friction Coefficient

```
pavementSensorFrictionCoefficient OBJECT-TYPE
  SYNTAX       Integer32 (0..101)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> A value representing the manufacturer's estimate of the
      friction coefficient of the roadway pavement for the specified
      pavement sensor. The actual coefficient of friction is dependent on
      many variables, including characteristics of the tire traveling on the
      pavement; thus it is recognized that it is impossible to provide a
      single mathematically precise value. However, the reported friction
      coefficient shall be based on an empirical model that has a strong
      correlation with actual measured friction coefficients using a
      standard test method and test apparatus, such as a decelerometer or a
      locked-wheel tester. The estimate is provided in hundredths (i.e., if
      the weight of a vehicle is 15,000 N and the estimated friction
      coefficient is 50, the resultant friction force offered by locked
      wheels on the pavement is expected to be approximately 15,000 N *
      50/100 = 7,500 N). This value should not be compared across vendors or
      sites due to the number of site-specific factors that can impact its
      accuracy, but the value can be useful to gauge the relative friction
      of a specific site at different points in time. For example, this
      value could be used to activate a warning message, but the exact value
      that would trigger that condition would need to be discovered
      empirically at each site.
    <Format>
      The value 101 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.24"
::= { essPavementSensorEntry 24 }
```

5.11.3.25 Pavement Monitoring Latitude

```
-- This object has been deprecated.
pavementMonitorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the location that the ESS
      pavement sensor is monitoring, per WGS-84 datum. A value of 0 for this
      object and pavementMonitorLongitude indicates that the location being
      monitored is the same as defined in pavementSensorLatitude and
      pavementSensorLongitude.
    <Format>
      The pavementMonitorLatitude at the North Pole is 90,000,000. The
      pavementMonitorLatitude at the South Pole is -90,000,000. The value
      90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essPavementMonitorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.25"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
```

```
::= { essPavementSensorEntry 25 }
```

5.11.3.26 Pavement Monitoring Longitude

```
-- This object has been deprecated.
pavementMonitorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the location that the ESS pavement sensor is monitoring. A
      value of 0 for this object and pavementMonitorLatitude indicates that
      the location being monitored is the same as defined in
      pavementSensorLatitude and pavementSensorLongitude.
    <Format>
      The pavementMonitorLongitude of 180 degrees West shall be -180,000,000.
      The pavementMonitorLongitude of 180 degrees East shall be 180,000,000.
      The value 180,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essPavementMonitorXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.26"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { essPavementSensorEntry 26 }
```

5.11.3.27 Pavement Ice Percentage

```
pavementIcePercentage OBJECT-TYPE
  SYNTAX       Integer32 (0..101)
  UNITS        "percent"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The percentage of ice on the surface by volume.
    <Format>
      The value 101 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.27"
::= { essPavementSensorEntry 27 }
```

5.11.3.28 Pavement Monitor X Offset

```
essPavementMonitorXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The X offset of the pavement monitor site from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
```



```
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.28"
::= { essPavementSensorEntry 28 }
```

5.11.3.29 Pavement Monitor Y Offset

```
essPavementMonitorYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the pavement monitor site from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.29"
::= { essPavementSensorEntry 29 }
```

5.11.3.30 Pavement Monitor Z Offset

```
essPavementMonitorZOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset elevation of the pavement at the monitor site
      as measured from the fdConfiguredElevation in centimeters.
    <Format>
      Upward offsets shall be positive and downward offsets shall be
negative.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.30"
::= { essPavementSensorEntry 30 }
```

5.11.3.31 Pavement Sensor X Offset

```
essPavementSensorXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The X offset of the pavement sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
```



```
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.31"
::= { essPavementSensorEntry 31 }
```

5.11.3.32 Pavement Sensor Y Offset

```
essPavementSensorYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the pavement sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.32"
::= { essPavementSensorEntry 32 }
```

5.11.3.33 Pavement Sensor Entity Identifier

```
essPavementSensorEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.2.1.33"
::= { essPavementSensorEntry 33 }
```

5.11.4 Number of Subsurface Sensors

```
numEssSubSurfaceSensors OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "sensors"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the Subsurface Sensor
      Table.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a sensor; however, the table is still defined as a
```



```
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.3"
::= { essNtcipPavement 3 }
```

5.11.5 Subsurface Sensor Table

```
essSubSurfaceSensorTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF EssSubSurfaceSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Table containing the subsurface sensor data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4"
::= { essNtcipPavement 4 }
```

5.11.6 Subsurface Sensor

```
essSubSurfaceSensorEntry OBJECT-TYPE
  SYNTAX       EssSubSurfaceSensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> A subsurface sensor is a sensor that reports the
      temperature and moisture condition of the roadway subsurface. It can
      be described through a number of attributes as indicated by the
      following subclauses."
  INDEX { essSubSurfaceSensorIndex }
::= { essSubSurfaceSensorTable 1 }

EssSubSurfaceSensorEntry ::= SEQUENCE {
    essSubSurfaceSensorIndex            Integer32,
    essSubSurfaceSensorLocation         SnmpAdminString,
    essSubSurfaceType                   INTEGER,
    essSubSurfaceSensorDepth            Integer32,
    essSubSurfaceTemperature            Integer32,
    essSubSurfaceSensorEntityID         PhysicalIndexOrZero,
    essSubSurfaceMoisture               Integer32,
    essSubSurfaceSensorError            INTEGER,
    essSubSurfaceSensorLatitude         Integer32,
    essSubSurfaceSensorLongitude        Integer32,
    essSubSurfaceSensorModelInformation Integer32,
    essSubSurfaceSensorXOffset          ITSInteger16,
    essSubSurfaceSensorYOffset          ITSInteger16 }
```

5.11.6.1 Subsurface Sensor Index

```
essSubSurfaceSensorIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide subsurface
      sensor data.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.1"
::= { essSubSurfaceSensorEntry 1 }
```


5.11.6.2 Subsurface Sensor Location

```
essSubSurfaceSensorLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the subsurface
      sensor.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.2"
::= { essSubSurfaceSensorEntry 2 }
```

5.11.6.3 Subsurface Type

```
essSubSurfaceType OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    unknown (2),
    concrete (3),
    asphalt (4),
    openGradedAsphalt (5),
    gravel (6),
    clay (7),
    loam (8),
    sand (9),
    permafrost (10),
    variousAggregates (11),
    air (12) }
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the type of subsurface. A value of air would
      indicate a bridge.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.3"
::= { essSubSurfaceSensorEntry 3 }
```

5.11.6.4 Subsurface Sensor Depth

```
essSubSurfaceSensorDepth OBJECT-TYPE
  SYNTAX       Integer32 (0..1001)
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Depth of subsurface sensor in centimeters below the
      pavement surface.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.4"
::= { essSubSurfaceSensorEntry 4 }
```

5.11.6.5 Subsurface Temperature

```
essSubSurfaceTemperature OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "tenths of degrees Celsius"
  MAX-ACCESS   read-only
```

```
  STATUS       current
  DESCRIPTION
    "<Definition> The current subsurface temperature in tenths of degrees
      Celsius.
    <Format>
      The value 1001 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.5"
::= { essSubSurfaceSensorEntry 5 }
```

5.11.6.6 Subsurface Sensor Entity Identifier

```
essSubSurfaceSensorEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.6"
::= { essSubSurfaceSensorEntry 6 }
```

5.11.6.7 Subsurface Moisture

```
essSubSurfaceMoisture OBJECT-TYPE
  SYNTAX       Integer32 (0..101)
  UNITS        "percent moisture"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The subsurface moisture expressed as a percentage (e.g. 0
      indicates dry, 100 indicates saturated).
    <Format>
      The value 101 indicates an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.7"
::= { essSubSurfaceSensorEntry 7 }
```

5.11.6.8 Subsurface Sensor Error

```
essSubSurfaceSensorError OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    none (2),
    noResponse (3),
    cutCable (4),
    shortCircuit (5) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> A value indicating the type of sensor error.
    <Format>
```



```
      other - An error has been detected that is not defined by the standard;
          see the manufacturer's documentation for more information.
      none - No error is detected, the sensor appears to be working properly
      noResponse - The sensor is configured and is believed to be connected,
but
          is not responding
      cutCable - The sensor is not configured, not present or not fully
          connected, perhaps because the cable was cut
      shortCircuit - The sensor input has detected a short-circuit.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.8"
::= { essSubSurfaceSensorEntry 8 }
```

5.11.6.9 Subsurface Sensor Latitude

```
-- This object has been deprecated.
essSubSurfaceSensorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the ESS subsurface
      sensor, per WGS-84 datum.
    <Format>
      The essSubSurfaceSensorLatitude at the North Pole is 90,000,000. The
      essSubSurfaceSensorLatitude at the South Pole is -90,000,000. The
      value 90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essSubSurfaceSensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.9"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { essSubSurfaceSensorEntry 9 }
```

5.11.6.10 Subsurface Sensor Longitude

```
-- This object has been deprecated.
essSubSurfaceSensorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS subsurface sensor location.
    <Format>
      The essSubSurfaceSensorLongitude of 180 degrees West shall be
      -180,000,000. The essSubSurfaceSensorLongitude of 180 degrees East
      shall be 180,000,000. The value 180,000,001 shall indicate a missing
      value.
    <Parameter Type> configuration
    <Superseded by> essSubSurfaceSensorXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.10"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
```



```
      obtained by dividing this value by 10."
::= { essSubSurfaceSensorEntry 10 }
```

5.11.6.11 Subsurface Sensor Model Information

```
-- This object has been deprecated.
essSubSurfaceSensorModelInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the row in the Module Table (See NTCIP 1201)
      that contains information about the make, model, and version number of
      the sensor associated with this row of the SubSurface Sensor Table.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Supplanted by> essSubSurfaceSensorEntityID (See 5.11.6.11)
    <Informative> This object was deprecated in version 5.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.11"
::= { essSubSurfaceSensorEntry 11 }
```

5.11.6.12 Subsurface Sensor X Offset

```
essSubSurfaceSensorXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset latitude of the subsurface sensor from the
      field device's reference location as defined by fdConfiguredLatitude
      and fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.12"
::= { essSubSurfaceSensorEntry 12 }
```

5.11.6.13 Subsurface Sensor Y Offset

```
essSubSurfaceSensorYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the subsurface sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
```

```
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.4.1.13"
::= { essSubSurfaceSensorEntry 13 }
```

5.11.7 Pavement Block

```
-- This object has been deprecated.
essPavementBlock OBJECT-TYPE
  SYNTAX       ITSOerString
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> An OER encoded string of the EssPavementData structure as
      defined below. This object is used for uploading current pavement data
      from the ESS in a bandwidth efficient manner.
    <Format>
      The OPTIONAL fields shall be present if the data is supported by the
      implementation and is valid. The OPTIONAL fields shall be omitted for
any
      data that is invalid or not supported by the implementation.


      EssPavementData ::= SEQUENCE OF PavementSensorData
        -- for (
      --  x = 1;
      --  x < numEssPavementSensors.0;
      --  x++)




      PavementSensorData ::= SEQUENCE {
        essPavementSensorIndex.x    OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceStatusV2.x      OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceTemperature.x      OPTIONAL, -- @NTCIP1204-Ess
        essPavementTemperature.x    OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceWaterDepth.x      OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceSalinity.x      OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceConductivity.x    OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceFreezePoint.x      OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceBlackIceSignal.x    OPTIONAL, -- @NTCIP1204-Ess
        essPavementSensorError.x    OPTIONAL  -- @NTCIP1204-Ess
      }
    <Parameter Type> status
    <Superseded by> essPavementV3Block (See 5.11.9)
    <Informative> This object was deprecated in version 03.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.5"
::= { essNtcipPavement 5 }
```

5.11.8 Subsurface Block Object

```
-- This object has been deprecated.
essSubSurfaceBlock OBJECT-TYPE
  SYNTAX       ITSOerString
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> An OER encoded string of the EssSubsurfaceData structure
```



```
      as defined below. This object is used for uploading current subsurface
      data from the ESS in a bandwidth efficient manner.
    <Format>
      The OPTIONAL fields shall be present if the data is supported by the
      implementation and is valid. The OPTIONAL fields shall be omitted for
any
      data that is invalid or not supported by the implementation.


      EssSubSurfaceData ::= SEQUENCE OF SubSurfaceSensorData
        -- for (
      --  x = 1;
      --  x < numEssSubSurfaceSensors.0;
      --  x++)


      SubSurfaceSensorData ::= SEQUENCE {
        essSubSurfaceSensorIndex.x    OPTIONAL, -- @NTCIP1204-Ess
        essSubSurfaceTemperature.x    OPTIONAL, -- @NTCIP1204-Ess
        essSubSurfaceMoisture.x      OPTIONAL, -- @NTCIP1204-Ess
        essSubSurfaceSensorError.x    OPTIONAL  -- @NTCIP1204-Ess
        }
    <Parameter Type> status
    <Informative> This object was deprecated and withdrawn in version 05 as
      the associated requirement was deemed to be no longer necessary in
      version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.6"
::= { essNtcipPavement 6 }
```

5.11.9 Pavement Block V3

```
-- This object has been deprecated.
essPavementV3Block OBJECT-TYPE
  SYNTAX       ITSOerString
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> An OER encoded string of the EssPavementDataV3 structure
      as defined below. This object is used for uploading current pavement
      data from the ESS in a bandwidth efficient manner.
    <Format>
      The OPTIONAL fields shall be present if the data is supported by the
      implementation and is valid. The OPTIONAL fields shall be omitted for
any
      data that is invalid or not supported by the implementation.


      EssPavementDataV3 ::= SEQUENCE OF PavementSensorDataV3
        -- for (
      --  x = 1;
      --  x < numEssPavementSensors.0;
      --  x++)




      PavementSensorDataV3 ::= SEQUENCE {
        essPavementSensorIndex.x    OPTIONAL, -- @NTCIP1204-Ess
```

```
        essSurfaceStatus.x      OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceTemperature.x      OPTIONAL, -- @NTCIP1204-Ess
        essPavementTemperature.x    OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceSalinity.x      OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceFreezePoint.x      OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceBlackIceSignal.x    OPTIONAL, -- @NTCIP1204-Ess
        essPavementSensorError.x    OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceIceOrWaterDepth.x    OPTIONAL, -- @NTCIP1204-Ess
        essSurfaceConductivityV2.x    OPTIONAL  -- @NTCIP1204-Ess
      }
    <Parameter Type> status
    <Informative> This object was deprecated and withdrawn in NTCIP 1204 v04
      as the associated requirement was deemed to be no longer necessary.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.9.7"
::= { essNtcipPavement 7 }
```

5.12 Mobile Platform Objects

```
essNtcipMobile OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects related to monitoring mobile platforms that act as
      an ESS (e.g., specially-equipped maintenance vehicles).
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.10"
::= {essNtcip 10}
```

5.12.1 Detected Friction

```
-- This object has been deprecated.
essMobileFriction OBJECT-TYPE
  SYNTAX       Integer32 (0..101)
  UNITS        "percent friction"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates measured coefficient of friction in percent.
    <Format>
      The value 101 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> pavementSensorFrictionCoefficient (See 5.11.3.24)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.10.1"
::= { essNtcipMobile 1 }
```

5.12.2 Observed Ground State

```
-- This object has been deprecated.
essMobileObservationGroundState OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    dry (2),
    moist (3),
    wet (4),
    flooded (5),
    frozen (6),
    glaze (7),
    dustySandy (8),
    veryDry (9),
    icy (10),
```



```
    patchyWetSnow (11),
    moderateWetSnowCover (12),
    fullWetSnowCover (13),
    patchyDrySnow (14),
    moderateDrySnowCover (15),
    fullDrySnowCover (16),
    driftingSnow (17),
    unknown (18) }
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The prevailing observed ground state of the surrounding
      environment as determined by the observer. This is an indicator of
      past weather conditions.
    <Parameter Type> status
    <Superseded by> essMobileObservationGroundStateV4 (See 5.12.4)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.10.2"
::= { essNtcipMobile 2 }
```

5.12.3 Observed Pavement State

```
-- This object has been deprecated.
essMobileObservationPavement OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    dry (2),
    wet (3),
    puddles (4),
    shallowStandingWater (5),
    shallowFlowingWater (6),
    deepStandingWater (7),
    deepFlowingWater (8),
    dustingFreshSnow (9),
    moderateFreshSnow (10),
    deepFreshSnow (11),
    plowedSnow (12),
    slush (13),
    packedSnowPatches (14),
    packedSnow (15),
    lightSnowDrifts (16),
    moderateSnowDrifts (17),
    heavySnowDrifts (18),
    frost (19),
    icePatches (20),
    moderatelyIcy (21),
    heavyIcing (22),
    blackIce (23),
    sheetIce (24),
    frozenSlush (25) }
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The prevailing observed conditions on the driving surface
      as determined by the observer.
    <Parameter Type> status
    <Superseded by> essMobileObservationPavementV4 (See 5.12.5)
    <Informative> This object was deprecated in version 04.
```

```
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.10.3"
::= { essNtcipMobile 3 }
```

5.12.4 Observed Ground State - Version 4

```
essMobileObservationGroundStateV4 OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    dry (2),
    moist (3),
    wet (4),
    flooded (5),
    frozen (6),
    glaze (7),
    dustySandy (8),
    veryDry (9),
    icy (10),
    patchyWetSnow (11),
    moderateWetSnowCover (12),
    fullWetSnowCover (13),
    patchyDrySnow (14),
    moderateDrySnowCover (15),
    fullDrySnowCover (16),
    driftingSnow (17),
    unknown (18),
   puddles (19),
   standingWater (20),
   flowingWater (21),
   freshSnow (22),
   plowedSnow (23),
   slush (24) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The prevailing observed ground state of the surrounding
      environment as determined by the observer. This is an indicator of
      past weather conditions.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.10.4"
::= { essNtcipMobile 4 }
```

5.12.5 Observed Pavement State - Version 4

```
essMobileObservationPavementV4 OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    dry (2),
    wet (3),
    puddles (4),
    shallowStandingWater (5),
    shallowFlowingWater (6),
    deepStandingWater (7),
    deepFlowingWater (8),
    dustingFreshSnow (9),
    moderateFreshSnow (10),
    deepFreshSnow (11),
    plowedSnow (12),
    slush (13),
    packedSnowPatches (14),
```



```
    packedSnow (15),
    lightSnowDrifts (16),
    moderateSnowDrifts (17),
    heavySnowDrifts (18),
    frost (19),
    icePatches (20),
    moderatelyIcy (21),
    heavyIcing (22),
    blackIce (23),
    sheetIce (24),
    frozenSlush (25),
   absorption (26),
   absorptionAtDewpoint (27),
   bareAndDry (28),
   bareAndWet (29),
   blowingsnow (30),
   chemicallyWet (31),
   dew (32),
   damp (33),
   wetSlush (34) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The prevailing observed conditions on the driving surface
      as determined by the observer.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.10.5"
::= { essNtcipMobile 5 }
```

5.13 Pavement Treatment Objects

```
essNtcipTreatment OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects that monitor the various types and amounts of
      treatments that are spread on the pavement surface.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11"
::= { essNtcip 11 }
```

5.13.1 Number of Treatments

```
numEssTreatments OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "treatments"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the Pavement Treatment
      Table.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.1"
::= { essNtcipTreatment 1 }
```

5.13.2 Pavement Treatment Table

```
essPavementTreatmentTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF EssPavementTreatmentEntry
  MAX-ACCESS   not-accessible
  STATUS       current
```



```
  DESCRIPTION
    "<Definition> Table containing the pavement treatment data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.2"
::= { essNtcipTreatment 2 }
```

5.13.3 Pavement Treatment

```
essPavementTreatmentEntry OBJECT-TYPE
  SYNTAX       EssPavementTreatmentEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> A pavement treatment is a chemical that can be applied to
      the roadway to de-ice or prevent icing of the pavement. It can be
      described through a number of attributes as indicated by the following
      subclauses."
  INDEX { essPavementTreatmentIndex }
::= { essPavementTreatmentTable 1 }

EssPavementTreatmentEntry ::= SEQUENCE {
  essPavementTreatmentIndex               Integer32,
  essPaveTreatProductType                 INTEGER,
  essPaveTreatProductForm                 INTEGER,
  essPercentProductMix                    Integer32}
```

5.13.3.1 Pavement Treatment Index

```
essPavementTreatmentIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide pavement
      treatment data.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.2.1.1"
::= { essPavementTreatmentEntry 1 }
```

5.13.3.2 Pavement Treatment Product Type

```
essPaveTreatProductType OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    sand (2),
    dirt (3),
    gravel (4),
    cinders (5),
    water (6),
    enhancedSalts (7),
    naCl (8),
    caCl (9),
    mgCl (10),
    cMA (11),
    kAC (12),
    naFormate (13),
    naA (14) }
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
```



```
    "<Definition> Indicates the type of treatment being applied to the road.
      An enhanced definition of some of the values are as follows: other -
      any other type of treatment water - used as a diluting agent cMA -
      Calcium-Magnesium Acetate kAC - Potassium-Magnesium Acetate naFormate
      - Sodium Formate naA - Sodium Acetate
    <Format>
      An enhanced definition of some of the values are as follows.
      other - any other type of treatment
      water - used as a diluting agent
      cMA - Calcium-Magnesium Acetate
      kAC - Potassium-Magnesium Acetate
      naFormate - Sodium Formate
      naA - Sodium Acetate
    <Parameter Type> configuration
    <Informative> Version 02 of this standard incorrectly defined the set
      constraint of this read-write object to be read-only; it should be
      always, however, the intent is that it would only be set by a local
      connection when the new product is being loaded and that remote
      systems would only read this object.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.2.1.2"
::= { essPavementTreatmentEntry 2 }
```

5.13.3.3 Treatment Product Form

```
essPaveTreatProductForm OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    dry (2),
    prewet (3),
    liquid (4) }
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the condition of the treatment being applied to
      the road.
    <Parameter Type> configuration
    <Informative> Version 02 and 03 of this standard incorrectly defined the
      set constraint of this read-write object to be read-only; it should be
      always, however, the intent is that it would only be set by a local
      connection when the new product is being loaded and that remote
      systems would only read this object.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.2.1.3"
::= { essPavementTreatmentEntry 3 }
```

5.13.3.4 Percentage of Treatment Type in Mix

```
essPercentProductMix OBJECT-TYPE
  SYNTAX       Integer32 (0..100)
  UNITS        "percent"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the percentage of the total application mix by
      weight that is of the type specified in essPaveTreatProductType.
    <Format>
      The sum of these percentages within the total mixture shall equal 100.
    <Parameter Type> configuration
    <Informative> Version 02 of this standard incorrectly defined the set
      constraint of this read-write object to be read-only; it should be
```



```
      always, however, the intent is that it would only be set by a local
      connection when the new product is being loaded and that remote
      systems would only read this object.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.2.1.4"
::= { essPavementTreatmentEntry 4 }
```

5.13.4 Treatment Amount

```
essPaveTreatmentAmount OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        " kilograms per lane kilometer"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates quantity of the treatment being applied in
      kilograms per lane kilometer.
    <Format>
      The value of 255 shall indicate an error condition or missing value.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.3"
::= { essNtcipTreatment 3 }
```

5.13.5 Treatment Width

```
essPaveTreatmentWidth OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "meters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the width of the spread of treatment in meters.
    <Format>
      The value of 255 shall indicate an error condition or missing value.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.4"
::= { essNtcipTreatment 4 }
```

5.13.6 Pavement Treatment Block

```
-- This object has been deprecated.
pavementTreatmentBlock OBJECT-TYPE
  SYNTAX       ITSOerString
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> An OER encoded string of the Pavement Treatment data. This
      object is used for uploading current pavement treatment data from the
      ESS in a bandwidth efficient manner.
    <Format>
      The OPTIONAL fields shall be present if the data is supported by the
      implementation and is valid. The OPTIONAL fields shall be omitted for
any
      data that is invalid or not supported by the implementation.


      Note: The following structure contains pts data elements in addition to
      the ess data elements. Although these are not currently required to
```



```
      fulfill any existing requirements, they are included to maintain
backward
      compatibility with the version 02 standard.


      PavementTreatmentBlock ::= SEQUENCE {
        treatmentInfo  SEQUENCE OF PavementTreatmentData OPTIONAL,
        essPaveTreatmentAmount.0  OPTIONAL, -- @NTCIP1204-Ess
        essPaveTreatmentWidth.0    OPTIONAL, -- @NTCIP1204-Ess
        ptsOperationalMode.0    OPTIONAL, -- @NTCIP1204-Ess
        ptsCommandState.0      OPTIONAL, -- @NTCIP1204-Ess
        ptsSprayerState.0      OPTIONAL, -- @NTCIP1204-Ess
        ptsSignalDuration.0    OPTIONAL, -- @NTCIP1204-Ess
        ptsSignalEventCount.0    OPTIONAL, -- @NTCIP1204-Ess
        ptsLastSignalEvent.0    OPTIONAL, -- @NTCIP1204-Ess
        ptsActiveEventCount.0    OPTIONAL, -- @NTCIP1204-Ess
        ptsInactiveEventCount.0    OPTIONAL, -- @NTCIP1204-Ess
        ptsLastactiveEvent.0    OPTIONAL, -- @NTCIP1204-Ess
        ptsLastInactiveEvent.0    OPTIONAL, -- @NTCIP1204-Ess
        ptsError.0        OPTIONAL, -- @NTCIP1204-Ess
        ptsMonitoringDetectors.0  OPTIONAL  -- @NTCIP1204-Ess
      }


      PavementTreatmentData ::=
        -- for (
        --  x = 1;
        --  x < numEssTreatments.0;
        --  x++)
      SEQUENCE {
        essPavementTreatmentIndex.x    OPTIONAL, -- @NTCIP1204-Ess
        essPaveTreatProductType.x    OPTIONAL, -- @NTCIP1204-Ess
        essPaveTreatProductForm.x    OPTIONAL, -- @NTCIP1204-Ess
        essPercentProductMix.x      OPTIONAL  -- @NTCIP1204-Ess
      }
    <Parameter Type> status
    <Informative> This object was deprecated and withdrawn in version 05 as
      the associated requirement was deemed to be no longer necessary in
      version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.5"
::= { essNtcipTreatment 5 }
```

5.13.7 Operational Mode [Obsolete]

```
-- This object is obsolete.
ptsOperationalMode OBJECT-TYPE
  SYNTAX       INTEGER {
    off (1),
    manual (2),
    automatic (3) }
  MAX-ACCESS   read-write
  STATUS       obsolete
  DESCRIPTION
    "<Definition> Indicates the operational mode of the Pavement Treatment
System.
      When in the 'off' state, the PTS shall not trigger the sprayer even if
      commanded to do so and shall always be inactive. The PTS shall
      transition to the requested operational mode, upon request.
```

```
      When in the 'automatic' state, the PTS shall monitor conditions and
trigger
      the sprayer based on a manufacturer specific algorithm. The algorithm
      shall only consider input from the detectors selected in the
      ptsMonitoringDetectors object. The PTS shall also trigger the sprayer
      if commanded to do so via the ptsCommandState object. The PTS shall
      transition to the requested operational mode, upon request.
      When in the 'manual' state, the PTS shall trigger the sprayer if
commanded
      to do so via the ptsCommandState object. The PTS shall transition to
      the requested operational mode, upon request.
    <Format>
      off  When set to this value the ESS does not trigger the
        bridge sprayer

      manual  When set to this value the ESS only triggers the
        bridge sprayer when manually commanded to do
        so (e.g., see bridgeSprayerMgmtSignalState).

      automatic  When set to this value the ESS triggers the
        bridge sprayer when manually commanded to do
        so or when the internal algorithm determines
        that the sprayer should be triggered.
    <Parameter Type> control
    <Superseded by> ptsOperationalModeV3 (See 5.13.19)
    <Informative> This object was made obsolete in version 03.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.6"
::= { essNtcipTreatment 6 }
```

5.13.8 Command State [Obsolete]

```
-- This object is obsolete.
ptsCommandState OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    inactive (2),
    activate (3) }
  MAX-ACCESS   read-write
  STATUS       obsolete
  DESCRIPTION
    "<Definition> Indicates the operational state of the PTS. When in the
      'inactive' state, the PTS shall not be spraying. Upon entering the
      'active' state, either by a manual SET of this object or through an
      automated algorithm, the PTS shall trigger the sprayer and spray the
      chemical for a duration as defined by the ptsSignalDuration object.
      Upon expiration of this duration, the PTS shall automatically
      transition back to the 'inactive' state.
    <Format>
      other -
      read  - indicates a unknown or initial state
      write - no effect
      inactive  -
      read  - indicates the ess is not signaling the bridge sprayer
      write - no effect
      activate  -
      read  - indicates the ess is signaling the bridge sprayer
      write - causes the ess to signal the bridge sprayer
    <Parameter Type> control
```



```
    <Superseded by> ptsCommandStateV3 (See 5.13.19)
    <Informative> This object was made obsolete in version 03.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.7"
::= { essNtcipTreatment 7 }
```

5.13.9 Sprayer State

```
ptsSprayerState OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    inactive (2),
    active (3) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> other     - indicates a unknown or initial state
                  inactive  - indicates the bridge sprayer is inactive
                  active    - indicates the bridge sprayer is active
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.8"
::= { essNtcipTreatment 8 }
```

5.13.10 Signal Duration

```
ptsSignalDuration OBJECT-TYPE
  SYNTAX       Integer32 (0..3600000)
  UNITS        "milliseconds"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The number of milliseconds of a simple logic level or
      state the bridge sprayer needs to detect a signal from the ESS.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.9"
::= { essNtcipTreatment 9 }
```

5.13.11 Signal Event Count

```
ptsSignalEventCount OBJECT-TYPE
  SYNTAX       Counter32
  UNITS        "events"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> An indication of the number of Signal Events that have
      occurred since the last SNMP engine initialization.
    <Parameter Type> status
    <Informative> SNMP counter objects do not have a defined initialization
      value nor any ability to be reset. The value reported by this object
      only has meaning when compared to a previous reading and when there is
      no intervening device initialization as indicated by snmpEngineBoots.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.10"
::= { essNtcipTreatment 10 }
```

5.13.12 Last Signal Event

```
-- This object has been deprecated.
ptsLastSignalEvent OBJECT-TYPE
  SYNTAX       Unsigned32
  UNITS        "seconds"
```



```
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The number of seconds since 00:00:00 Jan 1 1970 UTC.
    <Format>
      The value of 0 indicates an unknown or initial value.
    <Parameter Type> status
    <Superseded by> ptsLastSignalEventDate and ptsLastSignalEventTime (See
      5.13.26 and 5.13.27)
    <Informative> This object was deprecated in version 05.
      Within SNMPv1, this object was represented as a Counter in violation of
      Counter semantics. Within SNMPv3 exchanges, it is encoded as an
      Unsigned32 to conform to SMIv2 and SNMPv3 rules.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.11"
::= { essNtcipTreatment 11 }
```

5.13.13 Active Event Count

```
ptsActiveEventCount OBJECT-TYPE
  SYNTAX       Counter32
  UNITS        "events"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> An indication of the number of Active Events that have
      occurred since the last SNMP engine initialization.
    <Parameter Type> status
    <Informative> SNMP counter objects do not have a defined initialization
      value nor any ability to be reset. The value reported by this object
      only has meaning when compared to a previous reading and when there is
      no intervening device initialization as indicated by snmpEngineBoots.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.12"
::= { essNtcipTreatment 12 }
```

5.13.14 Inactive Event Count

```
ptsInactiveEventCount OBJECT-TYPE
  SYNTAX       Counter32
  UNITS        "events"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> An indication of the number of Inactive Events that have
      occurred since the last SNMP engine initialization.
    <Parameter Type> status
    <Informative> SNMP counter objects do not have a defined initialization
      value nor any ability to be reset. The value reported by this object
      only has meaning when compared to a previous reading and when there is
      no intervening device initialization as indicated by snmpEngineBoots.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.13"
::= { essNtcipTreatment 13 }
```

5.13.15 Last Active Event

```
-- This object has been deprecated.
ptsLastActiveEvent OBJECT-TYPE
  SYNTAX       Unsigned32
  UNITS        "seconds"
  MAX-ACCESS   read-only
```



```
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The number of seconds since 00:00:00 Jan 1 1970 UTC.
    <Format>
      The value of 0 indicates an unknown or initial value.
    <Parameter Type> status
    <Superseded by> ptsLastActiveEventDate and ptsLastActiveEventTime (See
      5.13.28 and 5.13.29)
    <Informative> This object was deprecated in version 05.
      Within SNMPv1, this object was represented as a Counter in violation of
      Counter semantics. Within SNMPv3 exchanges, it is encoded as an
      Unsigned32 to conform to SMIv2 and SNMPv3 rules.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.14"
::= { essNtcipTreatment 14 }
```

5.13.16 Last Inactive Event

```
-- This object has been deprecated.
ptsLastInactiveEvent OBJECT-TYPE
  SYNTAX       Counter32
  UNITS        "seconds"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The number of seconds since 00:00:00 Jan 1 1970 UTC.
    <Format>
      The value of 0 indicates an unknown or initial value.
    <Parameter Type> status
    <Superseded by> ptsLastInactiveEventDate and ptsLastInactiveEventTime
      (See 5.13.30 and 5.13.31)
    <Informative> This object was deprecated in version 05.
      Within SNMPv1, this object was represented as a Counter in violation of
      Counter semantics. Within SNMPv3 exchanges, it is encoded as an
      Unsigned32 to conform to SMIv2 and SNMPv3 rules.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.15"
::= { essNtcipTreatment 15 }
```

5.13.17 PTS Error Code

```
ptsError OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    ok (2),
    genericError (3),
    tankLow (4) }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the status of the bridge sprayer.
    <Format>
      other        - indicates a unknown or initial state
      ok           - indicates the bridge sprayer is operational
      genericError - indicates the bridge sprayer has an error
      tankLow      - indicates the bridge sprayer's tank is low
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.16"
::= { essNtcipTreatment 16 }
```


5.13.18 Monitoring Detectors

```
ptsMonitoringDetectors OBJECT-TYPE
  SYNTAX       OCTET STRING (SIZE (4))
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the pavement detectors that the PTS shall use in
      its algorithm that determines when the PTS automatically triggers the
      sprayer.
    <Format>
      Each bit indicates whether or not the associated pavement sensor shall
      be used within the algorithm. The first (high order) bit in the bit
      string shall reference the first pavement sensor. A value of one for
      any bit shall indicate that the sensor input shall be considered, and
      a value of zero shall mean that the input shall not be considered.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.17"
::= { essNtcipTreatment 17 }
```

5.13.19 Operational Mode - Version 3

```
ptsOperationalModeV3 OBJECT-TYPE
  SYNTAX       INTEGER {
    off (1),
    manual (2),
    automatic (3) }
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the operational mode of the Pavement Treatment
System.
      When in the 'off' state, the PTS shall not trigger the sprayer even if
      commanded to do so and shall always be inactive. The PTS shall
      transition to the requested operational mode, upon request.
      When in the 'automatic' state, the PTS shall monitor conditions and
trigger
      the sprayer based on a manufacturer specific algorithm. The algorithm
      shall only consider input from the detectors selected in the
      ptsMonitoringDetectors object. The PTS shall also trigger the sprayer
      if commanded to do so via the ptsCommandStateV3 object. The PTS shall
      transition to the requested operational mode, upon request.
      When in the 'manual' state, the PTS shall trigger the sprayer if
commanded
      to do so via the ptsCommandStateV3 object. The PTS shall transition to
      the requested operational mode, upon request.
    <Format>
      off  When set to this value the ESS does not trigger the
        bridge sprayer

      manual  When set to this value the ESS only triggers the
        bridge sprayer when manually commanded to do
        so (e.g., see ptsCommandStateV3).

      automatic  When set to this value the ESS triggers the
        bridge sprayer when manually commanded to do
        so or when the internal algorithm determines
        that the sprayer should be triggered.
```



```
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.18"
::= { essNtcipTreatment 18 }
```

5.13.20 Command State - Version 3

```
ptsCommandStateV3 OBJECT-TYPE
  SYNTAX       INTEGER {
    other (1),
    inactive (2),
    activate (3) }
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the operational state of the PTS. When in the
      'inactive' state, the PTS shall not be signaling the sprayer. Upon
      entering the 'active' state, either by a manual SET of this object or
      through an automated algorithm, the PTS shall trigger the sprayer
      using a signal that lasts for a duration as defined by the
      ptsSignalDuration object. Upon expiration of this duration, the PTS
      shall automatically transition back to the 'inactive' state.
    <Format>
      other -
      read  - indicates a unknown or initial state
      write - no effect
      inactive  -
      read  - indicates the ess is not signaling the bridge sprayer
      write - no effect
      activate  -
      read  - indicates the ess is signaling the bridge sprayer
      write - causes the ess to signal the bridge sprayer
    <Parameter Type> control
    <Informative> This object does not directly control the sprayer, rather
      it merely signals an external sprayer.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.19"
::= { essNtcipTreatment 19 }
```

5.13.21 PTS Latitude

```
-- This object has been deprecated.
essPavementTreatmentLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The latitude in 10^-6 degrees of the pavement treatment
      system, per WGS-84 datum.
    <Format>
      The essPavementTreatmentLatitude at the North Pole is 90,000,000. The
      essPavementTreatmentLatitude at the South Pole is -90,000,000. The
      value 90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> essPavementTreatmentYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.20"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
```

```
::= { essNtcipTreatment 20 }
```

5.13.22 PTS Longitude

```
-- This object has been deprecated.
essPavementTreatmentLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the pavement treatment system location.
    <Format>
      The essPavementTreatmentLongitude of 180 degrees West shall be
      -180,000,000. The essPavementTreatmentLongitude of 180 degrees East
      shall be 180,000,000. The value 180,000,001 shall indicate a missing
      value.
    <Parameter Type> configuration
    <Superseded by> essPavementTreatmentXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.21"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { essNtcipTreatment 21 }
```

5.13.23 PTS Location

```
essPavementTreatmentLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the pavement
      treatment system.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.22"
::= { essNtcipTreatment 22 }
```

5.13.24 PTS Model Information

```
-- This object has been deprecated.
essPavementTreatmentModelInformation OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the row in the Module Table (See NTCIP 1201)
      that contains information about the make, model, and version number of
      the pavement treatment system.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Superseded by> ptsEntityID (See 5.13.25)
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.23"
::= { essNtcipTreatment 23 }
```


5.13.25 PTS Last Signal Event Date

```
ptsLastSignalEventDate OBJECT-TYPE
  SYNTAX       ITSDateStamp
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The UTC date of the last signal event.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.24"
::= { essNtcipTreatment 24}
```

5.13.26 PTS Last Signal Event Time

```
ptsLastSignalEventTime OBJECT-TYPE
  SYNTAX       ITSDailyTimeStamp
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The number of milliseconds after 00:00:00.000 UTC on
      ptsLastSignalEventDate that the last signal event occurred.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.25"
::= { essNtcipTreatment 25 }
```

5.13.27 PTS Last Active Event Date

```
ptsLastActiveEventDate OBJECT-TYPE
  SYNTAX       ITSDateStamp
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The UTC date of the last active event.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.26"
::= { essNtcipTreatment 26 }
```

5.13.28 PTS Last Active Event Time

```
ptsLastActiveEventTime OBJECT-TYPE
  SYNTAX       ITSDailyTimeStamp
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The number of milliseconds after 00:00:00.000 UTC on
      ptsLastActiveEventDate that the last active event occurred.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.27"
::= { essNtcipTreatment 27 }
```

5.13.29 PTS Last Inactive Event Date

```
ptsLastInactiveEventDate OBJECT-TYPE
  SYNTAX       ITSDateStamp
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The UTC date of the last inactive event.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.28"
::= { essNtcipTreatment 28 }
```

5.13.30 PTS Last Inactive Event Time

```
ptsLastInactiveEventTime OBJECT-TYPE
  SYNTAX       ITSDailyTimeStamp
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The number of milliseconds after 00:00:00.000 UTC on
      ptsLastActiveEventDate that the last inactive event occurred.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.29"
::= { essNtcipTreatment 29 }
```

5.13.31 PTS X Offset

```
ptsXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The lateral offset of the pavement treatment system from
      the field device's reference location as defined by
      fdConfiguredLatitude and fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.30"
::= { essNtcipTreatment 30 }
```

5.13.32 PTS Y Offset

```
ptsYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the pavement treatment system from the
      field device's reference location as defined by fdConfiguredLatitude
      and fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.31"
::= { essNtcipTreatment 31 }
```

5.13.33 PTS Entity Identifier

```
ptsEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
```



```
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the pavement treatment system, such as
      the manufacturer, model, and hardware and software revision
      identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.11.32"
::= { essNtcipTreatment 32 }
```

5.14 Air Quality Parameters

```
essNtcipAirQuality OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Objects used for monitoring air quality conditions.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12"
::= { essNtcip 12 }
```

5.14.1 Carbon Monoxide Parameter

```
essCO OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "parts per million"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The concentration of carbon monoxide in the air, measured
      in parts per million.
    <Format>
      The value 255 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.1"
::= { essNtcipAirQuality 1 }
```

5.14.2 Carbon Dioxide Parameter

```
-- This object has been deprecated.
essCO2 OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "parts per billion"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The concentration of carbon dioxide in the air, measured
      in parts per billion.
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> essCO2V4 (See 5.14.13)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.2"
::= { essNtcipAirQuality 2 }
```

5.14.3 Nitrous Oxide Parameter

```
-- This object has been deprecated.
essNO OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "parts per million"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The concentration of nitrous oxide in the air, measured in
      parts per million.
    <Format>
      The value 255 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> essNOV4 (See 5.14.14)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.3"
::= { essNtcipAirQuality 3 }
```

5.14.4 Nitrogen Dioxide Parameter

```
essNO2 OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "parts per billion"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The concentration of nitrogen dioxide in the air, measured
      in parts per billion.
    <Format>
      The value 255 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.4"
::= { essNtcipAirQuality 4 }
```

5.14.5 Sulfur Dioxide Parameter

```
essSO2 OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "parts per billion"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The concentration of sulfur dioxide in the air, measured
      in parts per billion.
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.5"
::= { essNtcipAirQuality 5 }
```

5.14.6 Ozone Parameter

```
-- This object has been deprecated.
essO3 OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "parts per one hundred billion"
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
```



```
    "<Definition> The concentration of ozone in the air, measured in parts
      per one hundred billion.
    <Format>
      The value 255 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Superseded by> essO3V4 (See 5.14.15)
    <Informative> This object was deprecated in version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.6"
::= { essNtcipAirQuality 6 }
```

5.14.7 Particulate Matter Parameter

```
essPM10 OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "micrograms per cubic meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The concentration of small particulate matter of 10
      micrometers or less in diameter in the air, measured in micrograms per
      cubic meter.
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.7"
::= { essNtcipAirQuality 7 }
```

5.14.8 Air Quality Block Object

```
-- This object has been deprecated.
essAirQualityBlock OBJECT-TYPE
  SYNTAX       ITSOerString
  MAX-ACCESS   read-only
  STATUS       deprecated
  DESCRIPTION
    "<Definition> An OER encoded string of the EssAirQualityData structure
      as defined below.
      This object is used for uploading current air quality data from the ESS
in a
      bandwidth efficient manner.

      A GET shall return data for all of the fields in the structure (even if
they
      are indicated as OPTIONAL); unless the data values are not supported by
the
      controller or are invalid (e.g., the sensor is not attached), in which
case
      the values shall be omitted.

      essAirQualityData ::= SEQUENCE {
        essCO.0        OPTIONAL,  -- @NTCIP1204-Ess
        essCO2.0        OPTIONAL,  -- @NTCIP1204-Ess
        essNO.0        OPTIONAL,  -- @NTCIP1204-Ess
        essNO2.0        OPTIONAL,  -- @NTCIP1204-Ess
        essSO2.0        OPTIONAL,  -- @NTCIP1204-Ess
        essO3.0        OPTIONAL,  -- @NTCIP1204-Ess
        essPM10.0        OPTIONAL  -- @NTCIP1204-Ess
        }
    <Parameter Type> status
```



```
    <Informative> This object was deprecated and withdrawn in version 05 as
      the associated requirement was deemed to be no longer necessary in
      version 04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.8"
::= { essNtcipAirQuality 8 }
```

5.14.9 Particulate Matter (2.5) Parameter

```
essPM25 OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "micrograms per cubic meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The concentration of small particulate matter of 2.5
      micrometers or less in diameter in the air, measured in micrograms per
      cubic meter.
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.9"
::= { essNtcipAirQuality 9 }
```

5.14.10 Number of Air Quality Sensors

```
airQualitySensorTableNumSensors OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "sensors"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of entries in the air quality sensor
      table.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a sensor; however, the table is still defined as a
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.10"
::= { essNtcipAirQuality 10 }
```

5.14.11 Air Quality Sensor Table

```
airQualitySensorTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF AirQualitySensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> Table containing the air quality sensor data.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.11"
::= { essNtcipAirQuality 11 }
```

5.14.12 Air Quality Sensor

```
airQualitySensorEntry OBJECT-TYPE
  SYNTAX       AirQualitySensorEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> An air quality sensor is described through a number of
```



```
      attributes as indicated by the following subclauses."
  INDEX { airQualitySensorIndex }
::= { airQualitySensorTable 1 }

AirQualitySensorEntry ::= SEQUENCE {
    airQualitySensorIndex             Integer32,
    airQualitySensorHeight            Integer32,
    airQualitySensorLatitude          Integer32,
    airQualitySensorLongitude         Integer32,
    airQualitySensorLocation          SnmpAdminString,
    airQualitySensorModelInformation  Integer32,
    airQualitySensorXOffset           ITSInteger16,
    airQualitySensorYOffset           ITSInteger16,
    airQualitySensorZOffset           ITSInteger16,
    airQualitySensorEntityID          PhysicalIndexOrZero }
```

5.14.12.1 Air Quality Sensor Index

```
airQualitySensorIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Enumerated list of row entries that provide air quality
      sensor data.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.11.1.1"
::= { airQualitySensorEntry 1 }
```

5.14.12.2 Air Quality Sensor Height

```
-- This object has been deprecated.
airQualitySensorHeight OBJECT-TYPE
  SYNTAX       Integer32 (-1000..1001)
  UNITS        "meters"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The height of the air quality sensor with respect to the
      essReferenceHeight in meters.
    <Format>
      The value of 1001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> airQualitySensorZOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.11.1.2"
  REFERENCE "essReferenceHeight plus this value equals the WMO Binary Code
      Form FM 94 BUFR Table B item 0 07 001."
::= { airQualitySensorEntry 2 }
```

5.14.12.3 Air Quality Sensor Latitude

```
-- This object has been deprecated.
airQualitySensorLatitude OBJECT-TYPE
  SYNTAX       Integer32 (-90000000..90000001)
  UNITS        "microdegrees latitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
```



```
    "<Definition> The latitude in 10^-6 degrees of the ESS air quality
      sensor, per WGS-84 datum.
    <Format>
      The airQualitySensorLatitude at the North Pole is 90,000,000. The
      airQualitySensorLatitude at the South Pole is -90,000,000. The value
      90,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> airQualitySensorYOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.11.1.3"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be
      obtained by dividing this value by 10."
::= { airQualitySensorEntry 3 }
```

5.14.12.4 Air Quality Sensor Longitude

```
-- This object has been deprecated.
airQualitySensorLongitude OBJECT-TYPE
  SYNTAX       Integer32 (-180000000..180000001)
  UNITS        "microdegrees longitude"
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> The east longitude in 10^-6 degrees from the Prime
      Meridian of the ESS air quality sensor location.
    <Format>
      The airQualityLongitude of 180 degrees West shall be -180,000,000. The
      airQualityLongitude of 180 degrees East shall be 180,000,000. The
      value 180,000,001 shall indicate a missing value.
    <Parameter Type> configuration
    <Superseded by> airQualitySensorXOffset
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.11.1.4"
  REFERENCE "Resolution based on on-going location referencing activities;
      the WMO Binary Code Form FM 94 BUFR Table B item 0 06 001 can be
      obtained by dividing this value by 10."
::= { airQualitySensorEntry 4 }
```

5.14.12.5 Air Quality Sensor Location

```
airQualitySensorLocation OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A textual string indicating the location of the air
      quality sensor.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.11.1.5"
::= { airQualitySensorEntry 5 }
```

5.14.12.6 Air Quality Sensor Model Information

```
-- This object has been deprecated.
airQualitySensorModelInformation OBJECT-TYPE
  SYNTAX       Integer32(0..255)
  MAX-ACCESS   read-write
  STATUS       deprecated
```



```
  DESCRIPTION
    "<Definition> Indicates the row in the Module Table (See NTCIP 1201)
      that contains information about the make, model, and version number of
      the sensor associated with this row of the AirQuality Sensor Table.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> configuration
    <Supplanted by> airQualitySensorEntityID
    <Informative> This object was deprecated in version 05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.11.1.6"
::= { airQualitySensorEntry 6 }
```

5.14.12.7 Air Quality Sensor X Offset

```
airQualitySensorXOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The lateral offset of the air quality sensor from the
      field device's reference location as defined by fdConfiguredLatitude
      and fdConfiguredLongitude.
    <Format>
      For stationary devices, the X offset shall indicate the eastward
      (positive) or westward (negative) distance from the reference
      location. For transportable and mobile devices, the X offset shall
      indicate distances to the starboard side (positive) or port side
      (negative) of the reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.11.1.7"
::= { airQualitySensorEntry 7 }
```

5.14.12.8 Air Quality Sensor Y Offset

```
airQualitySensorYOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The Y offset of the air quality sensor from the field
      device's reference location as defined by fdConfiguredLatitude and
      fdConfiguredLongitude.
    <Format>
      For stationary devices, the Y offset shall indicate the northward
      (positive) or southward (negative) distance from the reference
      location. For transportable and mobile devices, the Y offset shall
      indicate distances to the fore (positive) or aft (negative) of the
      reference location on the vehicle.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.11.1.8"
::= { airQualitySensorEntry 8 }
```

5.14.12.9 Air Quality Sensor Z Offset

```
airQualitySensorZOffset OBJECT-TYPE
  SYNTAX       ITSInteger16
  UNITS        "centimeters"
```

```
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> The offset elevation of the air quality sensor from the
      fdConfiguredElevation in centimeters.
    <Format>
      Upward offsets shall be positive and downward offsets shall be
negative.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.11.1.9"
::= { airQualitySensorEntry 9 }
```

5.14.12.10 Air Quality Sensor Entity Identifier

```
airQualitySensorEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a sensor is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.11.1.10"
::= { airQualitySensorEntry 10 }
```

5.14.13 Carbon Dioxide Version 4 Parameter

```
essCO2V4 OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "parts per million"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The concentration of carbon dioxide in the air, measured
      in parts per million.
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.13"
::= { essNtcipAirQuality 13 }
```

5.14.14 Nitric Oxide Version 4 Parameter

```
essNOV4 OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
  UNITS        "parts per billion"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The concentration of nitric oxide in the air, measured in
      parts per billion.
    <Format>
      The value 255 shall indicate an error condition or missing value.
```



```
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.14"
::= { essNtcipAirQuality 14 }
```

5.14.15 Ozone Version 4 Parameter

```
essO3V4 OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "parts per billion"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The concentration of ozone in the air, measured in parts
      per billion.
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.15"
::= { essNtcipAirQuality 15 }
```

5.14.16 Particulate Matter (1.0) Parameter

```
essPM1 OBJECT-TYPE
  SYNTAX       Integer32 (0..65535)
  UNITS        "micrograms per cubic meter"
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> The concentration of small particulate matter of 1.0
      micrometers or less in diameter in the air, measured in micrograms per
      cubic meter.
    <Format>
      The value 65535 shall indicate an error condition or missing value.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.12.16"
::= { essNtcipAirQuality 16 }
```

5.15 Water Quality Parameters

```
essNtcipWaterQuality OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> This node contains objects used for monitoring water
      quality conditions. Reserved for future use.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.13"
::= { essNtcip 13 }
```

5.16 Snapshot Parameters

```
essNtcipSnapshot OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> Contains objects used to describe the snapshot camera
      feature.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14"
::= { essNtcip 14 }
```

5.16.1 Number of Snapshot Cameras

```
essSnapshotNumberOfCameras OBJECT-TYPE
  SYNTAX       Integer32 (0..255)
```



```
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the number of cameras that can be utilized for
      capturing snapshots on the ESS.
    <Parameter Type> status
    <Informative> This value may automatically change upon connecting or
      disconnecting a camera; however, the table is still defined as a
      static table since the creation/deletion of rows is not managed
      through SNMP logic.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.1"
::= { essNtcipSnapshot 1 }
```

5.16.2 Snapshot Camera Table

```
essSnapshotCameraTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF EssSnapshotCameraEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> The snapshot camera table provides summary information
      about the snapshot cameras supported by the ESS. It can be described
      through a number of attributes as indicated by the following
      subclauses.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.2"
::= { essNtcipSnapshot 2 }
```

5.16.3 Snapshot Camera

```
essSnapshotCameraEntry OBJECT-TYPE
  SYNTAX       EssSnapshotCameraEntry
  MAX-ACCESS   not-accessible
  STATUS       current
  DESCRIPTION
    "<Definition> A snapshot camera is a camera that is able to capture a
      picture and store it within the device's memory as a file. It can be
      described through a number of attributes as indicated by the following
      subclauses."
  INDEX { essSnapshotCameraIndex }
::= { essSnapshotCameraTable 1 }

EssSnapshotCameraEntry ::= SEQUENCE {
    essSnapshotCameraIndex            Integer32,
    essSnapshotCameraDescription      SnmpAdminString,
    essSnapshotCameraStoragePath      SnmpAdminString,
    essSnapshotCameraCommand          INTEGER,
    essSnapshotCameraError            INTEGER,
    essSnapshotCameraFilename         OCTET STRING,
    essSnapshotCameraSupportedFormats BITS,
    essSnapshotCameraFileFormat       DisplayString,
    essSnapshotCameraFilenameV5       SnmpAdminString,
    essSnapshotCameraEntityID         PhysicalIndexOrZero }
```

5.16.3.1 Snapshot Camera Index

```
essSnapshotCameraIndex OBJECT-TYPE
  SYNTAX       Integer32 (1..255)
  MAX-ACCESS   read-only
  STATUS       current
```



```
  DESCRIPTION
    "<Definition> Indicates the row number of this entry.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.2.1.1"
::= { essSnapshotCameraEntry 1 }
```

5.16.3.2 Snapshot Camera Description

```
essSnapshotCameraDescription OBJECT-TYPE
  SYNTAX       SnmpAdminString
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the description of this entry. The description
      should include information about the location, direction (for fixed
      cameras), and subject of the camera.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.2.1.2"
::= { essSnapshotCameraEntry 2 }
```

5.16.3.3 Snapshot Camera Storage Path

```
essSnapshotCameraStoragePath OBJECT-TYPE
  SYNTAX       SnmpAdminString (SIZE(1..255))
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the storage path of snapshots taken from this
      camera. The path indicated here shall be relative to the FTP login
      root. This path can only include the FTP login root and its
      subdirectories and cannot include any parent directories that may
      exist. The root is specified by the string '/' (one forward slash). A
      subdirectory from the root may be specified by the string '/subdir'.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.2.1.3"
  DEFVAL { "/" }
::= { essSnapshotCameraEntry 3 }
```

5.16.3.4 Snapshot Camera Command

```
essSnapshotCameraCommand OBJECT-TYPE
  SYNTAX       INTEGER {
    ready(1),
    captureSnapshot(2)  }
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> A command to control the snapshot feature of the ESS.
      Setting this object to a value of captureSnapshot(2) commands the ESS
      to take a snapshot and save the image to memory. A Get of this object
      returns a value of captureSnapshot(2) while the ESS is in the process
      of capturing and saving the image to memory. A Get of this object when
      the ESS is not in the process of capturing and saving the image to
      memory returns a value of ready(1). If any errors occur in the process
      of capturing and saving the image they shall be noted in
      essSnapshotError.
    <Parameter Type> control
    <Informative> Version 02 of this standard had a typo for the MAX-ACCESS;
      this object is required tobe read-write for the camera to capture a
```



```
      snapshot image.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.2.1.4"
::= { essSnapshotCameraEntry 4 }
```

5.16.3.5 Snapshot Camera Error

```
essSnapshotCameraError OBJECT-TYPE
  SYNTAX       INTEGER {
    none(1),
    hardware(2),
    insufficientMemory(3)  }
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the status of the last attempt to capture a
      snapshot using essSnapshotCommand.
    <Format>
      none - no error was detected
      hardware - an error occurred with the camera hardware when attempting
to
          capture a picture.
      insufficientMemory - the ESS does not have sufficient memory to store
the
      new
          picture.
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.2.1.5"
::= { essSnapshotCameraEntry 5 }
```

5.16.3.6 Snapshot Camera Filename

```
-- This object has been deprecated.
essSnapshotCameraFilename OBJECT-TYPE
  SYNTAX       OCTET STRING (SIZE(0..255))
  MAX-ACCESS   read-write
  STATUS       deprecated
  DESCRIPTION
    "<Definition> Indicates the filename used when storing new snapshot
      images.
    <Format>
      This parameter shall only consist of upper and lower case characters
      (A-Z,
      a-z), digits (0-9), underscores (_), periods (.), spaces, and the
following
      case-sensitive field names enclosed in chevrons (<>):
      camera: A three digit camera number equal to essSnapshotCameraIndex.
      sequence: A three digit value that increments by one each time this
      camera is used to take a picture. This value shall roll-over from '999'
to
          '000'. The initial value of this field and its value after a power
      outage
          is manufacture dependent.
      date: A six digit code indicating the UTC date in the format of YYMMDD.
      time: A six digit code indicating the UTC time in the format of HHMMSS.


      All implementations shall support all static character filenames with
up to
```



```
      eight characters in the base filename, a period, and up to three
characters
      in the filename extension. Support for longer filenames and the above
fields
      are optional.


      For example, if this parameter has a value of 'latest.jpg', every
snapshot
      taken is saved to 'latest.jpg' and overwrites any previous image saved
to
      that filename. If this parameter has a value of ' .jpg',
      each
      snapshot has a name (e.g., '060925 038') indicating the date it was
taken
      along with a relatively unique code. While the second form prevents the
      inadvertent overwriting of filenames, it increases the likelihood of
      consuming large amounts of field device memory (eventually resulting in
      insufficientMemory errors) if not properly managed by the management
      station.
    <Parameter Type> configuration
    <Superseded by> essSnapshotCameraFilenameV5 and
      essSnapshotCameraFileFormat
    <Informative> This object was deprecated in version 05.
      The filename does not necessarily define file format and it is left to
the
      users to define an appropriate filename. For example, this object may
      be set to a value of 'latest.bmp'. All implementations would be
      required to save their images with this filename; however, the image
      saved may vary. Some implementations may only save bitmapped images
      and the file would have an appropriate name. Other implementations may
      only save JPEG images and the '.bmp' extension may be confusing. Other
      implementations may support both formats and use the extension in this
      field to select the storage format, while yet others may support both
      formats but ignore the extension assigned by this field (and use some
      other mechanism to select the storage format).
      A zero length filename may result in unexpected operations. An
      implementation may reject a zero length filename by responding with
      genErr.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.2.6"
::= { essSnapshotCameraEntry 6 }
```

5.16.3.7 Snapshot Camera Supported Formats

```
essSnapshotCameraSupportedFormats OBJECT-TYPE
  SYNTAX       BITS {
    other (0),
    jpeg (1),
    heif (2),
    tiff (3),
    png (4),
    gif (5),
    bmp (6),
    webp (7),
    pdf (8),
    eps (9),
    raw (10),
    dng (11) }
```

```
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the file formats supported by the camera when
      storing new snapshot images.
       Can only be set to 'captureSnapshot' when value is currently
      'ready'; any other SET shall return a genErr, including a SET to
      'ready'.
    <Format>
      other: A file format not identified by this document. If other file
      formats
             are used, they shall be presented in all uppercase to avoid
conflicts
             with future extensions to this list.
      jpeg: Joint Photographic Experts Group format as standardized in
ISO/IEC
            10918.
      heif: High Efficiency Image File format as standardized in ISO/IEC
23008-12.
      tiff: Tagged Image File Format, Revision 6.0 as defined by the Aldus
            Corporation and available from ITU at
https://www.itu.int/itudoc/itu-
            t/com16/tiff-fx/docs/tiff6.pdf
      png:  Portable Network Graphics (Third Edition) as defined by the World
Wide
            Web Consortium (W3C) and available at https://www.w3.org/TR/png-
3/.
      gif:  Graphics Interchange Format Version 89a as developed by
CompuServe
            Incorporated and available at
https://www.w3.org/Graphics/GIF/spec-
            gif89a.txt
      bmp:  Microsoft Windows Bitmap Format, version 5 as defined by
Microsoft
            Corporation and available at https://learn.microsoft.com/en-
            us/windows/win32/gdi/bitmap-storage
      webp: The raster graphics file format developed by Google and available
at
            https://developers.google.com/speed/webp/docs/riff_container
      pdf:  Portable Document Format as developed by Adobe, Inc. and
standardized
            in ISO 32000-2.
      eps:  Encapsulated PostScript File Format, Version 3 as specified by
Adobe
            Systems Incorporated in May 1992 and available at
            https://printtechnologies.org/standards/files/epsf_spec_v3_0.pdf
      raw:  The native format offered by the camera manufacturer. This format
is
            not interoperable among manufacturers or perhaps even models, but
            ensures no loss of information.
      dng:  Digital Negative, Version 1.7.1.0 format as developed by Adobe as
a
            generic, interoperable raw format and available at https://

helpx.adobe.com/content/dam/help/en/photoshop/pdf/DNG_Spec_1_7_1_0.pdf
    <Parameter Type> status
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.2.7"
```



```
::= { essSnapshotCameraEntry 7 }
```

5.16.3.8 Snapshot Camera File Format

```
essSnapshotCameraFileFormat OBJECT-TYPE
  SYNTAX       DisplayString(SIZE (1..8))
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the filename extension to use when storing new
      snapshot images. If this parameter equals the name of a named bit
      defined by essSnapshotCameraSupportedFormats, the format shall be
      stored in the indicated file format. Other file formats can be used
      but shall use all uppercase characters to prevent conflicts with
      future standardized assignments.
      The ESS shall respond with a wrongValue error for an attempt to set
this
      object to a file format value that the camera does not support
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.2.8"
::= { essSnapshotCameraEntry 8 }
```

5.16.3.9 Snapshot Camera Filename Version 5

```
essSnapshotCameraFilenameV5 OBJECT-TYPE
  SYNTAX       SnmpAdminString (SIZE (1..255))
  MAX-ACCESS   read-write
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the filename used when storing new snapshot
      images.
    <Format>
      Case-sensitive field names enclosed in chevrons (<>) shall be
      interpreted as
      follows:


      camera: A three digit camera number equal to essSnapshotCameraIndex.
      sequence: A three digit value that increments by one each time this
      camera is used to take a picture. This value shall roll-over from '999'
to
          '000'. The initial value of this field and its value after a power
      outage
          is manufacture dependent.
      date: A six digit code indicating the UTC date in the format of YYMMDD.
      time: A six digit code indicating the UTC time in the format of HHMMSS.


      All implementations shall support all static NVT-ASCII character
filenames
      with up to eight characters in the base filename. Support for longer
      filenames, the above fields, and non-NVT-ASCII characters are optional.


      For example, if this parameter has a value of 'latest' and the value of
      essSnapshotCameraFileFormat is 'jpeg', every snapshot taken is saved to
      'latest.jpeg' and overwrites any previous image saved to that filename.
If
      this parameter has a value of ' ', each snapshot has a base
```



```
      name (e.g., '060925 038') indicating the date it was taken along with a
      relatively unique code. While the second form prevents the inadvertent
      overwriting of filenames, it increases the likelihood of consuming
large
      amounts of field device memory (eventually resulting in
insufficientMemory
      errors) if not properly managed by the management station.
    <Parameter Type> configuration
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.2.9"
::= { essSnapshotCameraEntry 9 }
```

5.16.3.10 Snapshot Camera Entity ID

```
essSnapshotCameraEntityID OBJECT-TYPE
  SYNTAX       PhysicalIndexOrZero
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION
    "<Definition> Indicates the row in the entPhysicalTable (See RFC 4133)
      that contains information about the sensor, such as the manufacturer,
      model, and hardware and software revision identifiers.
    <Format>
      The value of zero indicates that this information is not available.
    <Parameter Type> status
    <Informative> The mechanism used to configure this value when adding or
      modifying a camera is not defined by this document and is considered
      manufacturer-specific.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.2.14.2.10"
::= { essSnapshotCameraEntry 10 }
```

5.17 Conformance Information

```
essConformance OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node defining conformance information related to ESS
      objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127"
::= {ess 127}

essCompliances OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for compliance statements for ESS objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.1"
::= {essConformance 1}

essGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2"
::= {essConformance 2}
```

5.17.1 Controller Groups

```
essControllerGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
```



```
    "<Definition> A node for group definitions related to ESS objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1"
::= {essGroups 1}

essCharacteristicsGroupV1 OBJECT-GROUP
  OBJECTS {
      essNtcipCategory,
      essNtcipSiteDescription,
      essTypeofStation,
      essLatitude,
      essLongitude,
      essReferenceHeight }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The NTCIP 1204 objects required to claim base conformance
      to NTCIP 1204 v01.
    <Superseded by> essCharacteristicsGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.1"
::= {essControllerGroups 1}

essMobileGroupV1 OBJECT-GROUP
  OBJECTS {
      essVehicleSpeed,
      essVehicleBearing,
      essOdometer }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for a mobile ESS in
      v01.
    <Superseded by> fdMobilityGroupV1
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.2"
::= {essControllerGroups 2}

essMobileFrictionGroupV1 OBJECT-GROUP
  OBJECTS {
      essMobileFriction }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for mobile mobile
      friction in v01.
    <Superseded by> essPavementFrictionGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.3"
::= {essControllerGroups 3}

essDoorStatusGroupV2 OBJECT-GROUP
  OBJECTS {
      essDoorStatus }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The NTCIP 1204 objects required to claim conformance to
      door status in v02.
    <Superseded by> fdSrsaBasicGroupV1, where fdSrsaTypeCode = FBO
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.4"
::= {essControllerGroups 4}

essBatteryGroupV2 OBJECT-GROUP
  OBJECTS {
```



```
      essBatteryStatus }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The NTCIP 1204 objects required to claim base conformance
      to battery status in v02.
    <Superseded by> fdSrsaInputGroupV1, where fdSrsaTypeCode = FBC
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.5"
::= {essControllerGroups 5}

essLineVoltsGroupV2 OBJECT-GROUP
  OBJECTS {
      essLineVolts }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The NTCIP 1204 objects required to claim base conformance
      to line volts in v02.
    <Superseded by> fdSrsaInputGroupV1, where fdSrsaTypeCode = FLV
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.6"
::= {essControllerGroups 6}

essMetaDataBlockGroupV2 OBJECT-GROUP
  OBJECTS {
      essStationMetaDataBlock }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for the metadata
      block in v02.
    <Superseded by> essMetaDataBlockGroupV3
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.7"
::= {essControllerGroups 7}

essMobileBlockGroupV2 OBJECT-GROUP
  OBJECTS {
      essMobileBlock }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for the mobile block
      in v02.
    <Withdrawn> In v04
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.8"
::= {essControllerGroups 8}

essWeatherBlockGroupV2 OBJECT-GROUP
  OBJECTS {
      essWeatherBlock }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for the weather
      block in v02.
    <Superseded by> essWeatherBlockGroupV3
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.9"
::= {essControllerGroups 9}

essMetaDataBlockGroupV3 OBJECT-GROUP
  OBJECTS {
      essStationMetaDataV3Block }
  STATUS   deprecated
```



```
  DESCRIPTION
    "<Definition> The objects required to claim support for the metadata
      block in v03.
    <Withdrawn> In v04
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.10"
::= {essControllerGroups 10}

essWeatherBlockGroupV3 OBJECT-GROUP
  OBJECTS {
      essWeatherV3Block }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for the weather
      block in v03.
    <Withdrawn> In v04
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.11"
::= {essControllerGroups 11}

essStatusGroupV3 OBJECT-GROUP
  OBJECTS {
      essStatus }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for monitoring ESS
      status in v04.
    <Superseded by> fdControllerGroupV1
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.1.12"
::= {essControllerGroups 12}

essCharacteristicsGroupV5 OBJECT-GROUP
  OBJECTS {
      essTypeofStation }
  STATUS   current
  DESCRIPTION
    "<Definition> The NTCIP 1204 objects required to claim base conformance
      to NTCIP 1204 v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.13"
::= {essControllerGroups 13}
```

5.17.2 Pressure Groups

```
essPressureGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS pressure
      sensor objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.2"
::= {essGroups 2}

essPressureGroupV1 OBJECT-GROUP
  OBJECTS {
      essPressureHeight,
      essAtmosphericPressure }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for atmospheric
      pressure readings for v01.
    <Superseded by> essPressureSensorLocationGroupV4 and
```



```
      essPressureDataGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.2.1"
::= {essPressureGroups 1}

essPressureSensorLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      essPressureSensorHeight,
      essPressureSensorLatitude,
      essPressureSensorLongitude,
      essPressureSensorLocation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for atmospheric
      pressure readings for v04.
    <Superseded by> essPressureSensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.2.2"
::= {essPressureGroups 2}

essPressureSensorInfoGroupV4 OBJECT-GROUP
  OBJECTS {
      essPressureSensorModelInformation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for pressure sensor
      identification for v04.
    <Superseded by> essPressureSensorInfoGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.2.3"
::= {essPressureGroups 3}

essPressureDataGroupV4 OBJECT-GROUP
  OBJECTS {
      essNumPressureSensors,
      essPressureSensorIndex,
      essPressureSensorAtmosphericPressure }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for atmospheric
      pressure readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.2.4"
::= {essPressureGroups 4}

essPressureSensorLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      essPressureSensorLocation,
      essPressureSensorXOffset,
      essPressureSensorYOffset,
      essPressureSensorZOffset }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pressure sensor
      location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.2.5"
::= {essPressureGroups 5}

essPressureSensorInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      essPressureSensorEntityID }
```



```
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pressure sensor
      identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.2.6"
::= {essPressureGroups 6}
```

5.17.3 Wind Groups

```
essWindGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS wind sensor
      objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.3"
::= {essGroups 3}

essWindGroupV1 OBJECT-GROUP
  OBJECTS {
      essWindSensorHeight,
      essAvgWindDirection,
      essAvgWindSpeed,
      essMaxWindGustSpeed,
      essMaxWindGustDir }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for wind data in
      v01.
    <Superseded by> essWindDataGroupV2 and essWindSensorLocationGroupV2
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.3.1"
::= {essWindGroups 1}

essMobileWindGroupV1 OBJECT-GROUP
  OBJECTS {
      essSpotWindDirection,
      essSpotWindSpeed,
      essWindSituation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for mobile wind data
      in v01.
    <Superseded by> essWindDataGroupV2
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.3.2"
::= {essWindGroups 2}

essWindDataGroupV2 OBJECT-GROUP
  OBJECTS {
      windSensorTableNumSensors,
      windSensorIndex,
      windSensorAvgSpeed,
      windSensorAvgDirection,
      windSensorSpotSpeed,
      windSensorSpotDirection,
      windSensorGustSpeed,
      windSensorGustDirection,
      windSensorSituation }
  STATUS   current
  DESCRIPTION
```

```
    "<Definition> The objects required to claim support for wind data in
      v02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.3.3"
::= {essWindGroups 3}

essWindSensorLocationGroupV2 OBJECT-GROUP
  OBJECTS {
      windSensorHeight,
      windSensorLocation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for wind sensor
      location for v02.
    <Superseded by> essWindSensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.3.4"
::= {essWindGroups 4}

essWindSensorLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      windSensorLatitude,
      windSensorLongitude }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for wind sensor
      location for v04.
    <Superseded by> essWindSensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.3.5"
::= {essWindGroups 5}

essWindSensorInfoGroupV4 OBJECT-GROUP
  OBJECTS {
      windSensorModelInformation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for wind sensor
      model information for v04.
    <Superseded by> essWindSensorInfoGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.3.6"
::= {essWindGroups 6}

essWindSensorLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      windSensorLocation,
      windSensorXOffset,
      windSensorYOffset,
      windSensorZOffset }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for wind sensor
      location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.3.7"
::= {essWindGroups 7}

essWindSensorInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      windSensorEntityID }
  STATUS   current
```



```
  DESCRIPTION
    "<Definition> The objects required to claim support for wind sensor
      identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.3.8"
::= {essWindGroups 8}
```

5.17.4 Temperature Groups

```
essTemperatureGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS temperture
      sensor objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.4"
::= {essGroups 4}

essTemperatureGroupV1 OBJECT-GROUP
  OBJECTS {
      essNumTemperatureSensors,
      essTemperatureSensorIndex,
      essAirTemperature,
      essMaxTemp,
      essMinTemp }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for temperature
      readings for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.4.1"
::= {essTemperatureGroups 1}

essTemperatureSensorLocationGroupV1 OBJECT-GROUP
  OBJECTS {
      essTemperatureSensorHeight }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for temperature
      sensor location for v01.
    <Superseded by> essTemperatureSensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.4.2"
::= {essTemperatureGroups 2}

essTemperatureSensorLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      essTemperatureSensorLatitude,
      essTemperatureSensorLongitude,
      essTemperatureSensorLocation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for temperature
      sensor location for v04.
    <Superseded by> essTemperatureSensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.4.3"
::= {essTemperatureGroups 3}

essTemperatureSensorInfoGroupV4 OBJECT-GROUP
  OBJECTS {
      essTemperatureSensorModelInformation }
  STATUS   deprecated
```



```
  DESCRIPTION
    "<Definition> The objects required to claim support for temperature
      sensor model information for v04.
    <Superseded by> essTemperatureSensorInfoGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.4.4"
::= {essTemperatureGroups 4}

essTemperatureSensorLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      essTemperatureSensorLocation,
      essTemperatureSensorXOffset,
      essTemperatureSensorYOffset,
      essTemperatureSensorZOffset }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for temperature
      sensor location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.4.5"
::= {essTemperatureGroups 5}

essTemperatureSensorInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      essTemperatureSensorEntityID }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for temperature
      sensor identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.4.6"
::= {essTemperatureGroups 6}
```

5.17.5 Humidity Groups

```
essHumidityGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS humidity
      objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.5"
::= {essGroups 5}

essHumidityGroupV1 OBJECT-GROUP
  OBJECTS {
      essWetbulbTemp,
      essDewpointTemp,
      essRelativeHumidity }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for humidity
      readings for v01.
    <Superseded by> essHumidityDataGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.5.1"
::= {essHumidityGroups 1}

essHumiditySensorLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      humiditySensorHeight,
      humiditySensorLatitude,
      humiditySensorLongitude,
```



```
      humiditySensorLocation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for humidity sensor
      location for v04.
    <Superseded by> essHumiditySensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.5.2"
::= {essHumidityGroups 2}

essHumiditySensorInfoGroupV4 OBJECT-GROUP
  OBJECTS {
      humiditySensorModelInformation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for humidity sensor
      identification for v04.
    <Superseded by> essHumiditySensorInfoGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.5.3"
::= {essHumidityGroups 3}

essHumidityDataGroupV4 OBJECT-GROUP
  OBJECTS {
      humiditySensorTableNumSensors,
      humiditySensorIndex,
      humiditySensorRelativeHumidity,
      humiditySensorTemperatureInformation,
      humiditySensorWetbulbTemp,
      humiditySensorDewpointTemp }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for humidity
      readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.5.4"
::= {essHumidityGroups 4}

essHumiditySensorLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      humiditySensorLocation,
      humiditySensorXOffset,
      humiditySensorYOffset,
      humiditySensorZOffset }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for humidity sensor
      location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.5.5"
::= {essHumidityGroups 5}

essHumiditySensorInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      humiditySensorEntityID }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for humidity sensor
      identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.5.6"
::= {essHumidityGroups 6}
```


5.17.6 Precipitation Groups

```
essPrecipitationGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS precipitation
      objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6"
::= {essGroups 6}

essPrecipPresenceGroupV1 OBJECT-GROUP
  OBJECTS {
      essPrecipYesNo }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      presence for v01.
    <Superseded by> essPrecipPresenceGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.1"
::= {essPrecipitationGroups 1}

essPrecipRateGroupV1 OBJECT-GROUP
  OBJECTS {
      essPrecipRate,
      essPrecipitationStartTime,
      essPrecipitationEndTime }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      rate for v01.
    <Superseded by> essPrecipDataGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.2"
::= {essPrecipitationGroups 2}

essPrecipTotalsGroupV1 OBJECT-GROUP
  OBJECTS {
      essPrecipSituation,
      essPrecipitationOneHour,
      essPrecipitationThreeHours,
      essPrecipitationSixHours,
      essPrecipitationTwelveHours,
      essPrecipitation24Hours }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      totals for v01.
    <Superseded by> essPrecipTotalsGroupV4 and essPrecipSituationGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.3"
::= {essPrecipitationGroups 3}

essPrecipEmergingGroupV1 OBJECT-GROUP
  OBJECTS {
      essAdjacentSnowDepth,
      essRoadwaySnowDepth,
      essRoadwaySnowPackDepth,
      essSnowfallAccumRate,
      essIceThickness }
```

```
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for emergent
      precipitation information for v01.
    <Superseded by> essPrecipDataGroupV4, essPrecipIceThicknessGroupV4,
      essPrecipAdjacentSnowGroupV4, and essPrecipRoadwaySnowGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.4"
::= {essPrecipitationGroups 4}

essPrecipSensorInfoGroupV2 OBJECT-GROUP
  OBJECTS {
      precipitationSensorModelInformation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      sensor model information for v02.
    <Superseded by> essPrecipSensorInfoGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.5"
::= {essPrecipitationGroups 5}

essPrecipPresenceGroupV4 OBJECT-GROUP
  OBJECTS {
      precipitationSensorTableNumSensors,
      precipitationSensorIndex,
      precipitationSensorPrecipYesNo }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      presence for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.6"
::= {essPrecipitationGroups 6}

essPrecipDataGroupV4 OBJECT-GROUP
  OBJECTS {
      precipitationSensorPrecipRate,
      precipitationSensorSnowfallAccumRate,
      precipitationSensorPrecipitationStartTime,
      precipitationSensorPrecipitationEndTime }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      data readings for v04.
    <Superseded by> essPrecipDataGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.7"
::= {essPrecipitationGroups 7}

essPrecipSituationGroupV4 OBJECT-GROUP
  OBJECTS {
      precipitationSensorPrecipSituation }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      situation readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.8"
::= {essPrecipitationGroups 8}

essPrecipIceThicknessGroupV4 OBJECT-GROUP
```

```
  OBJECTS {
      precipitationSensorIceThickness }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for ice thickness
      readings for v04.
    <Superseded by> essPavementTemperatureGroupV2
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.9"
::= {essPrecipitationGroups 9}

essPrecipTotalsGroupV4 OBJECT-GROUP
  OBJECTS {
      precipitationSensorPrecipitationOneHour,
      precipitationSensorPrecipitationThreeHours,
      precipitationSensorPrecipitationSixHours,
      precipitationSensorPrecipitationTwelveHours,
      precipitationSensorPrecipitation24Hours }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      totals for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.10"
::= {essPrecipitationGroups 10}

essPrecipUserTotalGroupV4 OBJECT-GROUP
  OBJECTS {
      precipitationSensorPeriod,
      precipitationSensorPrecipitationUserDefined }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      user-defined totals for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.11"
::= {essPrecipitationGroups 11}

essPrecipSensorLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      precipitationSensorHeight,
      precipitationSensorLatitude,
      precipitationSensorLongitude,
      precipitationSensorLocation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      sensor location for v04.
    <Superseded by> essPrecipSensorInfoGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.12"
::= {essPrecipitationGroups 12}

essPrecipSensorInfoGroupV4 OBJECT-GROUP
  OBJECTS {
      precipitationSensorModelInformationV4 }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      sensor model information for v04.
    <Superseded by> essPrecipSensorInfoGroupV5
```



```
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.13"
::= {essPrecipitationGroups 13}

essPrecipDataGroupV5 OBJECT-GROUP
  OBJECTS {
      precipitationSensorPrecipRate,
      precipitationSensorSnowfallAccumRate,
      precipitationSensorPrecipStartDate,
      precipitationSensorPrecipStartTimeV5,
      precipitationSensorPrecipEndDate,
      precipitationSensorPrecipEndTimeV5 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      data readings for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.14"
::= {essPrecipitationGroups 14}

essPrecipSensorLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      precipitationSensorLocation,
      precipitationSensorXOffset,
      precipitationSensorYOffset,
      precipitationSensorZOffset }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      sensor location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.15"
::= {essPrecipitationGroups 15}

essPrecipSensorInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      precipitationSensorEntityID }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for precipitation
      sensor identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.16"
::= {essPrecipitationGroups 16}

essPrecipAdjacentSnowGroupV5 OBJECT-GROUP
  OBJECTS {
      precipitationSensorAdjacentSnowDepth }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for adjacent snow
      readings for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.17"
::= {essPrecipitationGroups 17}

essPrecipRoadwaySnowGroupV5 OBJECT-GROUP
  OBJECTS {
      precipitationSensorRoadwaySnowDepth,
      precipitationSensorRoadwaySnowPackDepth }
  STATUS   current
  DESCRIPTION
```



```
    "<Definition> The objects required to claim support for roadway snow
      readings for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.6.18"
::= {essPrecipitationGroups 18}
```

5.17.7 Radiation Groups

```
essRadiationGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS radiation
      objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.7"
::= {essGroups 7}

essRadiationGroupV1 OBJECT-GROUP
  OBJECTS {
      essSolarRadiation,
      essTotalSun }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for radiation
      readings for v01.
    <Superseded by> essRadiationGroupV2
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.7.1"
::= {essRadiationGroups 1}

essRadiationGroupV2 OBJECT-GROUP
  OBJECTS {
      essTotalSun,
      essInstantaneousTerrestrialRadiation,
      essInstantaneousSolarRadiation,
      essTotalRadiation,
      essTotalRadiationPeriod }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for radiation
      readings for v02.
    <Superseded by> essRadiationDataGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.7.2"
::= {essRadiationGroups 2}

essRadiationDataGroupV4 OBJECT-GROUP
  OBJECTS {
      essTotalRadiationPeriod,
      radiationSensorTableNumSensors,
      radiationSensorIndex,
      essTotalSunV4,
      essInstantaneousTerrestrialRadiationV4,
      essInstantaneousSolarRadiationV4,
      essTotalRadiationV4 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for radiation
      readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.7.3"
::= {essRadiationGroups 3}
```



```
essRadiationSensorLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      radiationSensorHeight,
      radiationSensorLatitude,
      radiationSensorLongitude,
      radiationSensorLocation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for radiation sensor
      location for v04.
    <Superseded by> essRadiationSensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.7.4"
::= {essRadiationGroups 4}

essRadiationSensorInfoGroupV4 OBJECT-GROUP
  OBJECTS {
      radiationSensorModelInformation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for radiation sensor
      identification for v04.
    <Superseded by> essRadiationSensorInfoGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.7.5"
::= {essRadiationGroups 5}

essRadiationSensorLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      radiationSensorLocation,
      radiationSensorXOffset,
      radiationSensorYOffset,
      radiationSensorZOffset }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for radiation sensor
      location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.7.6"
::= {essRadiationGroups 6}

essRadiationSensorInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      radiationSensorEntityID }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for radiation sensor
      identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.7.7"
::= {essRadiationGroups 7}
```

5.17.8 Visibility Groups

```
essVisibilityGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS visibility
      objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.8"
::= {essGroups 8}
```

```
essVisibilityGroupV1 OBJECT-GROUP
  OBJECTS {
      essVisibility }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for visibility
      readings for v01.
    <Superseded by> essVisibilityDataGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.8.1"
::= {essVisibilityGroups 1}

essVisibilitySituationGroupV1 OBJECT-GROUP
  OBJECTS {
      essVisibilitySituation }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for visibility
      situation readings for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.8.2"
::= {essVisibilityGroups 2}

essVisibilitySensorLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      visibilitySensorHeight,
      visibilitySensorLatitude,
      visibilitySensorLongitude,
      visibilitySensorLocation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for visibility
      sensor location for v04.
    <Superseded by> essVisibilitySensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.8.3"
::= {essVisibilityGroups 3}

essVisibilitySensorInfoGroupV4 OBJECT-GROUP
  OBJECTS {
      visibilitySensorModelInformation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for visibility
      sensor identification for v04.
    <Superseded by> essVisibilitySensorInfoGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.8.4"
::= {essVisibilityGroups 4}

essVisibilityDataGroupV5 OBJECT-GROUP
  OBJECTS {
      essNumVisibilitySensors,
      essVisibilitySensorCurrentReading }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for visibility
      readings for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.8.5"
::= {essVisibilityGroups 5}
```



```
essCloudSituationGroupV5 OBJECT-GROUP
  OBJECTS {
      essCloudSituationV4 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for cloud situation
      readings for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.8.6"
::= {essVisibilityGroups 6}

essVisibilitySensorLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      essVisibilitySensorLocation,
      essVisibilitySensorXOffset,
      essVisibilitySensorYOffset,
      essVisibilitySensorZOffset,
      essVisibilitySensorDirection }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for visibility
      sensor location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.8.7"
::= {essVisibilityGroups 7}

essVisibilitySensorInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      essVisibilitySensorEntityID }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for visibility
      sensor identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.8.8"
::= {essVisibilityGroups 8}
```

5.17.9 Pavement Groups

```
essPavementGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9"
::= {essGroups 9}

essPavementSensorCountGroupV1 OBJECT-GROUP
  OBJECTS {
      numEssPavementSensors,
      essPavementSensorIndex }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to identify the number of pavement
      sensors are available for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.1"
::= {essPavementGroups 1}

essPavementSensorMetaDataGroupV1 OBJECT-GROUP
  OBJECTS {
      essPavementSensorLocation,
      essPavementType,
```

```
      essPavementExposure,
      essPavementSensorType }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement sensor
      meta-data for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.2"
::= {essPavementGroups 2}

essPavementSensorSurfaceStatusGroupV1 OBJECT-GROUP
  OBJECTS {
      essSurfaceStatus }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement sensor
      condition for v01.
    <Superseded by> essPavementSurfaceCondGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.3"
::= {essPavementGroups 3}

essPavementSensorElevationGroupV1 OBJECT-GROUP
  OBJECTS {
      essPavementElevation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement sensor
      elevation data for v01.
    <Superseded by> essPavementSensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.4"
::= {essPavementGroups 4}

essPavementSurfaceTempGroupV1 OBJECT-GROUP
  OBJECTS {
      essSurfaceTemperature,
      essPavementSensorError }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement surface
      readings for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.5"
::= {essPavementGroups 5}

essPavementEnhancedGroupV1 OBJECT-GROUP
  OBJECTS {
      essPavementTemperature,
      essSurfaceWaterDepth }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for enhanced
      pavement readings for v01.
    <Superseded by> essPavementTemperatureGroupV2
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.6"
::= {essPavementGroups 6}

essSurfaceConductivityGroupV1 OBJECT-GROUP
  OBJECTS {
      essSurfaceConductivity }
```



```
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement surface
      conductivity for v01.
    <Superseded by> essSurfaceConductivityGroupV2
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.7"
::= {essPavementGroups 7}

essSurfaceSalinityGroupV1 OBJECT-GROUP
  OBJECTS {
      essSurfaceSalinity }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      salinity for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.8"
::= {essPavementGroups 8}

essPavementFreezeGroupV1 OBJECT-GROUP
  OBJECTS {
      essSurfaceFreezePoint,
      essSurfaceBlackIceSignal }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement surface
      freeze readings for v01.
    <Superseded by> essPavementTemperatureGroupV2
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.9"
::= {essPavementGroups 9}

essSurfaceConductivityGroupV2 OBJECT-GROUP
  OBJECTS {
      essSurfaceConductivityV2 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement surface
      conductivity for v02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.10"
::= {essPavementGroups 10}

essPavementTemperatureGroupV2 OBJECT-GROUP
  OBJECTS {
      essPavementTemperature,
      essSurfaceIceOrWaterDepth }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      temperature readings for v02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.11"
::= {essPavementGroups 11}

essPavementBlockGroupV2 OBJECT-GROUP
  OBJECTS {
      essPavementBlock }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for the pavement
```



```
      block in v02.
    <Superseded by> essPavementBlockGroupV3
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.12"
::= {essPavementGroups 12}

essPavementSensorDepthGroupV2 OBJECT-GROUP
  OBJECTS {
      pavementSensorTemperatureDepth }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for the pavement
      sensor depth in v02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.13"
::= {essPavementGroups 13}

essPavementSensorInfoGroupV2 OBJECT-GROUP
  OBJECTS {
      pavementSensorModelInformation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement sensor
      identification for v02.
    <Superseded by> essPavementSensorInfoGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.14"
::= {essPavementGroups 14}

essPavementBlockGroupV3 OBJECT-GROUP
  OBJECTS {
      essPavementV3Block }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for the pavement
      block in v03.
    <Withdrawn> In v04
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.15"
::= {essPavementGroups 15}

essPavementSurfaceCondGroupV4 OBJECT-GROUP
  OBJECTS {
      pavementSensorSurfaceCondition }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement surface
      condition readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.16"
::= {essPavementGroups 16}

essPavementFrictionGroupV4 OBJECT-GROUP
  OBJECTS {
      pavementSensorFrictionCoefficient }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      friction readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.17"
::= {essPavementGroups 17}
```



```
essPavementIcePercentGroupV4 OBJECT-GROUP
  OBJECTS {
      pavementIcePercentage }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for monitoring
      pavement ice percentage for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.18"
::= {essPavementGroups 18}

essPavementSensorLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      essPavementSensorLocation,
      pavementSensorLatitude,
      pavementSensorLongitude,
      pavementMonitorLatitude,
      pavementMonitorLongitude }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement sensor
      location for v04.
    <Superseded by> essPavementSensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.19"
::= {essPavementGroups 19}

essPavementForecastGroupV5 OBJECT-GROUP
  OBJECTS {
      pavementSensorForecastCondition }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      forecast readings for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.20"
::= {essPavementGroups 20}

essPavementSensorLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      essPavementSensorLocation,
      essPavementMonitorXOffset,
      essPavementMonitorYOffset,
      essPavementMonitorZOffset,
      essPavementSensorXOffset,
      essPavementSensorYOffset }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement sensor
      location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.21"
::= {essPavementGroups 21}

essPavementSensorInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      essPavementSensorEntityID }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement sensor
      identification for v05.
```



```
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.9.22"
::= {essPavementGroups 22}
```

5.17.10 Subsurface Groups

```
essSubSurfaceGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS subsurface
      objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.10"
::= {essGroups 10}

essSubSurfaceSensorCountGroupGroupV1 OBJECT-GROUP
  OBJECTS {
      numEssSubSurfaceSensors,
      essSubSurfaceSensorIndex }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to identify the number of subsurface
      sensors are available for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.10.1"
::= {essSubSurfaceGroups 1}

essSubSurfaceMoistureGroupV1 OBJECT-GROUP
  OBJECTS {
      essSubSurfaceMoisture }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for subsurface
      moisture readings for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.10.2"
::= {essSubSurfaceGroups 2}

essSubSurfaceBlockGroupV2 OBJECT-GROUP
  OBJECTS {
      essSubSurfaceBlock }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for the subsurface
      block in v02.
    <Withdrawn> In v04
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.10.3"
::= {essSubSurfaceGroups 3}

essSubSurfaceSensorLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      essSubSurfaceSensorLatitude,
      essSubSurfaceSensorLongitude }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for subsurface
      sensor location for v04.
    <Superseded by> essSubSurfaceSensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.10.4"
::= {essSubSurfaceGroups 4}

essSubSurfaceSensorInfoGroupV4 OBJECT-GROUP
```



```
  OBJECTS {
      essSubSurfaceSensorModelInformation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for subsurface
      sensor identification for v04.
    <Superseded by> essSubSurfaceSensorInfoGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.10.5"
::= {essSubSurfaceGroups 5}

essSubSurfaceDataGroupV5 OBJECT-GROUP
  OBJECTS {
      essSubSurfaceTemperature,
      essSubSurfaceSensorError }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for subsurface data
      readings for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.10.6"
::= {essSubSurfaceGroups 6}

essSubSurfaceSensorMetaDataGroupV5 OBJECT-GROUP
  OBJECTS {
      essSubSurfaceSensorLocation,
      essSubSurfaceType,
      essSubSurfaceSensorDepth }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for subsurface
      sensor meta-data for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.10.7"
::= {essSubSurfaceGroups 7}

essSubSurfaceSensorLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      essSubSurfaceSensorXOffset,
      essSubSurfaceSensorYOffset }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for subsurface
      sensor location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.10.8"
::= {essSubSurfaceGroups 8}

essSubSurfaceSensorInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      essSubSurfaceSensorEntityID }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for subsurface
      sensor identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.10.9"
::= {essSubSurfaceGroups 9}
```

5.17.11 Snapshot Groups

```
essSnapshotGroups OBJECT-IDENTITY
  STATUS       current
```



```
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS snapshot
      objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.11"
::= {essGroups 11}

essSnapshotCameraGroupV2 OBJECT-GROUP
  OBJECTS {
      essSnapshotNumberOfCameras,
      essSnapshotCameraIndex,
      essSnapshotCameraDescription,
      essSnapshotCameraStoragePath,
      essSnapshotCameraCommand,
      essSnapshotCameraError }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for snapshots for
      v02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.11.1"
::= {essSnapshotGroups 1}

essSnapshotFilenameGroupV3 OBJECT-GROUP
  OBJECTS {
      essSnapshotCameraFilename }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for snapshots for
      v03.
    <Superseded by> essSnapshotFilenameGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.11.2"
::= {essSnapshotGroups 2}

essSnapshotFilenameGroupV5 OBJECT-GROUP
  OBJECTS {
      essSnapshotCameraSupportedFormats,
      essSnapshotCameraFileFormat,
      essSnapshotCameraFilenameV5 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for snapshots for
      v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.11.3"
::= {essSnapshotGroups 3}

essSnapshotCameraInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      essSnapshotCameraEntityID }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for snapshot camera
      identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.11.4"
::= {essSnapshotGroups 4}
```

5.17.12 Observed Groups

```
essObservedGroups OBJECT-IDENTITY
  STATUS       current
```



```
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS observed
      readings.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.12"
::= {essGroups 12}

essObservedReadingGroupV1 OBJECT-GROUP
  OBJECTS {
      essWindSituation,
      essPrecipSituation,
      essCloudSituation,
      essVisibilitySituation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for observed
      readings for v01.
    <Superseded by> essObservedReadingGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.12.1"
::= {essObservedGroups 1}

essMobileObservationGroupV1 OBJECT-GROUP
  OBJECTS {
      essMobileObservationGroundState,
      essMobileObservationPavement }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for mobile observed
      readings for v01.
    <Superseded by> essObservedGroundStateGroupV4 and
      essObservedPavementStateGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.12.2"
::= {essObservedGroups 2}

essObservedReadingGroupV4 OBJECT-GROUP
  OBJECTS {
      essWindSituation,
      essPrecipSituation,
      essCloudSituationV4,
      essVisibilitySituation }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for observed
      readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.12.3"
::= {essObservedGroups 3}

essObservedGroundStateGroupV4 OBJECT-GROUP
  OBJECTS {
      essMobileObservationGroundStateV4 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for observed ground
      state readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.12.4"
::= {essObservedGroups 4}

essObservedPavementStateGroupV4 OBJECT-GROUP
```



```
  OBJECTS {
      essMobileObservationPavementV4 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for observed
      pavement state readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.12.5"
::= {essObservedGroups 5}
```

5.17.13 Water Level Groups

```
essWaterLevelGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS water level
      objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.13"
::= {essGroups 13}

essWaterDepthGroupV1 OBJECT-GROUP
  OBJECTS {
      essWaterDepth }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for water depth
      readings for v01.
    <Superseded by> essWaterLevelDataGroupV2
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.13.1"
::= {essWaterLevelGroups 1}

essWaterLevelDataGroupV2 OBJECT-GROUP
  OBJECTS {
      waterLevelSensorTableNumSensors,
      waterLevelSensorIndex,
      waterLevelSensorReading }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for water level
      readings for v02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.13.2"
::= {essWaterLevelGroups 2}

essWaterLevelSensorConfigurationGroupV4 OBJECT-GROUP
  OBJECTS {
      waterLevelSensorWarningLevel }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for water level
      configuration for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.13.3"
::= {essWaterLevelGroups 3}

essWaterLevelSensorLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      waterLevelSensorHeight,
      waterLevelSensorLatitude,
      waterLevelSensorLongitude,
      waterLevelSensorLocation,
```



```
      waterLevelSensorReferencePoint }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for water level
      sensor location for v04.
    <Superseded by> essWaterLevelSensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.13.4"
::= {essWaterLevelGroups 4}

essWaterLevelSensorInfoGroupV4 OBJECT-GROUP
  OBJECTS {
      waterLevelSensorModelInformation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for water level
      sensor identification for v04.
    <Superseded by> essWaterLevelSensorInfoGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.13.5"
::= {essWaterLevelGroups 5}

essWaterLevelSensorLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      waterLevelSensorLocation,
      waterLevelSensorReferencePoint,
      waterLevelSensorXOffset,
      waterLevelSensorYOffset,
      waterLevelSensorZOffset }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for water level
      sensor location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.13.6"
::= {essWaterLevelGroups 6}

essWaterLevelSensorInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      waterLevelSensorEntityID }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for water level
      sensor identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.13.7"
::= {essWaterLevelGroups 7}
```

5.17.14 Air Quality Groups

```
essAirQualityGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to ESS air quality
      objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14"
::= {essGroups 14}

essAirQualityCOGroupV1 OBJECT-GROUP
  OBJECTS {
      essCO }
  STATUS   current
```

```
  DESCRIPTION
    "<Definition> The objects required to claim support for carbon monoxide
      readings for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.1"
::= {essAirQualityGroups 1}

essAirQualityCO2GroupV1 OBJECT-GROUP
  OBJECTS {
      essCO2 }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for carbon dioxide
      readings for v01.
    <Superseded by> essAirQualityCO2GroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.2"
::= {essAirQualityGroups 2}

essAirQualityNOGroupV1 OBJECT-GROUP
  OBJECTS {
      essNO }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for nitric oxide
      readings for v01.
    <Superseded by> essAirQualityNOGroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.3"
::= {essAirQualityGroups 3}

essAirQualityNO2GroupV1 OBJECT-GROUP
  OBJECTS {
      essNO2 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for nitrogen dioxide
      readings for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.4"
::= {essAirQualityGroups 4}

essAirQualitySO2GroupV1 OBJECT-GROUP
  OBJECTS {
      essSO2 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for sulfur dioxide
      readings for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.5"
::= {essAirQualityGroups 5}

essAirQualityO3GroupV1 OBJECT-GROUP
  OBJECTS {
      essO3 }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for ozone readings
      for v01.
    <Superseded by> essAirQualityO3GroupV4
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.6"
```



```
::= {essAirQualityGroups 6}

essAirQualityPM10GroupV1 OBJECT-GROUP
  OBJECTS {
      essPM10 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for small (10
      micrometer) particulate matter readings for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.7"
::= {essAirQualityGroups 7}

essAQBlockGroupV2 OBJECT-GROUP
  OBJECTS {
      essAirQualityBlock }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for the air quality
      block in v02.
    <Withdrawn> In v04
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.8"
::= {essAirQualityGroups 8}

essAirQualityCO2GroupV4 OBJECT-GROUP
  OBJECTS {
      essCO2V4 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for carbon dioxide
      readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.9"
::= {essAirQualityGroups 9}

essAirQualityNOGroupV4 OBJECT-GROUP
  OBJECTS {
      essNOV4 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for nitric oxide
      readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.10"
::= {essAirQualityGroups 10}

essAirQualityO3GroupV4 OBJECT-GROUP
  OBJECTS {
      essO3V4 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for ozone readings
      for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.11"
::= {essAirQualityGroups 11}

essAirQualityPM25GroupV4 OBJECT-GROUP
  OBJECTS {
      essPM25 }
  STATUS   current
```

```
  DESCRIPTION
    "<Definition> The objects required to claim support for small (2.5
      micrometer) particulate matter readings for v04.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.12"
::= {essAirQualityGroups 12}

essAirQualitySensorLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      airQualitySensorTableNumSensors,
      airQualitySensorIndex,
      airQualitySensorHeight,
      airQualitySensorLatitude,
      airQualitySensorLongitude,
      airQualitySensorLocation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for air quality
      sensor location for v04.
    <Superseded by> essAirQualitySensorLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.13"
::= {essAirQualityGroups 13}

essAirQualitySensorInfoGroupV4 OBJECT-GROUP
  OBJECTS {
      airQualitySensorModelInformation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for air quality
      sensor identification for v04.
    <Superseded by> essAirQualitySensorInfoGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.14"
::= {essAirQualityGroups 14}

essAirQualityPM1GroupV5 OBJECT-GROUP
  OBJECTS {
      essPM1 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for small (1.0
      micrometer) particulate matter readings for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.15"
::= {essAirQualityGroups 15}

essAirQualitySensorLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      airQualitySensorTableNumSensors,
      airQualitySensorIndex,
      airQualitySensorLocation,
      airQualitySensorXOffset,
      airQualitySensorYOffset,
      airQualitySensorZOffset }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for air quality
      sensor location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.16"
::= {essAirQualityGroups 16}
```



```
essAirQualitySensorInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      airQualitySensorEntityID }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for air quality
      sensor identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.14.17"
::= {essAirQualityGroups 17}
```

5.17.15 Pavement Treatment Groups

```
essPavementTreatmentGroups OBJECT-IDENTITY
  STATUS       current
  DESCRIPTION
    "<Definition> A node for group definitions related to PTS objects.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15"
::= {essGroups 15}

ptsProductGroupV1 OBJECT-GROUP
  OBJECTS {
      numEssTreatments,
      essPavementTreatmentIndex,
      essPaveTreatProductType,
      essPaveTreatProductForm,
      essPercentProductMix }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      treatment table for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.1"
::= {essPavementTreatmentGroups 1}

ptsSpreadConfigGroupV1 OBJECT-GROUP
  OBJECTS {
      essPaveTreatmentAmount,
      essPaveTreatmentWidth }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      treatment spread configuration details for v01.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.2"
::= {essPavementTreatmentGroups 2}

ptsStatusGroupV2 OBJECT-GROUP
  OBJECTS {
      ptsSprayerState,
      ptsSignalEventCount,
      ptsLastSignalEvent,
      ptsActiveEventCount,
      ptsInactiveEventCount,
      ptsLastActiveEvent,
      ptsLastInactiveEvent,
      ptsError }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
```



```
      treatment status for v02.
    <Superseded by> ptsStatusGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.3"
::= {essPavementTreatmentGroups 3}

ptsConfigurationGroupV2 OBJECT-GROUP
  OBJECTS {
      ptsSignalDuration,
      ptsMonitoringDetectors }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      treatment configuration for v02.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.4"
::= {essPavementTreatmentGroups 4}

ptsCommandGroupV2 OBJECT-GROUP
  OBJECTS {
      ptsOperationalMode,
      ptsCommandState }
  STATUS   obsolete
  DESCRIPTION
    "<Definition> The objects required to claim support for the pavement
      treatment command objects for v02.
    <Superseded by> ptsOperationGroupV3 and ptsCommandGroupV3
    <Informative> Made obsolete in v03.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.5"
::= {essPavementTreatmentGroups 5}

essPtsBlockGroupV2 OBJECT-GROUP
  OBJECTS {
      pavementTreatmentBlock }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for the pavement
      treatment block in v02.
    <Withdrawn> In v04
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.6"
::= {essPavementTreatmentGroups 6}

ptsOperationGroupV3 OBJECT-GROUP
  OBJECTS {
      ptsOperationalModeV3 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for the pavement
      treatment operation parameter for v03.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.7"
::= {essPavementTreatmentGroups 7}

ptsCommandGroupV3 OBJECT-GROUP
  OBJECTS {
      ptsCommandStateV3 }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      treatment commands for v03.
```



```
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.8"
::= {essPavementTreatmentGroups 8}

ptsLocationGroupV4 OBJECT-GROUP
  OBJECTS {
      essPavementTreatmentLatitude,
      essPavementTreatmentLongitude,
      essPavementTreatmentLocation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      treatment location for v04.
    <Superseded by> ptsLocationGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.9"
::= {essPavementTreatmentGroups 9}

ptsInfoGroupV4 OBJECT-GROUP
  OBJECTS {
      essPavementTreatmentModelInformation }
  STATUS   deprecated
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      treatment system identification for v04.
    <Superseded by> ptsInfoGroupV5
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.10"
::= {essPavementTreatmentGroups 10}

ptsStatusGroupV5 OBJECT-GROUP
  OBJECTS {
      ptsSprayerState,
      ptsSignalEventCount,
      ptsActiveEventCount,
      ptsInactiveEventCount,
      ptsError,
      ptsLastSignalEventDate,
      ptsLastSignalEventTime,
      ptsLastActiveEventDate,
      ptsLastActiveEventTime,
      ptsLastInactiveEventDate,
      ptsLastInactiveEventTime }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      treatment status for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.11"
::= {essPavementTreatmentGroups 11}

ptsLocationGroupV5 OBJECT-GROUP
  OBJECTS {
      essPavementTreatmentLocation,
      ptsXOffset,
      ptsYOffset }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      treatment location for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.12"
```



```
::= {essPavementTreatmentGroups 12}

ptsInfoGroupV5 OBJECT-GROUP
  OBJECTS {
      ptsEntityID }
  STATUS   current
  DESCRIPTION
    "<Definition> The objects required to claim support for pavement
      treatment system identification for v05.
    <Object Identifier> 1.3.6.1.4.1.1206.4.2.5.127.2.15.13"
::= {essPavementTreatmentGroups 13}

END
```

5.18 Camera Images

A snapshot is an image captured in a computer file. The data related to the exchange of computer files is defined in SFTS v3.

Annex A
Requirements Traceability Matrix (RTM) [Normative]

The Requirements Traceability Matrix (RTM) links the Functional Requirements as presented in Section 3 with the corresponding Dialogs (Section 4.2) on the same (gray) line. Each Functional Requirement/Dialog relates/uses one or more groups of Objects. The Objects (also known as Data Elements) are listed to the side; the formal definition of each object is contained within Section 5. Using this table, each Functional Requirement can thus be traced in a standardized way.

> Note: The INDEX objects into any of the tables are not explicitly exchanged but are used as index values for other objects that are exchanged.

The audience for this table is implementers (vendors and central system developers) and conformance testers. Additionally, other interested parties might use this table to determine how particular functions are to be implemented using the standardized dialogs, interfaces, and object definitions.

To conform to a Functional Requirement, an ESS shall implement all Objects and Dialogs traced from that Functional Requirement; a management station shall implement all Dialogs traced from the Functional Requirement. In order to be consistent with a Functional Requirement, a management station shall be able to fulfill the Functional Requirement using only Objects and Dialogs that a conforming ESS is required to support.

Section 3.6 defines Supplemental Requirements, which are refining other functional requirements. These functional requirements in turn are generally traced to design elements (e.g., rather than being directly traced to design elements).

A.1 Notation [Informative]

A.1.1 Functional Requirement Columns

The functional requirements are defined within Section 3 and the RTM is based upon the requirements within that Section. The section number and the functional requirement name are indicated within these columns.

A.1.2 Dialog Column

The standardized dialogs are defined within Section 4 and the RTM references the traces from requirements to this dialog. The section number of the dialog is indicated within this column.

A.1.3 Object Columns

The objects are defined within Section 5 of this document and Section 2 of NTCIP 1201. The RTM references the data objects that are referenced by the dialog. The section number and object name are indicated within these columns.

A.1.4 Additional Specifications

The "Additional Specifications" column may (and should) be used to provide additional notes and requirements about the dialog or may be used by an implementer to provide any additional details about the implementation.

A.2 Instructions for Completing the RTM [Informative]

To find the standardized design content for a functional requirement, search for the requirement identification number and functional requirement under the functional requirements columns. Next to the functional requirements column is a dialog identification number, identifying either a generic dialog (found in Annex G) or a specified dialog (found in Section 4.2) to be used to fulfill that requirement. To the right of the dialog identification number are the identification number and name of the data objects that are referenced or used by the dialog to fulfill the functional requirement. Object definitions specific to this document can be found in Section 5. If an object is defined in a different standard, that standard shall be listed first, followed by the section number where the object definition can be found. The "Additional Specifications" column provides additional notes or details about the design content.

A.3 Requirements Traceability Matrix (RTM) Table

Requirement	Object Reference	Object	Dialogue	Notes
3.5.1.1 : Retrieve ESS Type of Station			ISO 26048-1 : Get elemental data	
	5.3.1	essTypeofStation		
3.5.1.2 : Retrieve Mobile ESS Movement			ISO 26048-1 : Get elemental data	
	ISO26048-1-FieldDevice	fdGnssLatitude		
	ISO26048-1-FieldDevice	fdGnssLongitude		
	ISO26048-1-FieldDevice	fdGnssElevation		
	ISO26048-1-FieldDevice	fdSpeed		
	ISO26048-1-FieldDevice	fdBearing		
	ISO26048-1-FieldDevice	fdOdometer		
3.5.2.1.1 : Determine Number of Atmospheric Pressure Sensors			ISO 26048-1 : Get elemental data	
	5.5.5	essNumPressureSensors		
3.5.2.1.2 : Retrieve Atmospheric Pressure Sensor Location			ISO 26048-1 : Get tabular data	

Requirement	Object Reference	Object	Dialogue	Notes
	5.5.7.5	essPressureSensorLocation		
	5.5.7.8	essPressureSensorXOffset		
	5.5.7.9	essPressureSensorYOffset		
	5.5.7.10	essPressureSensorZOffset		
3.5.2.1.3 : Retrieve Atmospheric Pressure Sensor Identity			ISO 26048-1 : Get tabular data	
	5.5.7.11	essPressureSensorEntityID		
3.5.2.1.4 : Configure Atmospheric Pressure Sensor Location			ISO 26048-1 : Set tabular data	
	5.5.7.5	essPressureSensorLocation		
	5.5.7.8	essPressureSensorXOffset		
	5.5.7.9	essPressureSensorYOffset		
	5.5.7.10	essPressureSensorZOffset		
3.5.2.1.5 : Retrieve Atmospheric Pressure			ISO 26048-1 : Get tabular data	
	5.5.7.7	essPressureSensorAtmosphericPressure		
3.5.2.2.1 : Determine Number of Wind Sensors			ISO 26048-1 : Get elemental data	
	5.6.8	windSensorTableNumSensors		
3.5.2.2.2 : Retrieve Wind Sensor Location			ISO 26048-1 : Get tabular data	
	5.6.10.3	windSensorLocation		
	5.6.10.14	windSensorXOffset		
	5.6.10.15	windSensorYOffset		
	5.6.10.16	windSensorZOffset		
3.5.2.2.3 : Retrieve Wind Sensor Identity			ISO 26048-1 : Get tabular data	
	5.6.10.17	windSensorEntityID		
3.5.2.2.4 : Configure Wind Sensor Location			ISO 26048-1 : Set tabular data	
	5.6.10.3	windSensorLocation		
	5.6.10.14	windSensorXOffset		
	5.6.10.15	windSensorYOffset		
	5.6.10.16	windSensorZOffset		
3.5.2.2.5 : Retrieve Wind Data			ISO 26048-1 : Get tabular data	

Requirement	Object Reference	Object	Dialogue	Notes
	5.6.10.4	windSensorAvgSpeed		
	5.6.10.5	windSensorAvgDirection		
	5.6.10.6	windSensorSpotSpeed		
	5.6.10.7	windSensorSpotDirection		
	5.6.10.8	windSensorGustSpeed		
	5.6.10.9	windSensorGustDirection		
	5.6.10.10	windSensorSituation		
3.5.2.3.1 : Determine Number of Temperature Sensors			ISO 26048-1 : Get tabular data	
	5.7.1	essNumTemperatureSensors		
3.5.2.3.2 : Retrieve Temperature Sensor Location			ISO 26048-1 : Get tabular data	
	5.7.3.6	essTemperatureSensorLocation		
	5.7.3.8	essTemperatureSensorXOffset		
	5.7.3.9	essTemperatureSensorYOffset		
	5.7.3.10	essTemperatureSensorZOffset		
3.5.2.3.3 : Retrieve Temperature Sensor Identity			ISO 26048-1 : Get tabular data	
	5.7.3.11	essTemperatureSensorEntityID		
3.5.2.3.4 : Configure Temperature Sensor Location			ISO 26048-1 : Set tabular data	
	5.7.3.6	essTemperatureSensorLocation		
	5.7.3.8	essTemperatureSensorXOffset		
	5.7.3.9	essTemperatureSensorYOffset		
	5.7.3.10	essTemperatureSensorZOffset		
3.5.2.3.5 : Retrieve Air Temperature			ISO 26048-1 : Get tabular data	
	5.7.3.3	essAirTemperature		
3.5.2.3.6 : Retrieve Daily Minimum and Maximum Temperature			ISO 26048-1 : Get elemental data	
	5.7.6	essMaxTemp		
	5.7.7	essMinTemp		
3.5.2.4.1 : Determine Number of Humidity Sensors			ISO 26048-1 : Get elemental data	
	5.8.25	humiditySensorTableNumSensors		

Requirement	Object Reference	Object	Dialogue	Notes
3.5.2.4.2 : Retrieve Humidity Sensor Location			ISO 26048-1 : Get tabular data	
	5.8.27.5	humiditySensorLocation		
	5.8.27.11	humiditySensorXOffset		
	5.8.27.12	humiditySensorYOffset		
	5.8.27.13	humiditySensorZOffset		
3.5.2.4.3 : Retrieve Humidity Sensor Identity			ISO 26048-1 : Get tabular data	
	5.8.27.14	humiditySensorEntityID		
3.5.2.4.4 : Configure Humidity Sensor Location			ISO 26048-1 : Set tabular data	
	5.8.27.5	humiditySensorLocation		
	5.8.27.11	humiditySensorXOffset		
	5.8.27.12	humiditySensorYOffset		
	5.8.27.13	humiditySensorZOffset		
3.5.2.4.5 : Configure Humidity Sensor Temperature			ISO 26048-1 : Set tabular data	
	5.8.27.8	humiditySensorTemperatureInformation		
3.5.2.4.6 : Retrieve Relative Humidity			ISO 26048-1 : Get tabular data	
	5.8.27.7	humiditySensorRelativeHumidity		
	5.8.27.8	humiditySensorTemperatureInformation		
	5.8.27.9	humiditySensorWetbulbTemp		
	5.8.27.10	humiditySensorDewpointTemp		
3.5.2.5.1 : Determine Number of Precipitation Sensors			ISO 26048-1 : Get elemental data	
	5.8.22	precipitationSensorTableNumSensors		
3.5.2.5.2 : Retrieve Precipitation Sensor Location			ISO 26048-1 : Get tabular data	
	5.8.24.5	precipitationSensorLocation		
	5.8.24.28	precipitationSensorXOffset		
	5.8.24.29	precipitationSensorYOffset		
	5.8.24.30	precipitationSensorZOffset		
3.5.2.5.3 : Retrieve Precipitation Sensor Identity			ISO 26048-1 : Get tabular data	
	5.8.24.31	precipitationSensorEntityID		

Requirement	Object Reference	Object	Dialogue	Notes
3.5.2.5.4 : Configure Precipitation Sensor Location			ISO 26048-1 : Set tabular data	
	5.8.24.5	precipitationSensorLocation		
	5.8.24.28	precipitationSensorXOffset		
	5.8.24.29	precipitationSensorYOffset		
	5.8.24.30	precipitationSensorZOffset		
3.5.2.5.5 : Configure Precipitation Total User-Specified Period			ISO 26048-1 : Set tabular data	
	5.8.24.7	precipitationSensorPeriod		
3.5.2.5.6 : Retrieve Precipitation Presence			ISO 26048-1 : Get tabular data	
	5.8.24.11	precipitationSensorPrecipYesNo		
3.5.2.5.7 : Retrieve Precipitation Rates			ISO 26048-1 : Get tabular data	
	5.8.24.12	precipitationSensorPrecipRate		
	5.8.24.13	precipitationSensorSnowfallAccumRate		
	5.8.24.24	precipitationSensorPrecipStartDate		
	5.8.24.25	precipitationSensorPrecipStartTimeV5		
	5.8.24.26	precipitationSensorPrecipEndDate		
	5.8.24.27	precipitationSensorPrecipEndTimeV5		
3.5.2.5.8 : Retrieve Precipitation Totals			ISO 26048-1 : Get tabular data	
	5.8.24.18	precipitationSensorPrecipitationOneHour		
	5.8.24.19	precipitationSensorPrecipitationThreeHours		
	5.8.24.20	precipitationSensorPrecipitationSixHours		
	5.8.24.21	precipitationSensorPrecipitationTwelveHours		
	5.8.24.22	precipitationSensorPrecipitation24Hours		
3.5.2.5.9 : Retrieve Precipitation Totals - User Specified			ISO 26048-1 : Get tabular data	
	5.8.24.7	precipitationSensorPeriod		
	5.8.24.23	precipitationSensorPrecipitationUserDefined		
3.5.2.5.10 : Retrieve Precipitation Type			ISO 26048-1 : Get elemental data	
	5.8.24.14	precipitationSensorPrecipSituation		
3.5.2.6.1 : Determine Number of Solar Radiation Sensors			ISO 26048-1 : Get elemental data	

Requirement	Object Reference	Object	Dialogue	Notes
	5.9.8	radiationSensorTableNumSensors		
3.5.2.6.2 : Retrieve Solar Radiation Sensor Location			ISO 26048-1 : Get tabular data	
	5.9.10.5	radiationSensorLocation		
	5.9.10.11	radiationSensorXOffset		
	5.9.10.12	radiationSensorYOffset		
	5.9.10.13	radiationSensorZOffset		
3.5.2.6.3 : Retrieve Solar Radiation Sensor Identity			ISO 26048-1 : Get tabular data	
	5.9.10.14	radiationSensorEntityID		
3.5.2.6.4 : Configure Solar Radiation Sensor Location			ISO 26048-1 : Set tabular data	
	5.9.10.5	radiationSensorLocation		
	5.9.10.11	radiationSensorXOffset		
	5.9.10.12	radiationSensorYOffset		
	5.9.10.13	radiationSensorZOffset		
3.5.2.6.5 : Retrieve Solar Radiation			4.2.9 : Retrieve Solar Radiation	
	5.9.7	essTotalRadiationPeriod		
	5.9.8	radiationSensorTableNumSensors		
	5.9.10.7	essTotalSunV4		
	5.9.10.8	essInstantaneousTerrestrialRadiationV4		
	5.9.10.9	essInstantaneousSolarRadiationV4		
	5.9.10.10	essTotalRadiationV4		
3.5.2.7.1 : Determine Number of Visibility Sensors			ISO 26048-1 : Get elemental data	
	5.10.2	essNumVisibilitySensors		
3.5.2.7.2 : Retrieve Visibility Sensor Location			ISO 26048-1 : Get elemental data	
	5.10.10.2	essVisibilitySensorLocation		
	5.10.10.3	essVisibilitySensorXOffset		
	5.10.10.4	essVisibilitySensorYOffset		
	5.10.10.5	essVisibilitySensorZOffset		
	5.10.10.6	essVisibilitySensorDirection		

Requirement	Object Reference	Object	Dialogue	Notes
3.5.2.7.3 : Retrieve Visibility Sensor Identity			ISO 26048-1 : Get elemental data	
	5.10.10.7	essVisibilitySensorEntityID		
3.5.2.7.4 : Configure Visibility Sensor Location			ISO 26048-1 : Set elemental data	
	5.10.10.2	essVisibilitySensorLocation		
	5.10.10.3	essVisibilitySensorXOffset		
	5.10.10.4	essVisibilitySensorYOffset		
	5.10.10.5	essVisibilitySensorZOffset		
	5.10.10.6	essVisibilitySensorDirection		
3.5.2.7.5 : Retrieve Visibility			ISO 26048-1 : Get tabular data	
	5.10.10.8	essVisibilitySensorCurrentReading		
3.5.2.8.1 : Determine Number of Pavement Sensors			ISO 26048-1 : Get elemental data	
	5.11.1	numEssPavementSensors		
3.5.2.8.2 : Retrieve Pavement Sensor Location			ISO 26048-1 : Get tabular data	
	5.11.3.2	essPavementSensorLocation		
	5.11.3.28	essPavementMonitorXOffset		
	5.11.3.29	essPavementMonitorYOffset		
	5.11.3.30	essPavementMonitorZOffset		
	5.11.3.31	essPavementSensorXOffset		
	5.11.3.32	essPavementSensorYOffset		
3.5.2.8.3 : Retrieve Pavement Sensor Identity			ISO 26048-1 : Get tabular data	
	5.11.3.33	essPavementSensorEntityID		
3.5.2.8.4 : Configure Pavement Sensor Location			ISO 26048-1 : Set tabular data	
	5.11.3.2	essPavementSensorLocation		
	5.11.3.28	essPavementMonitorXOffset		
	5.11.3.29	essPavementMonitorYOffset		
	5.11.3.30	essPavementMonitorZOffset		
	5.11.3.31	essPavementSensorXOffset		
	5.11.3.32	essPavementSensorYOffset		

Requirement	Object Reference	Object	Dialogue	Notes
3.5.2.8.5 : Retrieve Pavement Sensor Metadata			ISO 26048-1 : Get tabular data	
	5.11.3.2	essPavementSensorLocation		
	5.11.3.3	essPavementType		
	5.11.3.5	essPavementExposure		
	5.11.3.6	essPavementSensorType		
3.5.2.8.6 : Configure Pavement Sensor Metadata			ISO 26048-1 : Set tabular data	
	5.11.3.2	essPavementSensorLocation		
	5.11.3.3	essPavementType		
	5.11.3.5	essPavementExposure		
3.5.2.8.7 : Configure Passive Ice Detection Logic			4.2.7 : Configure Passive Ice Detection Logic	
	5.13.1	numEssTreatments		
	5.13.3.2	essPaveTreatProductType		
	5.13.3.3	essPaveTreatProductForm		
	5.13.3.4	essPercentProductMix		
3.5.2.8.8 : Retrieve Conditions for Freezing Algorithms - Active			ISO 26048-1 : Get tabular data	
	5.11.3.8	essSurfaceTemperature		
	5.11.3.9	essPavementTemperature		
	5.11.3.13	essSurfaceFreezePoint		
	5.11.3.14	essSurfaceBlackIceSignal		
	5.11.3.15	essPavementSensorError		
	5.11.3.16	essSurfaceIceOrWaterDepth		
	5.11.3.19	pavementSensorTemperatureDepth		
3.5.2.8.9 : Retrieve Conditions for Freezing Algorithms - Passive			4.2.5 : Retrieve Icing Conditions—Passive	
	5.11.3.8	essSurfaceTemperature		
	5.11.3.9	essPavementTemperature		
	5.11.3.11	essSurfaceSalinity		
	5.11.3.13	essSurfaceFreezePoint		
	5.11.3.14	essSurfaceBlackIceSignal		

Requirement	Object Reference	Object	Dialogue	Notes
	5.11.3.15	essPavementSensorError		
	5.11.3.16	essSurfaceIceOrWaterDepth		
	5.11.3.17	essSurfaceConductivityV2		
	5.11.3.19	pavementSensorTemperatureDepth		
	5.13.1	numEssTreatments		
	5.13.3.2	essPaveTreatProductType		
	5.13.3.3	essPaveTreatProductForm		
	5.13.3.4	essPercentProductMix		
3.5.2.8.10 : Retrieve Pavement Surface Temperature			ISO 26048-1 : Get tabular data	
	5.11.3.8	essSurfaceTemperature		
	5.11.3.15	essPavementSensorError		
3.5.2.8.11 : Retrieve Pavement Surface Condition			ISO 26048-1 : Get tabular data	
	5.11.3.15	essPavementSensorError		
	5.11.3.22	pavementSensorSurfaceCondition		
3.5.2.8.12 : Retrieve Forecasted Pavement Surface Condition			ISO 26048-1 : Get tabular data	
	5.11.3.23	pavementSensorForecastCondition		
3.5.2.8.13 : Retrieve Roadway Friction Coefficient			ISO 26048-1 : Get tabular data	
	5.11.3.24	pavementSensorFrictionCoefficient		
3.5.2.8.14 : Retrieve Ice Percentage			ISO 26048-1 : Get tabular data	
	5.11.3.27	pavementIcePercentage		
3.5.2.8.15 : Retrieve Adjacent Snow Depth			ISO 26048-1 : Get tabular data	
	5.8.24.8	precipitationSensorAdjacentSnowDepth		
3.5.2.8.16 : Retrieve Roadway Snow Depth			ISO 26048-1 : Get tabular data	
	5.8.24.9	precipitationSensorRoadwaySnowDepth		
	5.8.24.10	precipitationSensorRoadwaySnowPackDepth		
3.5.2.8.17 : Retrieve Roadway Ice Thickness			ISO 26048-1 : Get tabular data	
	5.11.3.16	essSurfaceIceOrWaterDepth		
3.5.2.9.1 : Determine Number of Subsurface Sensors			ISO 26048-1 : Get elemental data	

Requirement	Object Reference	Object	Dialogue	Notes
	5.11.4	numEssSubSurfaceSensors		
3.5.2.9.2 : Retrieve Subsurface Sensor Location			ISO 26048-1 : Get tabular data	
	5.11.6.2	essSubSurfaceSensorLocation		
	5.11.6.12	essSubSurfaceSensorXOffset		
	5.11.6.13	essSubSurfaceSensorYOffset		
3.5.2.9.3 : Retrieve Subsurface Sensor Identity			ISO 26048-1 : Get tabular data	
	5.11.6.6	essSubSurfaceSensorEntityID		
3.5.2.9.4 : Configure Subsurface Sensor Location			ISO 26048-1 : Set tabular data	
	5.11.6.2	essSubSurfaceSensorLocation		
	5.11.6.12	essSubSurfaceSensorXOffset		
	5.11.6.13	essSubSurfaceSensorYOffset		
3.5.2.9.5 : Retrieve Subsurface Sensor Metadata			ISO 26048-1 : Get tabular data	
	5.11.6.2	essSubSurfaceSensorLocation		
	5.11.6.3	essSubSurfaceType		
	5.11.6.4	essSubSurfaceSensorDepth		
3.5.2.9.6 : Configure Subsurface Sensor Metadata			ISO 26048-1 : Set tabular data	
	5.11.6.2	essSubSurfaceSensorLocation		
	5.11.6.3	essSubSurfaceType		
	5.11.6.4	essSubSurfaceSensorDepth		
3.5.2.9.7 : Retrieve Subsurface Temperature			ISO 26048-1 : Get tabular data	
	5.11.6.5	essSubSurfaceTemperature		
	5.11.6.8	essSubSurfaceSensorError		
3.5.2.9.8 : Retrieve Subsurface Moisture			ISO 26048-1 : Get tabular data	
	5.11.6.7	essSubSurfaceMoisture		
3.5.2.10.1 : Determine Number of Air Quality Sensors			ISO 26048-1 : Get elemental data	
	5.14.10	airQualitySensorTableNumSensors		
3.5.2.10.2 : Retrieve Air Quality Sensor Location			ISO 26048-1 : Get tabular data	
	5.14.12.5	airQualitySensorLocation		

Requirement	Object Reference	Object	Dialogue	Notes
	5.14.12.7	airQualitySensorXOffset		
	5.14.12.8	airQualitySensorYOffset		
	5.14.12.9	airQualitySensorZOffset		
3.5.2.10.3 : Retrieve Air Quality Sensor Identity			ISO 26048-1 : Get tabular data	
	5.14.12.10	airQualitySensorEntityID		
3.5.2.10.4 : Configure Air Quality Sensor Location			ISO 26048-1 : Set tabular data	
	5.14.12.5	airQualitySensorLocation		
	5.14.12.7	airQualitySensorXOffset		
	5.14.12.8	airQualitySensorYOffset		
	5.14.12.9	airQualitySensorZOffset		
3.5.2.10.5 : Retrieve Carbon Monoxide Reading			ISO 26048-1 : Get elemental data	
	5.14.1	essCO		
3.5.2.10.6 : Retrieve Nitrogen Dioxide Reading			ISO 26048-1 : Get elemental data	
	5.14.4	essNO2		
3.5.2.10.7 : Retrieve Sulfur Dioxide Reading			ISO 26048-1 : Get elemental data	
	5.14.5	essSO2		
3.5.2.10.8 : Retrieve Small Particulate Matter Reading			ISO 26048-1 : Get elemental data	
	5.14.7	essPM10		
3.5.2.10.9 : Retrieve Particulate Matter 2.5 Reading			ISO 26048-1 : Get elemental data	
	5.14.9	essPM25		
3.5.2.10.10 : Retrieve Particulate Matter 1.0 Reading			ISO 26048-1 : Get elemental data	
	5.14.16	essPM1		
3.5.2.10.11 : Retrieve Carbon Dioxide Reading			ISO 26048-1 : Get elemental data	
	5.14.13	essCO2V4		
3.5.2.10.12 : Retrieve Nitric Oxide Reading			ISO 26048-1 : Get elemental data	
	5.14.14	essNOV4		
3.5.2.10.13 : Retrieve Ozone Reading			ISO 26048-1 : Get elemental data	
	5.14.15	essO3V4		

Requirement	Object Reference	Object	Dialogue	Notes
3.5.2.11.1 : Determine Number of Water Level Sensors			ISO 26048-1 : Get elemental data	
	5.8.19	waterLevelSensorTableNumSensors		
3.5.2.11.2 : Retrieve Water Level Sensor Location			ISO 26048-1 : Get tabular data	
	5.8.21.7	waterLevelSensorLocation		
	5.8.21.9	waterLevelSensorReferencePoint		
	5.8.21.10	waterLevelSensorXOffset		
	5.8.21.11	waterLevelSensorYOffset		
	5.8.21.12	waterLevelSensorZOffset		
3.5.2.11.3 : Retrieve Water Level Sensor Identity			ISO 26048-1 : Get tabular data	
	5.8.21.13	waterLevelSensorEntityID		
3.5.2.11.4 : Retrieve Water Level Sensor Warning Level			ISO 26048-1 : Get tabular data	
	5.8.21.3	waterLevelSensorWarningLevel		
3.5.2.11.5 : Configure Water Level Sensor Location			ISO 26048-1 : Set tabular data	
	5.8.21.7	waterLevelSensorLocation		
	5.8.21.9	waterLevelSensorReferencePoint		
	5.8.21.10	waterLevelSensorXOffset		
	5.8.21.11	waterLevelSensorYOffset		
	5.8.21.12	waterLevelSensorZOffset		
3.5.2.11.6 : Configure Water Level Sensor Warning Level			ISO 26048-1 : Set tabular data	
	5.8.21.3	waterLevelSensorWarningLevel		
3.5.2.11.7 : Retrieve Water Level			ISO 26048-1 : Get tabular data	
	5.8.19	waterLevelSensorTableNumSensors		
	5.8.21.2	waterLevelSensorReading		
3.5.2.12.1 : Retrieve Wind Situation			ISO 26048-1 : Get tabular data	
	5.6.5	essWindSituation		
3.5.2.12.2 : Retrieve Precipitation Situation			ISO 26048-1 : Get elemental data	
	5.8.9	essPrecipSituation		
3.5.2.12.3 : Retrieve Visibility Situation			ISO 26048-1 : Get elemental data	

Requirement	Object Reference	Object	Dialogue	Notes
	5.10.3	essVisibilitySituation		
3.5.2.12.4 : Retrieve Cloud Situation			ISO 26048-1 : Get elemental data	
	5.9.11	essCloudSituationV4		
3.5.2.12.5 : Retrieve Ground State			ISO 26048-1 : Get elemental data	
	5.12.4	essMobileObservationGroundStateV4		
3.5.2.12.6 : Retrieve Pavement State			ISO 26048-1 : Get elemental data	
	5.12.5	essMobileObservationPavementV4		
3.5.2.13.1 : Determine Number of Snapshot Cameras			ISO 26048-1 : Get elemental data	
	5.16.1	essSnapshotNumberOfCameras		
3.5.2.13.2 : Retrieve Snapshot Camera Identity			ISO 26048-1 : Get elemental data	
	5.16.3.10	essSnapshotCameraEntityID		
3.5.2.13.3 : Determine Supported Image Storage Formats			ISO 26048-1 : Get elemental data	
	5.16.3.7	essSnapshotCameraSupportedFormats		
3.5.2.13.4 : Configure Snapshot Camera			ISO 26048-1 : Set tabular data	
	5.16.3.2	essSnapshotCameraDescription		
	5.16.3.8	essSnapshotCameraFileFormat		
	5.16.3.9	essSnapshotCameraFilenameV5		
3.5.2.13.5 : Retrieve Snapshot Camera Configuration			ISO 26048-1 : Get tabular data	
	5.16.3.2	essSnapshotCameraDescription		
	5.16.3.3	essSnapshotCameraStoragePath		
	5.16.3.8	essSnapshotCameraFileFormat		
	5.16.3.9	essSnapshotCameraFilenameV5		
3.5.2.13.6 : Capture Snapshot Image			4.2.1 : Capture Snapshot Image	
	5.16.3.4	essSnapshotCameraCommand		
	5.16.3.5	essSnapshotCameraError		
3.5.2.13.7 : Retrieve Snapshot			4.2.2 : Retrieve Snapshot	
3.5.2.13.8 : Delete Snapshot			4.2.3 : Delete Snapshot	
3.5.3.1.1 : Retrieve Pavement Treatment System Location			ISO 26048-1 : Get elemental data	

Requirement	Object Reference	Object	Dialogue	Notes
	5.13.23	essPavementTreatmentLocation		
	5.13.31	ptsXOffset		
	5.13.32	ptsYOffset		
3.5.3.1.2 : Retrieve Pavement Treatment System Identity			ISO 26048-1 : Get elemental data	
	5.13.33	ptsEntityID		
3.5.3.1.3 : Configure Pavement Treatment System Location			ISO 26048-1 : Set elemental data	
	5.13.23	essPavementTreatmentLocation		
	5.13.31	ptsXOffset		
	5.13.32	ptsYOffset		
3.5.3.1.4 : Retrieve Stationary Pavement Treatment Configuration			4.2.4 : Retrieve Stationary Pavement Treatment Configuration	
	5.13.1	numEssTreatments		
	5.13.3.2	essPaveTreatProductType		
	5.13.3.3	essPaveTreatProductForm		
	5.13.3.4	essPercentProductMix		
	5.13.10	ptsSignalDuration		
	5.13.18	ptsMonitoringDetectors		
3.5.3.1.5 : Configure Stationary Pavement Treatment System			4.2.6 : Configure Stationary Pavement Treatment System	
	5.13.1	numEssTreatments		
	5.13.3.2	essPaveTreatProductType		
	5.13.3.3	essPaveTreatProductForm		
	5.13.3.4	essPercentProductMix		
	5.13.10	ptsSignalDuration		
	5.13.18	ptsMonitoringDetectors		
3.5.3.1.6 : Configure Mobile Pavement Treatment System			4.2.8 : Configure Mobile Pavement Treatment System	
	5.13.1	numEssTreatments		
	5.13.3.2	essPaveTreatProductType		
	5.13.3.3	essPaveTreatProductForm		
	5.13.3.4	essPercentProductMix		

Requirement	Object Reference	Object	Dialogue	Notes
	5.13.4	essPaveTreatmentAmount		
	5.13.5	essPaveTreatmentWidth		
	5.13.10	ptsSignalDuration		
3.5.3.1.7 : Retrieve Mobile Pavement Treatment Configuration			4.2.10 : Retrieve Mobile Pavement Treatment System	
	5.13.1	numEssTreatments		
	5.13.3.2	essPaveTreatProductType		
	5.13.3.3	essPaveTreatProductForm		
	5.13.3.4	essPercentProductMix		
	5.13.4	essPaveTreatmentAmount		
	5.13.5	essPaveTreatmentWidth		
	5.13.10	ptsSignalDuration		
3.5.3.2.1 : Retrieve Pavement Treatment Status			ISO 26048-1 : Get elemental data	
	5.13.9	ptsSprayerState		
	5.13.11	ptsSignalEventCount		
	5.13.13	ptsActiveEventCount		
	5.13.14	ptsInactiveEventCount		
	5.13.17	ptsError		
	5.13.25	ptsLastSignalEventDate		
	5.13.26	ptsLastSignalEventTime		
	5.13.27	ptsLastActiveEventDate		
	5.13.28	ptsLastActiveEventTime		
	5.13.29	ptsLastInactiveEventDate		
	5.13.30	ptsLastInactiveEventTime		
3.5.3.2.2 : Retrieve PTS Operational Mode			ISO 26048-1 : Get elemental data	
	5.13.19	ptsOperationalModeV3		
3.5.3.4.1 : Set PTS Operational Mode			ISO 26048-1 : Set elemental data	
	5.13.19	ptsOperationalModeV3		
3.5.3.4.2 : Manually Activate PTS Sprayer			ISO 26048-1 : Set elemental data	

Requirement	Object Reference	Object	Dialogue	Notes
	5.13.20	ptsCommandStateV3		

A.4 Versions and Object Refinements

Per RFC 2580, MIB modules can include MODULE-COMPLIANCE macros to define:

- When each object-group must be supported.
- When object-types can be sub-ranged within an AGENT-CAPABILITIES statement,
- To what extent access to objects can be restricted within implementations,
- Which object types were introduced and deprecated within each version of the standard,
- When refinements were made to the valid syntax of objects (e.g., new or deprecated enumerations),

IETF MIB modules typically contain one MODULE-COMPLIANCE statement for each revision of the module.

NTCIP standards define when each object-type must be supported using the PRL and RTM traceability tables. These tables allow the reader to better understand the user needs behind each object-type. Some of the other details mentioned above are often discussed within object descriptions, requirements, or other locations within the standard. However, some issues, such as when objects were added or ranges changed are seldom discussed in other portions of the document.

Rather than using MODULE-COMPLIANCE macros within each MIB module, the NTCIP standards include a version conformance table and an object refinement table to provide identical information in a more concise manner that does not complicate the MIB modules. These tables are provided to ensure that these implementation issues are documented within the standard and to provide a single summary area for this information. It is recognized that these tables duplicate and extend requirements contained within object-type descriptions, the PRL, and the RTM. In case of any conflict between these sources the object-type descriptions, PRL, and RTM take precedence over the version conformance table and object refinement table.

A.4.1 Version Conformance

Table 9 indicates which object groups and capabilities are required for each version of NTCIP 1204 for the objects contained within this MIB, starting with NTCIP 1204 v05, the first version of this document to include object group definitions.

The MIB version compliance table supplements the conformance symbols for the PRL and RTM by identifying the following additional symbols:

a) a hyphen (-) indicates that the object group was not defined in that version of the document,
b) the letter 'd' indicates that the object group was "deprecated" for that version of the document and is not required, and
c) the letter 'o' indicates that the object group was "obsolete" for that version of the document and is not required.

Table 9: Version Conformance for NTCIP1203-Dms MIB

Group	v05 (current)
fdActionAdminGroupV1	CondTrigger OR DayPlan OR SchedTrigger: M
fdActionGroupV1	CondTrigger OR DayPlan OR SchedTrigger: M
fdCabinetLocationGroupV1	M
fdPowerSourceGroupV1	M

fdUtcClockGroupV1	UTC:M
fdLocalClockGroupV1	LocalClock:M
fdDstClockGroupV1	LocalClock:O
fdCommandAdminGroupV1	Command:M
fdCommandGroupV1	Command:M
fdCondTriggerAdminGroupV1	CondTrigger:M
fdCondTriggerGroupV1	CondTrigger:M
fdControllerGroupV1	M
fdDayPlanSchedulerGroupV1	DayPlan:M
fdDynObjAdminGroupV1	DynObj:M
fdDynObjBasicGroupV1	DynObj:M
fdDynObjRefreshGroupV1	DynObj:O
fdDynObjNewValueGroupV1	DynObj:O
fdLogAdminGroupV1	Log:M
fdLogConfigGroupV1	Log:M
fdLogRetrievalGroupV1	Log:M
fdNotifyAdminGroupV1	Notify:M
fdNotifyFactoryGroupV1	Notify:M
fdNotifyChannelGroupV1	Notify:M
fdNotifyDataGroupV1	Notify:M
fdNotifyGroupV1	Notify:M
fdOwnerGroupV1	SchedTrigger OR Log OR Notify OR Command OR Recording: M
fdRecordingGroupV1	Recording:M
fdSchedTriggerAdministrativeGroup	SchedTrigger:M
fdSchedTriggerBasicGroup	SchedTrigger:M
fdSrsaBasicGroupV1	Srsa:M
fdSrsaOutputGroupV1	SrsaOutput:M
fdSrsaInputGroupV1	SrsaInput:M
essCharacteristicsGroupV5	M
essPressureSensorDataGroupV4	Press:M
essPressureSensorLocationGroupV5	Press:O
essPressureSensorInformationGroupV5	Press:O
essWindSensorDataGroupV2	Wind:M
essWindSensorLocationGroupV5	Wind:O
essWindSensorInformationGroupV5	Wind:O
essTempSensorDataGroupV1	Temp:M
essTempSensorLocationGroupV5	Temp:O
essTempSensorInformationGroupV5	Temp:O
essHumiditySensorDataGroupV4	Humidity:M
essHumiditySensorLocationGroupV5	Humidity:O
essHumiditySensorInformationGroupV5	Humidity:O
essPrecipPresenceGroupV4	Precip:M
essPrecipRateGroupV4	Precip:O
essPrecipTimesGroupV5	Precip:O
essPrecipSensorLocationGroupV5	Precip:O
essPrecipSensorInformationGroupV5	Precip:O
essPrecipTotalGroupV4	Precip:O
essPrecipUserTotalGroupV4	Precip:O
essIceThicknessGroupV4	Precip:O
essAdjacentSnowGroupV4	Precip:O
essRoadwaySnowGroupV4	Precip:O
essSolarRadiationSensorDataGroupV4	Rad:M

essSolarRadiationSensorLocationGroupV5	Rad:O
essSolarRadiationSensorInformationGroupV5	Rad:O
essVisibilitySensorDataGroupV1	Visibility:M
essVisibilitySensorLocationGroupV5	Visibility:O
essVisibilitySensorInformationGroupV5	Visibility:O
essPavementBlackIceGroupV1	Pave:O
essPavementTemperatureGroupV1	Pave:O
essPavementSurfaceFreezePointGroupV1	Pave:O
essPavementSurfaceSalinityGroupV1	Pave:O
essPavementSurfaceConductivityGroupV2	Pave:O
essPavementSurfaceIceOrWaterDepthGroupV2	Pave:O
essPavementSensorDepthGroupV2	Pave:O
essPavementSurfaceTemperatureGroupV4	Pave:O
essPavementSurfaceConditionGroupV4	Pave:O
essPavementForecastGroupV4	Pave:O
essPavementFrictionGroupV4	Pave:O
essPavementSensorMetadataGroupV5	Pave:O
essPavementSensorLocationGroupV5	Pave:O
essPavementSensorInformationGroupV5	Pave:O
essSubsurfaceSensorDataGroupV1	Subsurf:M
essSubsurfaceMoistureGroupV1	Subsurf:O
essSubsurfaceSensorLocationGroupV5	Subsurf:O
essSubsurfaceSensorInformationGroupV5	Subsurf:O
essSnapshotCameraGroupV1	Camera:M
essSnapshotCameraFilenameGroupV5	Camera:M
essWaterLevelSensorDataGroupV4	Water:M
essWaterLevelSensorConfigurationGroupV4	Water:O
essWaterLevelSensorLocationGroupV5	Water:O
essWaterLevelSensorInformationGroupV5	Water:O
essAirQualityCOGroupV2	CO:M
essAirQualityNO2GroupV2	NO2:M
essAirQualitySO2GroupV2	SO2:M
essAirQualityPM10GroupV2	PM10:M
essAirQualityCO2GroupV4	CO2:M
essAirQualityNOGroupV4	NO:M
essAirQualityO3GroupV4	O3:M
essAirQualityPM25GroupV4	PM25:M
essAirQualitySensorLocationGroupV5	Air:O
essAirQualitySensorInformationGroupV5	Air:O
ptsTreatmentGroupV1	PTS:M
ptsMobileTreatmentGroupV1	PTS:O
ptsSignalDurationGroupV2	PTS:O
ptsMonitoringDetectorsGroupV2	PTS:O
ptsStatusGroupV2	PTS:O
ptsOperationGroupV3	PTS:O
ptsTimeGroupV5	
ptsLocationGroupV5	PTS:O
ptsInformationGroupV5	PTS:O
essPrecipSituationGroupV1	O
essVisibilitySituationGroupV1	O
essWindSituationGroupV2	O
essCloudSituationGroupV4	O
essPrecipSituationGroupV4	O

essGroundStateGroupV4	O
essPavementObservationGroupV4	O

A.5 Object Refinements

The syntax of the refinement column of the table follows the formats defined in RFC 2580, Section 5.4.3. However, rather than repeating text for each version, the table allows a concise representation of the restrictions when no change is made and a clearer indication when revisions are made.

To conform to this MIB, implementations shall:

- support the defined MAX-ACCESS of each supported object, unless the object refinement table indicates a different minimum access;
- support at least the access defined when the object refinement table indicates a refined access for the object type;
- support the full range of values defined by the SYNTAX for each supported object, unless the object refinement table indicates a different SYNTAX;
- support at least the range of values defined when the object refinement table indicates a refined syntax for the object type.

NOTE 1— The refined access or syntax includes any text in the DESCRIPTION field.

NOTE 2— Information in the table regarding versions prior to v04 are informative interpretations of the previous versions and not normative.

Table 10 indicates the object refinements for the object types used by NTCIP 1204.

Table 10: Object Refinements for NTCIP1204-Ess MIB

Obj	Versions	Refinement
essPressureSensorHeight		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPressureSensorLatitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPressureSensorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPressureSensorLocation		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
essPressureSensorXOffset		

Obj	Versions	Refinement
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPressureSensorYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPressureSensorZOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
windSensorHeight		
	v02-v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
windSensorLocation		
	v02-v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
windSensorLatitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
windSensorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
windSensorXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
windSensorYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
windSensorZOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essTemperatureSensorHeight		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essTemperatureSensorLatitude		

Obj	Versions	Refinement
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essTemperatureSensorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essTemperatureSensorLocation		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
essTemperatureSensorXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essTemperatureSensorYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essTemperatureSensorZOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
waterLevelSensorWarningLevel		
	v04-v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
waterLevelSensorHeight		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
waterLevelSensorLatitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
waterLevelSensorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
waterLevelSensorLocation		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."

Obj	Versions	Refinement
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
waterLevelSensorReferencePoint		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
waterLevelSensorXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
waterLevelSensorYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
waterLevelSensorZOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
precipitationSensorHeight		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
precipitationSensorLatitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
precipitationSensorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
precipitationSensorLocation		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
precipitationSensorXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."

Obj	Versions	Refinement
precipitationSensorYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
precipitationSensorZOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
humiditySensorHeight		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
humiditySensorLatitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
humiditySensorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
humiditySensorLocation		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
humiditySensorTemperatureInformation		
	v04-v05	DESCRIPTION "The value must reference an active temperature sensor."
humiditySensorXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
humiditySensorYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
humiditySensorZOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
radiationSensorHeight		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."

Obj	Versions	Refinement
radiationSensorLatitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
radiationSensorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
radiationSensorLocation		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
radiationSensorXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
radiationSensorYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
radiationSensorZOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
visibilitySensorHeight		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
visibilitySensorLatitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
visibilitySensorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
visibilitySensorLocation		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only

Obj	Versions	Refinement
		DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
visibilitySensorXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
visibilitySensorYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
visibilitySensorZOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementSensorLocation		
	v01-04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
essPavementType		
	v01-v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementElevation		
	v01-v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementExposure		
	v01-v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementSensorType		
	v01	SYNTAX INTEGER { other (1), contactPassive (2), contactActive (3), infrared (4), radar (5), vibrating (6), microwave (7) } DESCRIPTION "Version 1 only supported the first seven values."
	v02-v04	SYNTAX INTEGER { other (1), contactPassive (2), contactActive (3), infrared (4),

Obj	Versions	Refinement
		radar (5), vibrating (6), microwave (7), laser (8) } DESCRIPTION "Version 2 added the value for laser."
	v05	SYNTAX INTEGER { other (1), contactPassive (2), contactActive (3), infrared (4), radar (5), vibrating (6), microwave (7), laser (8), audio (9) } DESCRIPTION "Version 5 added the value for audio."
essPavementSensorLatitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementSensorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementMonitorLatitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementMonitorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementMonitorXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementMonitorYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementMonitorZOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementSensorXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementSensorYOffset		
	v05	MIN-ACCESS read-only

Obj	Versions	Refinement
		DESCRIPTION "Support for setting this object is optional."
essSubSurfaceSensorLocation		
	v01-04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
essSubSurfaceType		
	v01-v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essSubSurfaceSensorDepth		
	v01-v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essSubSurfaceSensorLatitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essSubSurfaceSensorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essSubSurfaceSensorXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essSubSurfaceSensorYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPaveTreatProductType		
	v01-v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional for mobile pavement treatment systems."
essPaveTreatProductForm		
	v01-v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional for mobile pavement treatment systems."
essPaveTreatProductMix		
	v01-v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional for mobile pavement treatment systems."
essPaveTreatmentAmount		

Obj	Versions	Refinement
	v01-v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional for mobile pavement treatment systems."
essPaveTreatmentWidth		
	v01-v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional for mobile pavement treatment systems."
ptsCommandState		
	v02	WRITE-SYNTX INTEGER { activate (3) } DESCRIPTION "The values other and inactive are read-only values."
ptsSignalDuration		
	v02-v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional for mobile pavement treatment systems."
ptsCommandStateV3		
	v03-v05	WRITE-SYNTX INTEGER { activate (3) } DESCRIPTION "The values other and inactive are read-only values."
essPavementTreatmentLatitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementTreatmentLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essPavementTreatmentLocation		
	04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
ptsXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
ptsYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
airQualitySensorHeight		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
airQualitySensorLatitude		

Obj	Versions	Refinement
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
airQualitySensorLongitude		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
airQualitySensorLocation		
	v04	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional. Implementations shall support all NVT ASCII characters; support for other characters is optional."
airQualitySensorXOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
airQualitySensorYOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
airQualitySensorZOffset		
	v05	MIN-ACCESS read-only DESCRIPTION "Support for setting this object is optional."
essSnapshotCameraDescription		
	v02-v04	DESCRIPTION "Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	DESCRIPTION "Implementations shall support all NVT ASCII characters; support for other characters is optional."
essSnapshotCameraStoragePath		
	v02-v04	DESCRIPTION "Implementations only support NVT ASCII as the object was defined as a DisplayString."
	v05	DESCRIPTION "Implementations shall support all NVT ASCII characters; support for other characters is optional."
essSnapshotCameraFilename		
	v03-v04	DESCRIPTION "Implementations may limit the range of valid characters to NVT ASCII."
essSnapshotCameraFileFormat		
	v05	DESCRIPTION "Implementations are only required to support text strings corresponding to the supported formats as defined in essSnapshotCameraSupportedFormats."
essSnapshotCameraFilenameV5		
	v05	DESCRIPTION "Implementations shall support all NVT ASCII characters; support for other characters is optional."

Annex B
Object Tree [Informative]

The following listing provides the Environmental Sensor Station Object Tree Structure as provided by smidump. The tree structure identifies how the object definitions are combined under specific nodes. Each row in the tree starts with a five field code. The first field indicates the status of the item as follows:
+ = the item is current
x = the item is deprecated
o = the item is obsolete

The next two fields are not used in this listing. The fourth field indicates "r" if the item allows read operations and "-" otherwise. The fifth field indicates "w" if the item allows write operations and "-" otherwise.

```
---- ess(1.3.6.1.4.1.1206.4.2.5)
  +---- essBufr(1)
  |  +---- essBufrInstrumentation(2)
  |  |  +--r- essTypeofStation(1)
  |  x---- essBufrLocationVertical(7)
  |  |  x--r- essAtmosphericPressure(4)
  |  +---- essBufrWind(11)
  |  |  x--r- essAvgWindDirection(1)
  |  |  x--r- essAvgWindSpeed(2)
  |  |  x--r- essMaxWindGustSpeed(41)
  |  |  x--r- essMaxWindGustDir(43)
  |  +---- essBufrPrecip(13)
  |  |  x--r- essRelativeHumidity(3)
  |  |  x--r- essPrecipRate(14)
  |  |  x--r- essSnowfallAccumRate(15)
  |  |  x--r- essPrecipitationOneHour(19)
  |  |  x--r- essPrecipitationThreeHours(20)
  |  |  x--r- essPrecipitationSixHours(21)
  |  |  x--r- essPrecipitationTwelveHours(22)
  |  |  x--r- essPrecipitation24Hours(23)
  |  +---- essBufrRadiation(14)
  |     x--r- essInstantaneousTerrestrialRadiation(17)
  |     x--r- essInstantaneousSolarRadiation(18)
  |     x--r- essSolarRadiation(24)
  |     x--r- essTotalRadiation(25)
  |     x--r- essTotalSun(31)
  +---- essNtcip(2)
  |  +---- essNtcipIdentification(1)
  |  |  x--r- essNtcipCategory(1)
  |  |  x--rw essNtcipSiteDescription(2)
  |  +---- essNtcipLocation(2)
  |  |  x--r- essLatitude(1)
  |  |  x--r- essLongitude(2)
  |  |  x--r- essVehicleSpeed(3)
  |  |  x--r- essVehicleBearing(4)
  |  |  x--r- essOdometer(5)
  |  x---- essNtcipHeight(3)
  |  |  x--r- essReferenceHeight(1)
  |  |  x--r- essPressureHeight(2)
  |  |  x--r- essWindSensorHeight(3)
```

```
| +---- essNtcipWind(4)
| | x--r- essSpotWindDirection(1)
| | x--r- essSpotWindSpeed(2)
| | +--r- essWindSituation(3)
| | +--r- windSensorTableNumSensors(7)
| | +---- windSensorTable(8)
| |   +---- windSensorEntry(1) [windSensorIndex]
| |     +--r- windSensorIndex(1)
| |     x--rw windSensorHeight(2)
| |     +--rw windSensorLocation(3)
| |     +--r- windSensorAvgSpeed(4)
| |     +--r- windSensorAvgDirection(5)
| |     +--r- windSensorSpotSpeed(6)
| |     +--r- windSensorSpotDirection(7)
| |     +--r- windSensorGustSpeed(8)
| |     +--r- windSensorGustDirection(9)
| |     +--r- windSensorSituation(10)
| |     x--rw windSensorLatitude(11)
| |     x--rw windSensorLongitude(12)
| |     x--r- windSensorModelInformation(13)
| |     +--rw windSensorXOffset(14)
| |     +--rw windSensorYOffset(15)
| |     +--rw windSensorZOffset(16)
| |     +--r- windSensorEntityID(17)
| +---- essNtcipTemperature(5)
| | +--r- essNumTemperatureSensors(1)
| | +---- essTemperatureSensorTable(2)
| | | +---- essTemperatureSensorEntry(1) [essTemperatureSensorIndex]
| | |   +--r- essTemperatureSensorIndex(1)
| | |   x--rw essTemperatureSensorHeight(2)
| | |   +--r- essAirTemperature(3)
| | |   x--rw essTemperatureSensorLatitude(4)
| | |   x--rw essTemperatureSensorLongitude(5)
| | |   +--rw essTemperatureSensorLocation(6)
| | |   x--rw essTemperatureSensorModelInformation(7)
| | |   +--rw essTemperatureSensorXOffset(8)
| | |   +--rw essTemperatureSensorYOffset(9)
| | |   +--rw essTemperatureSensorZOffset(10)
| | |   +--r- essTemperatureSensorEntityID(11)
| | x--r- essWetbulbTemp(3)
| | x--r- essDewpointTemp(4)
| | +--r- essMaxTemp(5)
| | +--r- essMinTemp(6)
| +---- essNtcipPrecip(6)
| | x--r- essWaterDepth(1)
| | x--r- essAdjacentSnowDepth(2)
| | x--r- essRoadwaySnowDepth(3)
| | x--r- essRoadwaySnowPackDepth(4)
| | x--r- essPrecipYesNo(5)
| | +--r- essPrecipSituation(6)
| | x--r- essIceThickness(7)
| | x--r- essPrecipitationStartTime(8)
| | x--r- essPrecipitationEndTime(9)
| | x--rw precipitationSensorModelInformation(10)
| | +--r- waterLevelSensorTableNumSensors(11)
| | +---- waterLevelSensorTable(12)
```

```
| | | +---- waterLevelSensorEntry(1) [waterLevelSensorIndex]
| | |    +--r- waterLevelSensorIndex(1)
| | |    +--r- waterLevelSensorReading(2)
| | |    +--rw waterLevelSensorWarningLevel(3)
| | |    x--rw waterLevelSensorHeight(4)
| | |    x--rw waterLevelSensorLatitude(5)
| | |    x--rw waterLevelSensorLongitude(6)
| | |    +--rw waterLevelSensorLocation(7)
| | |    x--rw waterLevelSensorModelInformation(8)
| | |    +--rw waterLevelSensorReferencePoint(9)
| | |    +--rw waterLevelSensorXOffset(10)
| | |    +--rw waterLevelSensorYOffset(11)
| | |    +--rw waterLevelSensorZOffset(12)
| | |    +--r- waterLevelSensorEntityID(13)
| | +--r- precipitationSensorTableNumSensors(13)
| | +---- precipitationSensorTable(14)
| | | +---- precipitationSensorEntry(1) [precipitationSensorIndex]
| | |    +--r- precipitationSensorIndex(1)
| | |    x--rw precipitationSensorHeight(2)
| | |    x--rw precipitationSensorLatitude(3)
| | |    x--rw precipitationSensorLongitude(4)
| | |    +--rw precipitationSensorLocation(5)
| | |    x--rw precipitationSensorModelInformationV4(6)
| | |    +--rw precipitationSensorPeriod(7)
| | |    +--r- precipitationSensorAdjacentSnowDepth(8)
| | |    +--r- precipitationSensorRoadwaySnowDepth(9)
| | |    +--r- precipitationSensorRoadwaySnowPackDepth(10)
| | |    +--r- precipitationSensorPrecipYesNo(11)
| | |    +--r- precipitationSensorPrecipRate(12)
| | |    +--r- precipitationSensorSnowfallAccumRate(13)
| | |    +--r- precipitationSensorPrecipSituation(14)
| | |    x--r- precipitationSensorIceThickness(15)
| | |    x--r- precipitationSensorPrecipitationStartTime(16)
| | |    x--r- precipitationSensorPrecipitationEndTime(17)
| | |    +--r- precipitationSensorPrecipitationOneHour(18)
| | |    +--r- precipitationSensorPrecipitationThreeHours(19)
| | |    +--r- precipitationSensorPrecipitationSixHours(20)
| | |    +--r- precipitationSensorPrecipitationTwelveHours(21)
| | |    +--r- precipitationSensorPrecipitation24Hours(22)
| | |    +--r- precipitationSensorPrecipitationUserDefined(23)
| | |    +--r- precipitationSensorPrecipStartDate(24)
| | |    +--r- precipitationSensorPrecipStartTimeV5(25)
| | |    +--r- precipitationSensorPrecipEndDate(26)
| | |    +--r- precipitationSensorPrecipEndTimeV5(27)
| | |    +--rw precipitationSensorXOffset(28)
| | |    +--rw precipitationSensorYOffset(29)
| | |    +--rw precipitationSensorZOffset(30)
| | |    +--r- precipitationSensorEntityID(31)
| | +--r- humiditySensorTableNumSensors(15)
| | +---- humiditySensorTable(16)
| |   +---- humiditySensorEntry(1) [humiditySensorIndex]
| |      +--r- humiditySensorIndex(1)
| |      x--rw humiditySensorHeight(2)
| |      x--rw humiditySensorLatitude(3)
| |      x--rw humiditySensorLongitude(4)
| |      +--rw humiditySensorLocation(5)
```

```
| |       x--rw humiditySensorModelInformation(6)
| |       +--r- humiditySensorRelativeHumidity(7)
| |       +--rw humiditySensorTemperatureInformation(8)
| |       +--r- humiditySensorWetbulbTemp(9)
| |       +--r- humiditySensorDewpointTemp(10)
| |       +--rw humiditySensorXOffset(11)
| |       +--rw humiditySensorYOffset(12)
| |       +--rw humiditySensorZOffset(13)
| |       +--r- humiditySensorEntityID(14)
| +---- essNtcipRadiation(7)
| | x--r- essCloudSituation(1)
| | +--r- essTotalRadiationPeriod(2)
| | +--r- radiationSensorTableNumSensors(3)
| | +---- radiationSensorTable(4)
| | | +---- radiationSensorEntry(1) [radiationSensorIndex]
| | |     +--r- radiationSensorIndex(1)
| | |     x--rw radiationSensorHeight(2)
| | |     x--rw radiationSensorLatitude(3)
| | |     x--rw radiationSensorLongitude(4)
| | |     +--rw radiationSensorLocation(5)
| | |     x--rw radiationSensorModelInformation(6)
| | |     +--r- essTotalSunV4(7)
| | |     +--r- essInstantaneousTerrestrialRadiationV4(8)
| | |     +--r- essInstantaneousSolarRadiationV4(9)
| | |     +--r- essTotalRadiationV4(10)
| | |     +--rw radiationSensorXOffset(11)
| | |     +--rw radiationSensorYOffset(12)
| | |     +--rw radiationSensorZOffset(13)
| | |     +--r- radiationSensorEntityID(14)
| | +--r- essCloudSituationV4(5)
| +---- essNtcipVisibility(8)
| | x--r- essVisibility(1)
| | +--r- essNumVisibilitySensors(2)
| | +--r- essVisibilitySituation(3)
| | x--rw visibilitySensorHeight(4)
| | x--rw visibilitySensorLatitude(5)
| | x--rw visibilitySensorLongitude(6)
| | x--rw visibilitySensorLocation(7)
| | x--rw visibilitySensorModelInformation(8)
| | +---- essVisibilitySensorTable(9)
| |   +---- essVisibilitySensorEntry(1) [essPressureSensorIndex]
| |       +---- essVisibilitySensorIndex(1)
| |       +--rw essVisibilitySensorLocation(2)
| |       +--rw essVisibilitySensorXOffset(3)
| |       +--rw essVisibilitySensorYOffset(4)
| |       +--rw essVisibilitySensorZOffset(5)
| |       +--r- essVisibilitySensorDirection(6)
| |       +--r- essVisibilitySensorEntityID(7)
| |       +--r- essVisibilitySensorCurrentReading(8)
| +---- essNtcipPavement(9)
| | +--r- numEssPavementSensors(1)
| | +---- essPavementSensorTable(2)
| | | +---- essPavementSensorEntry(1) [essPavementSensorIndex]
| | |     +--r- essPavementSensorIndex(1)
| | |     +--rw essPavementSensorLocation(2)
| | |     +--rw essPavementType(3)
```



```
| | |    x--rw essPavementElevation(4)
| | |    +--rw essPavementExposure(5)
| | |    +--r- essPavementSensorType(6)
| | |    x--r- essSurfaceStatus(7)
| | |    +--r- essSurfaceTemperature(8)
| | |    +--r- essPavementTemperature(9)
| | |    x--r- essSurfaceWaterDepth(10)
| | |    +--r- essSurfaceSalinity(11)
| | |    x--r- essSurfaceConductivity(12)
| | |    +--r- essSurfaceFreezePoint(13)
| | |    +--r- essSurfaceBlackIceSignal(14)
| | |    +--r- essPavementSensorError(15)
| | |    +--r- essSurfaceIceOrWaterDepth(16)
| | |    +--r- essSurfaceConductivityV2(17)
| | |    x--rw pavementSensorModelInformation(18)
| | |    +--r- pavementSensorTemperatureDepth(19)
| | |    x--rw pavementSensorLatitude(20)
| | |    x--rw pavementSensorLongitude(21)
| | |    +--r- pavementSensorSurfaceCondition(22)
| | |    +--r- pavementSensorForecastCondition(23)
| | |    +--r- pavementSensorFrictionCoefficient(24)
| | |    x--rw pavementMonitorLatitude(25)
| | |    x--rw pavementMonitorLongitude(26)
| | |    +--r- pavementIcePercentage(27)
| | |    +--rw essPavementMonitorXOffset(28)
| | |    +--rw essPavementMonitorYOffset(29)
| | |    +--rw essPavementMonitorZOffset(30)
| | |    +--rw essPavementSensorXOffset(31)
| | |    +--rw essPavementSensorYOffset(32)
| | |    +--r- essPavementSensorEntityID(33)
| | +--r- numEssSubSurfaceSensors(3)
| | +---- essSubSurfaceSensorTable(4)
| | |  +---- essSubSurfaceSensorEntry(1) [essSubSurfaceSensorIndex]
| | |    +--r- essSubSurfaceSensorIndex(1)
| | |    +--rw essSubSurfaceSensorLocation(2)
| | |    +--rw essSubSurfaceType(3)
| | |    +--rw essSubSurfaceSensorDepth(4)
| | |    +--r- essSubSurfaceTemperature(5)
| | |    +--r- essSubSurfaceSensorEntityID(6)
| | |    +--r- essSubSurfaceMoisture(7)
| | |    +--r- essSubSurfaceSensorError(8)
| | |    x--rw essSubSurfaceSensorLatitude(9)
| | |    x--rw essSubSurfaceSensorLongitude(10)
| | |    x--rw essSubSurfaceSensorModelInformation(11)
| | |    +--rw essSubSurfaceSensorXOffset(12)
| | |    +--rw essSubSurfaceSensorYOffset(13)
| | x--r- essPavementBlock(5)
| | x--r- essSubSurfaceBlock(6)
| | x--r- essPavementV3Block(7)
| +---- essNtcipMobile(10)
| | x--r- essMobileFriction(1)
| | x--r- essMobileObservationGroundState(2)
| | x--r- essMobileObservationPavement(3)
| | +--r- essMobileObservationGroundStateV4(4)
| | +--r- essMobileObservationPavementV4(5)
| +---- essNtcipTreatment(11)
```

```
| | +--r- numEssTreatments(1)
| | +---- essPavementTreatmentTable(2)
| | | +---- essPavementTreatmentEntry(1) [essPavementTreatmentIndex]
| | |    +--r- essPavementTreatmentIndex(1)
| | |    +--rw essPaveTreatProductType(2)
| | |    +--rw essPaveTreatProductForm(3)
| | |    +--rw essPercentProductMix(4)
| | +--rw essPaveTreatmentAmount(3)
| | +--rw essPaveTreatmentWidth(4)
| | x--r- pavementTreatmentBlock(5)
| | o--rw ptsOperationalMode(6)
| | o--rw ptsCommandState(7)
| | +--r- ptsSprayerState(8)
| | +--rw ptsSignalDuration(9)
| | +--r- ptsSignalEventCount(10)
| | x--r- ptsLastSignalEvent(11)
| | +--r- ptsActiveEventCount(12)
| | +--r- ptsInactiveEventCount(13)
| | x--r- ptsLastActiveEvent(14)
| | x--r- ptsLastInactiveEvent(15)
| | +--r- ptsError(16)
| | +--rw ptsMonitoringDetectors(17)
| | +--rw ptsOperationalModeV3(18)
| | +--rw ptsCommandStateV3(19)
| | x--rw essPavementTreatmentLatitude(20)
| | x--rw essPavementTreatmentLongitude(21)
| | +--rw essPavementTreatmentLocation(22)
| | x--rw essPavementTreatmentModelInformation(23)
| | +--r- ptsLastSignalEventDate(24)
| | +--r- ptsLastSignalEventTime(25)
| | +--r- ptsLastActiveEventDate(26)
| | +--r- ptsLastActiveEventTime(27)
| | +--r- ptsLastInactiveEventDate(28)
| | +--r- ptsLastInactiveEventTime(29)
| | +--rw ptsXOffset(30)
| | +--rw ptsYOffset(31)
| | +--r- ptsEntityID(32)
| +---- essNtcipAirQuality(12)
| | +--r- essCO(1)
| | x--r- essCO2(2)
| | x--r- essNO(3)
| | +--r- essNO2(4)
| | +--r- essSO2(5)
| | x--r- essO3(6)
| | +--r- essPM10(7)
| | x--r- essAirQualityBlock(8)
| | +--r- essPM25(9)
| | +--r- airQualitySensorTableNumSensors(10)
| | +---- airQualitySensorTable(11)
| | | +---- airQualitySensorEntry(1) [airQualitySensorIndex]
| | |    +--r- airQualitySensorIndex(1)
| | |    x--rw airQualitySensorHeight(2)
| | |    x--rw airQualitySensorLatitude(3)
| | |    x--rw airQualitySensorLongitude(4)
| | |    +--rw airQualitySensorLocation(5)
| | |    x--rw airQualitySensorModelInformation(6)
```



```
| | |     +--rw airQualitySensorXOffset(7)
| | |     +--rw airQualitySensorYOffset(8)
| | |     +--rw airQualitySensorZOffset(9)
| | |     +--r- airQualitySensorEntityID(10)
| | +--r- essCO2V4(13)
| | +--r- essNOV4(14)
| | +--r- essO3V4(15)
| | +--r- essPM1(16)
| +---- essNtcipWaterQuality(13)
| +---- essNtcipSnapshot(14)
| | +--r- essSnapshotNumberOfCameras(1)
| | +---- essSnapshotCameraTable(2)
| |    +---- essSnapshotCameraEntry(1) [essSnapshotCameraIndex]
| |       +--r- essSnapshotCameraIndex(1)
| |       +--rw essSnapshotCameraDescription(2)
| |       +--r- essSnapshotCameraStoragePath(3)
| |       +--rw essSnapshotCameraCommand(4)
| |       +--r- essSnapshotCameraError(5)
| |       x--rw essSnapshotCameraFilename(6)
| |       +--r- essSnapshotCameraSupportedFormats(7)
| |       +--rw essSnapshotCameraFileFormat(8)
| |       +--rw essSnapshotCameraFilenameV5(9)
| |       +--r- essSnapshotCameraEntityID(10)
| +---- essNtcipInstrumentation(15)
| | x--r- essDoorStatus(1)
| | x--r- essBatteryStatus(2)
| | x--r- essLineVolts(3)
| | x--r- essStationMetaDataBlock(4)
| | x--r- essWeatherBlock(5)
| | x--r- essMobileBlock(6)
| | x--r- essStationMetaDataV3Block(7)
| | x--r- essWeatherV3Block(8)
| | x--r- essStatus(9)
| +---- essNtcipPressure(16)
|    +--r- essNumPressureSensors(1)
|    +---- essPressureSensorTable(2)
|       +---- essPressureSensorEntry(1) [essPressureSensorIndex]
|          +--r- essPressureSensorIndex(1)
|          x--rw essPressureSensorHeight(2)
|          x--rw essPressureSensorLatitude(3)
|          x--rw essPressureSensorLongitude(4)
|          +--rw essPressureSensorLocation(5)
|          x--rw essPressureSensorModelInformation(6)
|          +--r- essPressureSensorAtmosphericPressure(7)
|          +--rw essPressureSensorXOffset(8)
|          +--rw essPressureSensorYOffset(9)
|          +--rw essPressureSensorZOffset(10)
|          +--r- essPressureSensorEntityID(11)
 +---- essConformance(127)
   +---- essCompliances(1)
   +---- essGroups(2)
      +---- essControllerGroups(1)
      | x---- essCharacteristicsGroupV1(1)
      | x---- essMobileGroupV1(2)
      | x---- essMobileFrictionGroupV1(3)
      | x---- essDoorStatusGroupV2(4)
```

```
|  x---- essBatteryGroupV2(5)
|  x---- essLineVoltsGroupV2(6)
|  x---- essMetaDataBlockGroupV2(7)
|  x---- essMobileBlockGroupV2(8)
|  x---- essWeatherBlockGroupV2(9)
|  x---- essMetaDataBlockGroupV3(10)
|  x---- essWeatherBlockGroupV3(11)
|  x---- essStatusGroupV3(12)
|  +---- essCharacteristicsGroupV5(13)
+---- essPressureGroups(2)
|  x---- essPressureGroupV1(1)
|  x---- essPressureSensorLocationGroupV4(2)
|  x---- essPressureSensorInfoGroupV4(3)
|  +---- essPressureDataGroupV4(4)
|  +---- essPressureSensorLocationGroupV5(5)
|  +---- essPressureSensorInfoGroupV5(6)
+---- essWindGroups(3)
|  x---- essWindGroupV1(1)
|  x---- essMobileWindGroupV1(2)
|  +---- essWindDataGroupV2(3)
|  x---- essWindSensorLocationGroupV2(4)
|  x---- essWindSensorLocationGroupV4(5)
|  x---- essWindSensorInfoGroupV4(6)
|  +---- essWindSensorLocationGroupV5(7)
|  +---- essWindSensorInfoGroupV5(8)
+---- essTemperatureGroups(4)
|  +---- essTemperatureGroupV1(1)
|  x---- essTemperatureSensorLocationGroupV1(2)
|  x---- essTemperatureSensorLocationGroupV4(3)
|  x---- essTemperatureSensorInfoGroupV4(4)
|  +---- essTemperatureSensorLocationGroupV5(5)
|  +---- essTemperatureSensorInfoGroupV5(6)
+---- essHumidityGroups(5)
|  x---- essHumidityGroupV1(1)
|  x---- essHumiditySensorLocationGroupV4(2)
|  x---- essHumiditySensorInfoGroupV4(3)
|  +---- essHumidityDataGroupV4(4)
|  +---- essHumiditySensorLocationGroupV5(5)
|  +---- essHumiditySensorInfoGroupV5(6)
+---- essPrecipitationGroups(6)
|  x---- essPrecipPresenceGroupV1(1)
|  x---- essPrecipRateGroupV1(2)
|  x---- essPrecipTotalsGroupV1(3)
|  x---- essPrecipEmergingGroupV1(4)
|  x---- essPrecipSensorInfoGroupV2(5)
|  +---- essPrecipPresenceGroupV4(6)
|  x---- essPrecipDataGroupV4(7)
|  +---- essPrecipSituationGroupV4(8)
|  x---- essPrecipIceThicknessGroupV4(9)
|  +---- essPrecipTotalsGroupV4(10)
|  +---- essPrecipUserTotalGroupV4(11)
|  x---- essPrecipSensorLocationGroupV4(12)
|  x---- essPrecipSensorInfoGroupV4(13)
|  +---- essPrecipDataGroupV5(14)
|  +---- essPrecipSensorLocationGroupV5(15)
|  +---- essPrecipSensorInfoGroupV5(16)
```

```
|  +---- essPrecipAdjacentSnowGroupV5(17)
|  +---- essPrecipRoadwaySnowGroupV5(18)
+---- essRadiationGroups(7)
|  x---- essRadiationGroupV1(1)
|  x---- essRadiationGroupV2(2)
|  +---- essRadiationDataGroupV4(3)
|  x---- essRadiationSensorLocationGroupV4(4)
|  x---- essRadiationSensorInfoGroupV4(5)
|  +---- essRadiationSensorLocationGroupV5(6)
|  +---- essRadiationSensorInfoGroupV5(7)
+---- essVisibilityGroups(8)
|  x---- essVisibilityGroupV1(1)
|  +---- essVisibilitySituationGroupV1(2)
|  x---- essVisibilitySensorLocationGroupV4(3)
|  x---- essVisibilitySensorInfoGroupV4(4)
|  +---- essVisibilityDataGroupV5(5)
|  +---- essCloudSituationGroupV5(6)
|  +---- essVisibilitySensorLocationGroupV5(7)
|  +---- essVisibilitySensorInfoGroupV5(8)
+---- essPavementGroups(9)
|  +---- essPavementSensorCountGroupV1(1)
|  +---- essPavementSensorMetaDataGroupV1(2)
|  x---- essPavementSensorSurfaceStatusGroupV1(3)
|  x---- essPavementSensorElevationGroupV1(4)
|  +---- essPavementSurfaceTempGroupV1(5)
|  x---- essPavementEnhancedGroupV1(6)
|  x---- essSurfaceConductivityGroupV1(7)
|  +---- essSurfaceSalinityGroupV1(8)
|  +---- essPavementFreezeGroupV1(9)
|  +---- essSurfaceConductivityGroupV2(10)
|  +---- essPavementTemperatureGroupV2(11)
|  x---- essPavementBlockGroupV2(12)
|  +---- essPavementSensorDepthGroupV2(13)
|  x---- essPavementSensorInfoGroupV2(14)
|  x---- essPavementBlockGroupV3(15)
|  +---- essPavementSurfaceCondGroupV4(16)
|  +---- essPavementFrictionGroupV4(17)
|  +---- essPavementIcePercentGroupV4(18)
|  x---- essPavementSensorLocationGroupV4(19)
|  +---- essPavementForecastGroupV5(20)
|  +---- essPavementSensorLocationGroupV5(21)
|  +---- essPavementSensorInfoGroupV5(22)
+---- essSubSurfaceGroups(10)
|  +---- essSubSurfaceSensorCountGroupGroupV1(1)
|  +---- essSubSurfaceMoistureGroupV1(2)
|  x---- essSubSurfaceBlockGroupV2(3)
|  x---- essSubSurfaceSensorLocationGroupV4(4)
|  x---- essSubSurfaceSensorInfoGroupV4(5)
|  +---- essSubSurfaceDataGroupV5(6)
|  +---- essSubSurfaceSensorMetaDataGroupV5(7)
|  +---- essSubSurfaceSensorLocationGroupV5(8)
|  +---- essSubSurfaceSensorInfoGroupV5(9)
+---- essSnapshotGroups(11)
|  +---- essSnapshotCameraGroupV2(1)
|  x---- essSnapshotFilenameGroupV3(2)
|  +---- essSnapshotFilenameGroupV5(3)
```

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|  +---- essSnapshotCameraInfoGroupV5(4)
+---- essObservedGroups(12)
|  x---- essObservedReadingGroupV1(1)
|  x---- essMobileObservationGroupV1(2)
|  +---- essObservedReadingGroupV4(3)
|  +---- essObservedGroundStateGroupV4(4)
|  +---- essObservedPavementStateGroupV4(5)
+---- essWaterLevelGroups(13)
|  x---- essWaterDepthGroupV1(1)
|  +---- essWaterLevelDataGroupV2(2)
|  +---- essWaterLevelSensorConfigurationGroupV4(3)
|  x---- essWaterLevelSensorLocationGroupV4(4)
|  x---- essWaterLevelSensorInfoGroupV4(5)
|  +---- essWaterLevelSensorLocationGroupV5(6)
|  +---- essWaterLevelSensorInfoGroupV5(7)
+---- essAirQualityGroups(14)
|  +---- essAirQualityCOGroupV1(1)
|  x---- essAirQualityCO2GroupV1(2)
|  x---- essAirQualityNOGroupV1(3)
|  +---- essAirQualityNO2GroupV1(4)
|  +---- essAirQualitySO2GroupV1(5)
|  x---- essAirQualityO3GroupV1(6)
|  +---- essAirQualityPM10GroupV1(7)
|  x---- essAQBlockGroupV2(8)
|  +---- essAirQualityCO2GroupV4(9)
|  +---- essAirQualityNOGroupV4(10)
|  +---- essAirQualityO3GroupV4(11)
|  +---- essAirQualityPM25GroupV4(12)
|  x---- essAirQualitySensorLocationGroupV4(13)
|  x---- essAirQualitySensorInfoGroupV4(14)
|  +---- essAirQualityPM1GroupV5(15)
|  +---- essAirQualitySensorLocationGroupV5(16)
|  +---- essAirQualitySensorInfoGroupV5(17)
+---- essPavementTreatmentGroups(15)
   +---- ptsProductGroupV1(1)
   +---- ptsSpreadConfigGroupV1(2)
   x---- ptsStatusGroupV2(3)
   +---- ptsConfigurationGroupV2(4)
   o---- ptsCommandGroupV2(5)
   x---- essPtsBlockGroupV2(6)
   +---- ptsOperationGroupV3(7)
   +---- ptsCommandGroupV3(8)
   x---- ptsLocationGroupV4(9)
   x---- ptsInfoGroupV4(10)
   +---- ptsStatusGroupV5(11)
   +---- ptsLocationGroupV5(12)
   +---- ptsInfoGroupV5(13
```


Annex C
Test Procedures [Normative]

C.1 Purpose

Test procedures for testing an implementation of this document are available at https://github.com/ite-org/NTCIP1204.

Annex D
Documentation of Revisions [Informative]

Annex D identifies the changes that have been made to this document. The NTCIP effort makes reasonable efforts to ensure that standards are as backward compatible as possible, but the primary purpose of this document is to provide interoperability by developing standards in a consensus environment. When changes are required to meet these objectives, the problematic objects are refined (if the issue is primarily editorial) or deprecated and, in most cases, replaced with new objects. Annex D identifies why each of these changes has been made. New implementations should support the new/replacement objects; they may also support deprecated objects.

D.1 NTCIP 1204 v04 to NTCIP 1204 v05

The motivation behind the v05 update was to enhance the security of NTCIP devices. This entailed revising the MIB to conform to SMIv2 conventions, as normally used with SNMPv3, and ensuring that the structure of object-types allow for easy management of access control. The references in the document were also updated to reference ISO 26048-1 and ISO 15784-2 rather than NTCIP 1201 and NTCIP 1103 to leverage work already developed by others and to reflect a more international design (e.g., by revising text fields to support UTF-8 character encodings rather than just ASCII). Specific changes are listed below.

D.1.1 Update MIB from SMIv1 to SMIv2 format

In order to enhance the security of NTCIP, the protocol migrated from SNMPv1 to SNMPv3. SNMPv1 is designed to exchange objects defined in a MIB conforming to the Structure and Management of Information version 1 (i.e., SMIv1), as defined in RFC 1155, RFC 1212, and RFC 1213. SNMPv3 is designed to exchange objects defined in a MIB conforming to SMIv3, as defined in RFC 2578, RFC 2579, and RFC 2580. While the MIB formats are similar, There were several changes required as described below.

D.1.1.1 Removal of Header

The header that preceded the MIB was removed from the standard. The filename was not needed and the description was moved into the MODULE-IDENTITY macro within the body of the MIB.

D.1.1.2 Change to Imports Clause

The IMPORTS clause was updated to replace the import of foundational concepts from RFC 1155, 1212, 1213 with the import of similar concepts from RFC 2578, 2579, 2580, and 3411.

D.1.1.3 Declaration of Module Identity

A module identity was added to formally declare the module's intent and to provide a revision history.

D.1.1.4 Declaration of Object Identities

Object nodes, which used to be defined as simple OBJECT IDENTIFERS, were replaced with OBJECT-IDENTITY macros so that a description and status would be formally associated with these nodes.

D.1.1.5 Revisions to Syntax

The SYNTAX clause of each OBJECT-TYPE was reviewed and updated as needed to conform to SMIv2 rules. Ranged integers were generally converted to "Integer32", to minimize backwards compatibility issues; however, integers that provided a 4-octet unsigned range (e.g., "0.. 4294967295") were generally

converted to "Unsigned32". DisplayStrings were generally converted to SnmpAdminStrings to allow for non-English (i.e., UTF-8) characters. Counters were reviewed to ensure that the semantics conformed to teh requirements of a counter.

D.1.1.6 Revision of Units

The units of an object type, which had previously been captured within a "<Units>" subclause of the DESCRIPTION clause, were moved to the UNITS clause defined by SMIv2.

D.1.1.7 Revision of Access

The ACCESS clause of SMIv1 was revised to become the MAX-ACCESS clause defined by SMIv2. The object refinement table in Annex A identifies any instances where implementations are allowed to support a lower level of access, as defined by the MIN-ACCESS clause.

D.1.1.8 Revision of Status

The status clause was revised from a poorly-defined indication of conformance to a simple indication of whether the item is "current", "deprecated", or "obsolete". Conformance within NTCIP is still defined by the PRL and RTM.

D.1.1.9 Addition of Object Groups

Within SNMPv3, an implementation's support of capabilities is indicated through an AGENT-CAPABILITIES macro provided in a separate file. This statement relies upon the definition of OBJECT-GROUPs. As such, OBJECT-GROUPs were added to the MIB to allow use of this feature rather than the less descriptive historically used NTCIP format that only indicated the standard versions that the implementation supported.

D.1.1.10 Version History of Object Groups

Within SMIv2, conformance requirements for a MIB are usually defined by a MODULE-COMPLIANCE macro. Within NTCIP, the PRL and RTM provide a more robust solution to defining conformance. As a result, NTCIP MIBs do not contain MODULE-COMPLIANCE statements but this results in losing details about when object groups were added and deprecated from design. Within NTCIP, this information is captured within the name and description field of object groups. The version in which an object group was added is reflected by the "V" number at the end of the object group's name. The version in which it was made obsolete is either indicated by the "V" number of the group's superseding object, or shown within the "<Withdrawn>" subclause, if the group is not superseded.

D.1.1.11 Addition of Object Refinement Table

Within SMIv2, object definitions can be refined within the MODULE-COMPLIANCE macro. For example, object ranges can be refined to allow implementations to support a defined minimum subrange of the full range defined for the object in the MIB. This is particularly useful for showing the evolution of enumerated lists and showing which versions of a MIB support which enumerated values. Because NTCIP standards do not include the MODULE-COMPLIANCE macro, this information is provided in the object refinement table provided in Annex A. The "Refinements" column of this table conforms to the format defined in RFC 2580 for defining these types of refinements.

D.1.1.12 Object Ranges

The text at the top of Section 5 was revised to follow standard SNMP conventions and to require the support for the full range of an object, unless explicitly stated in the object refinement table.

D.1.2 Revisions for SNMPv3

In addition to the general refinements to support SMIv2, SNMPv3 required an update to error codes. In some locations, Section 4 and 5 refer to specific SNMP error codes to be used. The error codes provided in SNMPv3 are more extensive than those provided in SNMPv1; as a result, this text has been updated to reflect the correct SNMPv3 error codes to be used.

D.1.3 Replace NTCIP 1201 and NTCIP 1103 with ISO 26048-1

Most of the objects defined within NTCIP 1201 and NTCIP 1103 had to be deprecated due to a variety of reasons, but the most common reason was that the tables were not defined to easily allow different management systems to manage their own rows within tables. Rather than reproducing these tables from scratch, the NTCIP community decided to adopt the objects defined in ISO 26048-1 since these were largely based on the NTCIP design but updated to implement the desired changes. Adopting ISO 26048-1 resulted in the following specific changes.

D.1.3.1 Replacement of User Needs

Many of the generic user needs previously contained in NTCIP 1204 (and which had been planned to migrate to NTCIP 1201) were deleted and replaced with references to specific user needs defined in ISO 26048-1. This effected the following user needs:

a) Architectural Needs
b) Retrieve ESS Characteristics simplified to Retrieve ESS Type of Station
c) Generic Features
d) Monitor Door Status
e) Monitor Power
f) Monitor the Status of the ESS

D.1.3.2 Adopting ISO 26048-1 Traceability Tables

Rather than repeating the traceability defined in ISO 26048-1, the PRL in this document references the traceability tables defined for ISO 26048-1.

D.1.3.3 Adopting Textual Conventions

This document imports the following textual conventions from ISO 26048-1:

a) ITSDailyTimeStamp and ITSDateStamp: Used to replace references to time, which was previously based on a 4-octet unsigned integer that createed problems in implementations. The new approach allows for a time range without rollover issues and provides a resolution down to milliseconds.
b) ITSInteger16: This is a textual convention for a 2-octet integer.
c) ITSOerString: This is a textual convention to represent an OER string in a manner that will allow management stations to automatically display the value appropriately.

Changing the way time was handled was required due to the invalid use of an unsigned 4-octet integer in the previous version. To overcome this problem, the ITSDailyTimeStamp and ITSDateStamp textual conventions were used to replace the following objects:

a) precipitationSensorPrecipitationStartTime superseded by precipitationSensorPrecipStartDate and precipitationSensorPrecipStartTimeV5
b) precipitationSensorPrecipitationEndTime superseded by precipitationSensorPrecipEndDate and precipitationSensorPrecipEndTimeV5
c) ptsLastSignalEvent superseded by ptsLastSignalEventDate and ptsLastSignalEventTime
d) ptsLastActiveEvent superseded by ptsLastActiveEventDate and ptsLastActiveEventTime
e) ptsLastInactiveEvent superseded by ptsLastInactiveEventDate and ptsLastInactiveEventTime

D.1.3.4 Reference to Physical Index

In addition, this document imports PhysicalIndexOrZero from RFC 6933 so that the sensors can point to their entry in the entity table, which is used by ISO 26048-1 rather than the previously defined NTCIP module table. This resulted in the following changes:

- essPressureSensorModelInformation supplanted by essPressureSensorEntityID
- windSensorModelInformation supplanted by windSensorEntityID
- essTemperatureSensorModelInformation supplanted by essTemperatureSensorEntityID
- waterLevelSensorModelInformation supplanted by waterLevelSensorEntityID

- precipitationSensorModelInformationV4 supplanted by precipitationSensorEntityID
- humiditySensorModelInformation supplanted by humiditySensorEntityID
- radiationSensorModelInformation supplanted by radiationSensorEntityID
- visibilitySensorModelInformation superseded by essVisibilitySensorEntityID
- pavementSensorModelInformation supplanted by pavementSensorEntityID
- essSubSurfaceSensorModelInformation supplanted by essSubSurfaceSensorEntityID
- essPavementTreatmentModelInformation superseded by ptsEntityID
- airQualitySensorModelInformation supplanted by airQualitySensorEntityID

D.1.3.5 Replacement of General Object Types

The following objects were replaced with objects defined or referenced by ISO 26048-1:

- essNtcipCategory superseded by ISO26048-1-FieldDevice.fdMobility
- essNtcipSiteDescription supplanted by SNMPv2-MIB.sysLocation (RFC 3418)
- essDoorStatus superseded by ISO26048-1-Srsa.fdSrsaTypeWarning.FDO
- essBatteryStatus superseded by ISO26048-1-Srsa.fdSrsaPortValue.FBC
- essLineVolts superseded by ISO26048-1-Srsa.fdSrsaPortValue.FLV
- essStatus superseded by ISO26048-1-Controller.fdControllerStatus
- essLatitude superseded by ISO26048-1-FieldDevice.fdConfiguredLatitude
- essLongitude superseded by ISO26048-1-FieldDevice.fdConfiguredLongitude
- essVehicleSpeed superseded by ISO26048-1-FieldDevice.fdSpeed
- essVehicleBearing superseded by ISO26048-1-FieldDevice.fdBearing
- essOdometer superseded by ISO26048-1-FieldDevice.fdOdometer
- essReferenceHeight superseded by ISO26048-1-FieldDevice.fdConfiguredElevation

D.1.3.6 Replaced Annex F and G with References to ISO 26048-1

The dialogs and processes defined in Annex F and G in the prior version of this document were intended to migrate to NTCIP 1201. However, this information is already defined in ISO 26048-1 and has replaced the material previously in Annex F and G.

D.1.4 Other Security Enhancements

In addition to the above, the following security enhancements were also made.

D.1.4.1 Added Security User Needs and Requirements

User needs and requirements were added to require conforming implementations to not support SNMPv1. The support of unsecured protocols is itself a vulnerability. However, it is recognized that deployment of SNMPv3 will require time; as such, the document implementations to support SNMPv1 but classifies such devices as consistent rather than conformant.

D.1.4.2 Updated Security of Supporting Protocols

Prior versions of this document allowed snapshot camera images to be retrieved via FTP. This version prohibits all unsecured protocols within conformant devices and instead relies upon the following protocols:

a) HTTPS
b) SSH
c) SFTP

D.1.5 Updates to Conform to NTCIP 8004

The following changes were made to conform with NTCIP 8004.

D.1.5.1 Deleted Tags

The following subclauses were deleted from the DESCRIPTION clause as they are not defined in NTCIP 8004 and were deemed to be unnecessary:

a) Descriptive Name
b) Data Concept Type

D.1.5.2 Added Tags

The following subclauses were added to the DESCRIPTION clause to conform to NTCIP 8004:

a) Superseded by
b) Supplanted by
c) Withdrawn

D.1.5.3 Ensured Consistent Use of Tags

Other tags were applied more consistently by using a requirements management tool that allowed quick analysis of which tags were used for each object type.

D.1.5.4 Updated Module Name

The name of the MIB module was updated to the format defined by NTCIP 8004. The new naming convention conforms to broader MIB standards that do not change the module name with each new version.

D.1.6 Conforming to Industry Resolution Standards

Objects related to latitude, longitude, and elevation did not conform to industry standards for centimeter-level accuracy for latitude and longitude and decimeter accuracy for elevation. The objects were updated to support this resolution. In addition, the position of sensors was changed to relative offsets from the ESS reference location rather than their own latitude and longitude positions. This allows a mobile station to have a constant offset for each sensor rather than requiring the RPU to constantly calculate the respective latitude and longitude of each sensor.

- essPressureSensorHeight superseded by essPressureSensorZOffset
- essPressureSensorLatitude superseded by essPressureSensorYOffset
- essPressureSensorLongitude superseded by essPressureSensorXOffset
- windSensorHeight superseded by windSensorZOffset
- windSensorLatitude superseded by windSensorYOffset
- windSensorLongitude superseded by windSensorXOffset
- essTemperatureSensorHeight superseded by essTemperatureSensorZOffset
- essTemperatureSensorLatitude superseded by essTemperatureSensorYOffset
- essTemperatureSensorLongitude superseded by essTemperatureSensorXOffset
- waterLevelSensorHeight superseded by waterLevelSensorZOffset
- waterLevelSensorLatitude superseded by waterLevelSensorYOffset
- waterLevelSensorLongitude superseded by waterLevelSensorYOffset
- precipitationSensorHeight superseded by precipitationSensorZOffset
- precipitationSensorLatitude superseded by precipitationSensorYOffset
- precipitationSensorLongitude superseded by precipitationSensorXOffset
- humiditySensorHeight superseded by humiditySensorZOffset
- humiditySensorLatitude superseded by humiditySensorYOffset
- humiditySensorLongitude superseded by humiditySensorXOffset
- radiationSensorHeight superseded by radiationSensorZOffset
- radiationSensorLatitude superseded by radiationSensorYOffset
- radiationSensorLongitude superseded by radiationSensorXOffset
- visibilitySensorHeight superseded by essVisibilitySensorZOffset

- visibilitySensorLatitude superseded by essVisibilitySensorYOffset
- visibilitySensorLongitude superseded by essVisibilitySensorXOffset
- essPavementElevation superseded by essPavementZOffset
- pavementSensorLatitude superseded by pavementSensorYOffset
- pavementSensorLongitude superseded by pavementSensorXOffset
- pavementMonitorLatitude superseded by essPavementMonitorYOffset
- pavementMonitorLongitude superseded by essPavementMonitorXOffset
- essSubSurfaceSensorLatitude superseded by essSubSurfaceSensorYOffset
- essSubSurfaceSensorLongitude superseded by essSubSurfaceSensorXOffset
- essPavementTreatmentLatitude superseded by essPavementTreatmentYOffset
- essPavementTreatmentLongitude superseded by essPavementTreatmentXOffset
- airQualitySensorHeight superseded by airQualitySensorZOffset
- airQualitySensorLatitude superseded by airQualitySensorYOffset
- airQualitySensorLongitude superseded by airQualitySensorXOffset

D.1.7 Renumbering Requirements and Dialogs

The clause numbering of user needs and objects were retained compared to prior versions of this document to facilitate traceability. However, the clause numbers for dialogs and requirements were reordered to remove unnecessary clauses and provide a more organized listing.

D.1.8 Updated Reference Physical Architecture

The reference physical architecture was updated to conform with ARC-IT modelling conventions. The architecture is consistent with the content of ARC-IT but is more detailed.

D.1.9 Updated References to ARC-IT Content

Prior versions of this document explained how its contents related to the National ITS Architecture. The latest version of the National ITS Architecture is known as ARC-IT and the relationships to its content have been updated to reflect the current version.

D.1.10 Other Revisions

Several other edits have been made as follows:

D.1.10.1 Removed Backward Compatibility Needs

SNMPv3 is not backwards compatible with SNMPv1. As such, there was little benefit in including user needs and requirements for backwards compatibility in this version. It is expected that future versions will re-introduce backward compatibility requirements with this version.

D.1.10.2 Updated Boilerplate

The upgrade to SNMPv3 is requiring an update to all NTCIP standards. As a part of this process, the boilerplate text throughout the document is being made more consistent to minimize any unintended interpretations.

D.1.10.3 Updated all references

All normative and other references in the document were reviewed to ensure that the latest versions of those documents uwere referenced. In addition, the references only cite a specific version in Section 1.2. References within the text only cite the main document number as defined in these sections. This allows for easier maintenance of this document so that each reference in the text does not have to be updated in each subsequent version.

D.1.10.4 New Reference for OER

OER was originally defined in NTCIP 1102. When the developers of ASN.1 learned of this new encoding standard, they determined that it would be a useful international standard. As such, they developed ISO/IEC 8824-7, which is also known as ITU-T X.696. The ISO/IEC/ITU-T version of OER is fully

consistent with NTCIP 1102 and extends it to support additional ASN.1 concepts. Rather than maintaining a parallel standard, the NTCIP community has agreed to adopt the ISO/IEC/ITU-T version.

D.1.10.5 Added Support for Multiple Visibility Sensors

In v04, the object for essVisibility had been marked deprecated but the traceability tables still referenced it. When reviewing this anomaly, the WG decided that the singular object should be replaced with a table of visibility sensors. In addition to the edits noted in other locations, this resulted in the following changes:

a) essVisibility superseded by essVisibilitySensorCurrentReading
b) visibilitySensorLocation superseded by essVisibilitySensorLocation

D.1.10.6 Added Support for Monitoring PM 1.0

The WG expressed a need to add support for monitoring levels of small particulate matter with a size of 1.0 micrometer or smaller.

D.1.10.7 Clarified Requirements for Response Times

Requirements were refined to clarify the response times and notification timeliness, as shown in 3.6.29 and 3.6.30.

D.1.10.8 Refined Definition of Snapshot Camera Filenames

Previous versions of the MIB noted that there was no requirement for the filename assigned to a snapshot camera image to reflect the encoding format for the image (e.g., a jpg image could be saved to a file with a .bmp extension). This version of the standard made the following changes:

a) added essSnapshotCameraSupportedFormats,
b) essSnapshotCameraFilename was superseded by essSnapshotCameraFilenameV5 and essSnapshotCameraFileFormat

D.1.10.9 Revised Dialogs for Mobile Profiles

The dialogs for capturing mobile profiles were changed to rely upon the use of dynamic objects. Prior to v04, this requirement relied upon the use of block objects; however, anytime any object type in this standard was updated, these block objects had to be deprecated and replaced. In v04, this process was replaced with a dialog; however, the dialog disassociated the time stamp and location data from the data being retrieved. As a result, this version replaces both of these designs with the use of dynamic objects as defined in ISO 26048-1 so that the timestamp and location data can all be collected in a single request using a process that is flexible enough to handle version updates without replacing its design.

D.1.10.10 Ice Thickness

A review of the precipitation ice thickness object resulted in its deprcation and replacement with the existing surface ice or water depth object.

a) precipitationSensorIceThickness superseded by essSurfaceIceOrWaterDepth

D.1.10.11 Udpated Class Diagrams

The class diagrams contained in Section 4 were updated to show the "current" data used in this document.

D.1.10.12 Generated Key Content from Requirements Management Tool

The key content of this standard was imported into a requirements management tool so that traces could be properly managed rules could be enforced in an automated fashion. The key content included:

a) user needs,
b) requirements,
c) dialogs, and
d) MIB content.

Once this content was finalized, it was exported to an HTML file and reintegrated into the draft. This approach:

a) Improves consistency of cross-references in tables,
b) Allows automated error checking, and
c) Allows single source for MIB in either Word or ASCII text file

D.1.10.13 Updated Object Tree in Annex B

The graphic in Annex B was replaced with a listing of the object tree as automatically generated from teh MIB using smidump.

D.1.10.14 Moved Test Procedures to GitHub

The test procedures formerly contained in Annex C are being moved to GitHub and reformatted according to the rules being developed by the NTCIP community.

Annex E
User Requests [Informative]

Annex E identifies features that were suggested for this document, but are either supported by mechanisms that may not be readily obvious, or are not supported by this document.

E.1 Features Indirectly Supported

The following identifies how certain features are supported by this document.

E.1.1 Archiving Data on a Periodic Basis for Dial-up Operations

Some users wish to configure their ESS to archive data into memory on a periodic basis so that multiple readings may be retrieved in bulk at a later time (e.g., because of a long polling cycle over a dial-up link). To operate in a meaningful manner, each entry into the archive needs to have a timestamp that identifies when the measurement was taken.

This capability is provided through the "Provide Off-Line Log Data" Architectural Need defined in Annex **Error! Reference source not found.**. This architectural need can be used in conjunction with any data s upported by the device.

E.1.2 Precision and Accuracy Information

Some users need to know precision and accuracy information for each sensor, in addition to the type of sensor. Some users need this information to calibrate their weather models. The ESS WG discussed this feature and concluded direct support of this feature would result in a standard that is roughly two times the size and complexity of this document. To support this capability indirectly, this document added support to provide metadata about the sensor. The metadata includes the make and model of each sensor. A user needing precision, accuracy, and type information about the sensor can then look up that information based on the sensor make and model.

> Note: At the time this document was developed, USDOT's Weather Data Environment (WxDE) was maintaining a list of all known sensor types used in the United States for environmental sensor stations. Each known sensor type is assigned a unique identifier in the WxDE. USDOT has suggested using the unique identifier, or using the sensor make and model name in the list, in describing the sensor make and model for naming consistency.

E.1.3 Retrieve Sensor Profile with Mobile Sources

One of the user needs identified was to collect sensor data from a mobile platform at regular intervals or on a conditional exception-based reporting (e.g., if an ice patch is detected). This feature requires that each sensor data record be either time-stamped or location-stamped or both. One method to collect this data with a time-stamp is to log the sensor data in an event log along with a time stamp, and optionally with the location of the mobile platform, then retrieve the event logs. NTCIP 1204 v03 also added block objects that supported this feature, but these block objects were removed in this document (See Annex **Error! Reference source not found.**).

Requirement **Error! Reference source not found.** supports recovering the sensor data from a mobile p latform, including the time the sensor data is retrieved, but that is not a timestamp.

Another possibility is the development of an XML mobile block for communication between mobile platforms (e.g., snow plows) and a center (e.g., maintenance management or traffic management center). This requires a translation of the MIB/ASN.1 definition contained in the this document to an XML Schema definition. The XML Schema defines XML content (i.e., messages). NTCIP 2306 v01, provides guidance on the transport and compression of XML based on web services. NTCIP 2306 v01 also includes a method for describing message exchange combinations called dialogs, written in Web Services Description Language (WSDL). NTCIP 2306 v01 defines the following dialogs: Request-Response, Subscription-Publication, and One-way.

The Internet Engineering Task Force has developed RFC 5935, which defines the expression of Management Information Base (MIB) datatypes into XML Schema Definition (XSD) language. The primary objective of RFC 5935 is to enable the production of XML documents that are as faithful to the MIB as possible, using XSD as the validation mechanism.

The following example is taken from NTCIP 1204 v03. The example is NOT an endorsement by the ESS WG that the proposed example is an official interpretation of this document in XML format, but is for provided for informational purposes only. The MIB definition of the Mobile Block follows. The XML translation of a SEQUENCE is not included in the RFC 5935, but XML has a corresponding concept, which is follows the MIB definition.

E.1.3.1 Example Mobile Block MIB

```
essMobileBlock OBJECT-TYPE
SYNTAX      OerString
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION "<Definition>An OER encoded string of the EssMobileData structure
as defined below. This object is used for uploading current mobile station
data from the ESS in a bandwidth efficient manner.

The OPTIONAL fields shall be present if the data is supported by the
implementation and is valid. The OPTIONAL fields shall be omitted for any
data that is invalid or not supported by the implementation.

EssMobileData ::= SEQUENCE {
      essLatitude.0                       OPTIONAL, -- @NTCIP1204-v03
      essLongitude.0                      OPTIONAL, -- @NTCIP1204-v03
      essReferenceHeight.0                OPTIONAL, -- @NTCIP1204-v03
      essVehicleSpeed.0                   OPTIONAL, -- @NTCIP1204-v03
      essVehicleBearing.0                 OPTIONAL, -- @NTCIP1204-v03
      essVehicleOdemeter.0                OPTIONAL, -- @NTCIP1204-v03
      essMobileFriction.0                 OPTIONAL, -- @NTCIP1204-v03
      essMobileObservationGroundState.0   OPTIONAL, -- @NTCIP1204-v03
      essMobileObservationPavement.0      OPTIONAL, -- @NTCIP1204-v03
      essPaveTreatmentAmount.0            OPTIONAL, -- @NTCIP1204-v03
      essPaveTreatmentWidth.0             OPTIONAL  -- @NTCIP1204-v03
      }
<SetConstraint>read-only
<DescriptiveName>MobilePlatform.mobileBlock:frame
<Data Concept Type>Data Element"
::=   { essNtcipInstrumentation 6 }
```

E.1.3.2 Example Mobile Block XML Schema

The XML Schema representation follows

```
<xs:complexType name="EssMobileData">
        <xs:sequence>
            <xs:element name="essLatitude" type="EssLatitude"/>
            <xs:element name="essLongitude" type="EssLongitude"/>
            <xs:element name="essReferenceHeight" type="EssReferenceHeight"/>
            <xs:element name="essVehicleSpeed" type="EssVehicleSpeed"/>
            <xs:element name="essVehicleBearing" type="EssVehicleBearing"/>
            <xs:element name="essVehicleOdometer" type="EssVehicleOdometer"/>
            <xs:element name="essMobileFriction" type="xs:integer"/>
            <xs:element name="essMobileObservationGroundState" type="xs:integer"/>
            <xs:element name="essMobileObservationPavement" type="xs:integer"/>
            <xs:element name="essPaveTreatmentAmount" type="xs:integer"/>
            <xs:element name="essPaveTreatmentWidth" type="xs:integer"/>
        </xs:sequence>
        <!-- This is from v03 -->
</xs:complexType>
```

E.1.3.3 Example Latitude MIB and XML Schema

An example of the translation of a MIB definition for essLatitude follows, with its XML schema counterpart.

Latitude

```
essLatitude OBJECT-TYPE
SYNTAX      INTEGER (-90000000..90000001)
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION "<Definition>The latitude in 10^-6 degrees of the ESS station,
per WGS-84 datum.
<SetConstraint>read-only
<DescriptiveName>ESS.latitude:quantity
<Valid Value Rule>
The essLatitude at the North Pole is 90,000,000. The essLatitude at the South
Pole is -90,000,000. The value 90,000,001 shall indicate a missing value.
<Data Concept Type>Data Element
<Unit>latitude"
REFERENCE   "Resolution based on on-going location referencing activities;
the WMO Binary Code Form FM 94 BUFR Table B item 0 05 001 can be obtained by
dividing this value by 10."
::=   { essNtcipLocation 1}
```

```
<xs:simpleType name="EssLatitude">
        <xs:annotation>
            <xs:documentation>
                <objectClass>ESS</objectClass>
                <valueDomainTerm>qty</valueDomainTerm>
                <units>latitude</units>
                <!-- <Unit> -->
            </xs:documentation>
        </xs:annotation>
        <xs:restriction base="xs:integer">
            <xs:minInclusive value="-90000000"/>
            <xs:maxInclusive value="90000001"/>
            <!-- INTEGER translates to xs:integer -->
        </xs:restriction>
</xs:simpleType>
```


E.2 Features Not Supported by This Version

E.2.1 User Defined Sampling Periods

Some users have requested the ability to configure the details about how a device calculates the current reading. For example, some have requested the ability to configure an overall sampling period that is used to archive data and then, for each entry into the archive, a second sampling period over which measurements are actually taken and averaged.

ESS WG discussed this feature and concluded that it would:

a) result in a standard that was not backward compatible with NTCIP 1204 v01.
b) result in a standard that was roughly three times the size and complexity of NTCIP 1204 v03
c) be difficult to implement and test

Instead, ESS WG has followed an approach that allows all data to be monitored, measured, and archived continuously using averaging periods that are appropriate and in wide use for each parameter. This data can be uploaded to a central system for further statistical analysis, if needed.

E.3 File Transfer Protocol (FTP)

Some agencies do not allow the use of FTP to transfer files, such as camera snapshots, across their agency's network. To conform to this document, the implementation is still required to support the use of FTP as specified by this document, but those implementations are allowed to use other protocols, such as HTTPS:, FTPS: or SFTP:, to transfer camera snapshots.