CLARUS **SYSTEM DESIGN**

SYSTEM INTERFACE GUIDE FOR CONTRIBUTORS

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1 INTRODUCTION

The *Clarus* system's purpose is to collect, quality check, and distribute environmental observations. Environmental observations are required by the *Clarus* system for it to process and in order for the system to be successful in its intended purpose. This interface guide describes the available mechanisms for contributors to provide the needed environmental observations.

Generally, observations are stored by their respective contributors in electronic files. In addition to the available observation collection mechanisms, this document also describes the preferred electronic file naming convention, frequency of observation availability, and the preferred formatting for the data content of the electronic files.

Observations are saved into the *Clarus* system by two general methods, pull and push. In the pull method, the *Clarus* system uses contributor-provided information to connect to and retrieve observation files from contributor systems. In the push method, contributors send collected observation files to the *Clarus* system. The *Clarus* system then uses the same contributor-provided information to process the transmitted observations.

Observations are transmitted between the contributor and *Clarus* systems using two common Internet protocols, FTP and HTTP. Both FTP and HTTP can be used for the pull method. Currently, only FTP is available for the push method.

1.1 Definitions, Acronyms, and Abbreviations

This document may contain terms, acronyms, and abbreviations that are unfamiliar to the reader. A list of terms and their definitions useful to understanding this document and its concepts is provided here as a reference.

Table 1 – Document Terms and Their Definitions

Term	Definition
Administrator	An individual with access to and control over information fundamental to a process. In the case of computer hardware and software systems, this is a person with sufficient privileges to make system-wide configuration changes that affect system operation.
ASCII	American Standard Code for Information Interchange. This is an encoding scheme that assigns English upper and lower-case letters, numbers, and other punctuation characters to a numeric value between 0 and 127. Each character can be communicated digitally using 7 binary digits or bits. Most computers understand this encoding and typically display the information as readable text.
Basic authentication	The simplest and most minimal access control to a shared resource. Access control is typically granted to a system or person who provides the correct username and password. This security measure is considered minimal because the supposedly secret information is not protected. Any system connected to the same communication network as the shared resource can copy the security information and use it for its own purposes.
Clarus	The *Clarus* system. An environmental data sharing system that collects, evaluates, and disseminates environmental data gathered from geographically diverse environmental sensors.

Term	Definition
Contributor	An agency with access to and control over environmental sensor data that wishes to share its information and have that information quality checked by the *Clarus* system.
CSV	Comma Separated Value. An information storage scheme that represents data as ASCII characters, with data values bounded by a delimiting character. The delimiting character can be any character not contained within any data element. However, comma and tab characters are the most widely used delimiters.
ESS	Environmental Sensor Station. A stationary or mobile structure that serves as an anchoring point for environmental sensors and their data collection devices. The term typically refers to both the structure and its hosted environmental components.
FTP	File Transfer Protocol. A widely-used method for transmitting information in the form of electronic files between computer systems. The protocol supports typical file management operations such as directory browsing, file renaming, and file deletion.
HTML	Hyper-Text Markup Language. A set of tags used to create documents that can be displayed with an Internet document browser. The tags indicate to the interpreting application how to present the document content.
HTTP	Hyper-Text Transport Protocol. A simple, text-based communication mechanism consisting of a header and a body used to transmit information, typically HTML documents, between computer systems.
Interface	A definition of the information and format of that information that is expected and used to communicate data between systems.
IP	Internet Protocol. A communication scheme that uses numeric addresses and ports to transfer and route information between computer systems on a communication network.
UTC	The language-independent abbreviation for Coordinated Universal Time. A world time reference standard based on atomic clock measurements. All time zones are defined relative to UTC.
XML	eXtensible Markup Language. A flexible and open-ended method for defining structured information documents and metadata, in the form of tags, which describe the document content and enable that content to be transformed for a multitude of transmission or presentation purposes.

1.2 References

- *Clarus Weather System Design – System Requirements Specification*; Mixon/Hill, Inc.; December 2005.
- *ITE TM 1.03 – Standards for Traffic Management Center to Center Communications* (TMDD); American Association of State Highway and Transportation Officials, and Institute of Transportation Engineers; working draft v1.5; Dec. 15, 2003.
- *NTCIP 1204 v02.23b; NTCIP Environmental Sensor Station Interface Standard – Version 02*; National Electrical Manufacturers' Association, American Association of State Highway and Transportation Officials, and Institute of Transportation Engineers; 2005.

2 INTERFACE DEFINITIONS

The *Clarus* system's ability to provide an easily understood representation of surface transportation weather and pavement conditions will be driven in large part by the quantity and quality of data that it will be collecting. Even though observations will be submitted by a large number of diverse contributors, the information description and formatting will need to be consistent in order to enable a successful interface with the *Clarus* system.

2.1 Interface

Contributor data files will need to be in a text-based, Comma Separated Value (CSV) format. Two methods are available for contributor file exchange:

File Push Method: This method allows the contributor to send (or "push") a file to a specified directory within the *Clarus* system at predetermined intervals. A password/username combination must be used to invoke this method.

File Pull Method: This method allows the contributor to create a data file which is placed in a predetermined directory on a server to which a contributor has access. At predetermined intervals, the *Clarus* system will connect to the appropriate contributor directory and obtain (or "pull") the data file into the *Clarus* system. This process can also use a password/username in the transaction.

2.1.1 File Identification

Each file generated by the contributor must contain certain attributes within its filename. The filename must include the file creation date and time based on Coordinated Universal Time (UTC). UTC is based on the Gregorian calendar and is expressed using a 24-hour clock. Additional information on UTC can be found at: http://aa.usno.navy.mil/faq/docs/UT.html.

One example of an acceptably formatted filename is shown below in Figure 1. Notice in the example that the file creation time on the right-hand side of each line differs from the filename timestamp. The possible confusion that results when humans examine the files is the reason it is recommended that hosting servers be set to UTC as well.

There is also a one minute clock skew between the file creation time and the filename timestamp. Any number of reasons could account for this behavior. Perhaps the contributor processes copy files between systems, or by policy a deliberate offset is added. In any case, the *Clarus* system only needs to know when to collect the files and how to generate the correct filename.

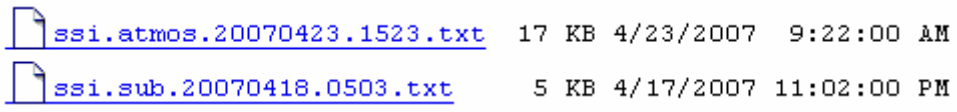

Figure 1 – Filename Format

Filenames may include additional constant information as desired by the contributor. The information contained within the filename does not need to be in any particular order. However, it is recommended that the time-varying

information be grouped together to facilitate obvious filename creation. In the above example, the network name and observation group to which the file belongs have been applied as a prefix to the UTC date and time.

Each data file must have a unique name. Unique filenames assist with contributor data management activities and prevent observations from being overwritten when new observations are recorded. The filename can be specified using special formatting characters. The form in Appendix D contains both the location in which to record the specification as well as the characters and instructions for doing so.

Typically, observation files are retained within the operational directory for some period of time defined by a contributor's own policies. The *Clarus* system maintains observations within its cache for seven days. It is suggested that seven days of historical data also be kept available on the contributor's server. Matching the retention policies between a contributor system and the *Clarus* system allows an extra opportunity for *Clarus* to receive any data that might have been missed due to an unplanned network or system outage.

2.1.2 Collection Frequency

The *Clarus* system is a real-time system and, by definition, its processes are required to start and complete within a specified time period. Lengthy processing delays reduce the value of the real-time quality checked observations. The *Clarus* system is sufficiently robust and configurable to accept a variety of collection schedules. However, due to the time-sensitive value of the observations and based on experience from the proof-of-concept demonstration, it is recommended that observations be made available to the *Clarus* system at intervals between 10 and 30 minutes.

2.1.3 File Access

The contributor will provide the *Clarus* system administrator with the information necessary to obtain data files.

2.1.3.1 Pull Access

Access to contributor observations can be restricted at the discretion of the administering agency. In the case of the pull method of collection, the *Clarus* system supports basic authentication for both FTP and HTTP protocols. A form is provided in Appendix D as a convenience to record the information needed by the *Clarus* system for it to pull observations from the contributor's server. A description of the information to be provided follows:

Protocol – The communication protocol used. This can be either "http" or "ftp".

Host Name – The Internet Protocol (IP) host address of the contributing server. It can be specified in either "dot notation" such as 64.126.107.42, or as an Internet domain name such as "www.claruscontributor.org".

Host Port – The logical port used to connect to the contributing server. This is a numeric value. Well-known default ports for http and ftp are port 80 and port 21,

respectively, but can be different depending on the individual contributor's network policies and organizational needs.

File Path –The complete directory path for the location where a contributor's files are located. An example is "/home/data/".

File Period – The frequency at which observation files are created or updated with new information. This number is specified in seconds. For example, if observations are collected into a file regularly at 30 minute intervals, the "filePeriod" is 1800 seconds (30 minutes multiplied by 60 seconds per minute).

File Midnight Offset – This is the number of seconds after the beginning of a 24-hour day (midnight) that an observation file is created. As an example, if observations are recorded at twenty 20 minute intervals at exactly 0, 20, and 40 minutes after the hour then the midnight offset is zero (0). If the observations are collected at 5, 25, and 45 minutes after the hour then the midnight offset would be set to 300 seconds (5 minutes).

File UTC Offset – This is the hour difference between UTC time and the time at which files are written to the contributing server if the server's operating system is not set to UTC time. If the file is saved in UTC time, this value is zero (0). If the system is set to its local time, the value is determined by the number of hours between UTC and the server's local time. Refer to Table 2 below, provided as a quick reference to pertinent time zone offset information.

> **NOTE: If the server's operating system is not set to UTC time, then the likelihood of files being missed or collected late increases greatly when daylight saving time adjustments occur during the year.**

Username – If a username is required to retrieve the files, the username must be provided. If the username is case-sensitive, then the proper case must be clearly specified.

Password – If a password is required to retrieve the files, the password must be provided. If the password is case-sensitive, then the proper case must be clearly specified.

Table 2 – North America Common Time Zones

Time Zone Description	UTC Offset (Hours)	
	Standard	Daylight Saving
Newfoundland	-3.5	-2.5
Atlantic	-4.0	-3.0
Eastern	-5.0	-4.0
Central	-6.0	-5.0
Mountain	-7.0	-6.0
Pacific	-8.0	-7.0
Alaska	-9.0	-8.0
Hawaii	-10.0	-9.0

2.1.3.2 Push Access

The *Clarus* system uses FTP to accept observation files being sent to it from contributors. Basic authentication is used to restrict access to a contributor's push destination, so that only authorized individuals and the *Clarus* system have access to the supplied observations. The same file naming, frequency, and data description specifications as the pull method also apply to the push method.

Each contributor using this method will be given a path, username, and password to access the *Clarus* system. At the specified time, the contributor's system will connect to the *Clarus* system and transmit the newly collected observation files. The *Clarus* system will then use the same collection rules as the pull method to retrieve the observations from its FTP server.

Observation files will be maintained on the *Clarus* FTP server for the amount of time specified by the system requirements. This time period is currently defined as seven days.

2.2 Data Description

Observation data contained within the collection files will be in a comma separated value (CSV) format. This file format contains information represented by ASCII text characters with values typically delimited or separated by the comma character. Although CSV formatted files can use other characters, such as a tab, as the delimiter; the comma is preferred in the context of the *Clarus* system.

2.2.1 Header

The contributor will provide one and only one header in each file. The header will be the first information encountered within a data file. At least one record within the header must contain the complete set of field names for the data in the file. Each field name will correspond with a data element within the file. The header information may include multiple records as long as the configuration information provided to the *Clarus* system indicates the number of records to expect in the file header and which specific record contains the column metadata.

A form is provided in Appendix E as a convenience to record the information needed by the *Clarus* system for it to interpret observations accurately. The same information needs to be provided for each column described by the file header. A description of the information to be provided for each column follows:

Label – The name of column.

obsTypeName – The textual description of the *Clarus* observation type being reported. A complete list of available obsTypeNames can be found in Appendix C.

Null Value – The value the contributor uses to identify null or missing data.

Units – The units of the data element (e.g., degrees Fahrenheit, miles per hour, etc).

Scale Factor – Any scale factor of 10 that is needed to decode a data element (e.g., atmospheric pressure is reported in hundredths so the scale factor would be 100).

An example header containing one row is included below. The header row example is very wide and wraps in this width-constrained document. A second example combining both the header record and data record concepts is contained in section 2.2.2. Note that two consecutive commas with no label indicate a column that is to be ignored.

sysid,Rpuid,Senid,DtTm,AirTemp,Dewpoint,Rh,SpdAvg,
SpdGust,DirMin,DirAvg,DirMax,Pressure,PcIntens,PcType,
PcRate,Pc10Min,Visibility,Pc1Hr,Pc3Hr,Pc6Hr,Pc12Hr,
Pc24Hr,Height,snowdepth,,

2.2.2 Data Record

The majority of data within the observation files will be made up of data records. Data records contain comma-delimited elements that make up the aggregated ESS observations. All references to times or dates within a data record must be made with respect to UTC using a 24-hour clock time representation.

Observation sites which are permanently out-of-service will be removed from the data collection process and data for those locations will not be included within the contributor's data file. However, locations that are temporarily out-of-service will continue to be part of the collected data.

An example of a header containing a single line, and two data records is shown below in Figure 2. An atmospheric observation file example is provided in Appendix A, and a surface observation file example is provided in Appendix B. The file examples are provided in a tabular format with grid lines to promote readability.

```
sysid,Rpuid,Senid,DtTm,AirTemp,Dewpoint,Rh,SpdAvg,SpdGust,DirMin,DirAvg,DirMax,Pressure,PcIntens,PcType,PcRate,Pc10Min,Visibility,Pc1Hr,Pc3Hr,Pc6Hr,Pc12Hr,Pc24Hr,Height,snowdepth,,
351,13,0,12/29/06 09:02,-310,-440,91,7,21,,60,17,65535,None,None,-1,-1,-1,-1,-1,-1,-1,,,
351,14,0,12/28/06 23:45,220,120,93,2,16,,10,89,65535,None,None,-1,-1,-1,-1,-1,-1,-1,,,
```

Figure 2 – CSV Header with Observations Example

In the example shown above, each comma-delimited data element corresponds to an element within the header record. So, in the first data record:

- The sysid = 351.
- The Rpuid = 13.
- The UTC-based date/time stamp is 12/29/06 at 9:02 UTC.
- The air temperature is encoded with a scale factor in Degrees Celsius. Because the scale factor is "times 100", the air temperature (encoded as -310) is actually -3.10°C.
- The Pressure = 65535 which is a null value.
- Commas without data elements (at the right end of the data record) indicate missing data.

APPENDIX A - ATMOSPHERIC OBSERVATION DATA FILE EXAMPLE

Note that values of 65535 and -1 represent null data.

sysid	Rpuid	Senid	DtTm	AirTemp	Dewpoint	Rh	SpdAvg	SpdGust	Pressure	Pc10Min	Pc1Hr
351	0	0	4/27/2007 15:14	410	210	86	6	11	65535	-1	-1
351	1	0	4/27/2007 15:01	470	200	83	30	41	65535	-1	-1
351	2	0	4/27/2007 15:31	640	130	70	13	22	65535	-1	-1
351	3	0	4/27/2007 15:19	300	-80	76	5	9	65535	-1	-1
351	4	0	4/27/2007 15:31	540	-320	54	7	22	65535	-1	-1
351	5	0	4/27/2007 15:34	520	440	94	36	49	65535	-1	-1
351	6	0	4/27/2007 14:36	520	-100	64	7	10	65535	-1	-1
351	7	0	4/27/2007 14:50	470	-50	69	1	3	65535	-1	-1
351	8	0	4/27/2007 15:30	490	200	82	2	6	65535	-1	-1
351	9	0	4/27/2007 15:31	410	240	89	0	2	65535	-1	-1
351	11	0	4/27/2007 15:11	180	-140	79	3	4	65535	-1	-1
351	12	0	4/7/2007 12:16	320	200	92	13	34	65535	372	1168
351	13	0	4/27/2007 15:31	-250	-320	95	8	11	65535	-1	-1
351	14	0	4/27/2007 15:30	340	200	91	3	9	65535	-1	-1
351	15	0	4/27/2007 15:32	32767	32767	101	255	255	65535	0	0
351	16	0	4/27/2007 15:33	350	20	79	4	15	65535	0	0
351	17	0	4/27/2007 15:05	280	90	87	7	21	65535	0	20
351	18	0	4/27/2007 15:15	-90	-100	99	12	19	65535	0	60
351	19	0	4/27/2007 15:30	-20	-350	79	9	14	65535	0	0
351	20	0	4/27/2007 15:10	120	-20	90	3	7	65535	0	0
351	21	0	4/27/2007 15:18	120	110	99	6	10	65535	-1	-1
351	22	0	4/27/2007 15:31	0	-290	80	6	12	9678	0	0
351	23	0	4/27/2007 15:20	50	50	99	6	10	65535	-1	-1
351	24	0	4/17/2007 5:17	0	-650	62	6	10	9210	0	0
351	25	0	4/27/2007 15:30	40	0	97	2	3	9461	0	0
351	26	0	4/27/2007 15:13	-150	-210	95	4	12	65535	-1	-1
351	29	0	4/27/2007 15:20	-320	-890	65	10	14	9318	0	0

APPENDIX B - SURFACE OBSERVATION DATA FILE EXAMPLE

Note that values of 32767 represent null data.

sysid	Rpuid	senid	DtTm	sfcond	sftemp	frztemp	chemfactor	chempct	depth	icepct	subsftemp
351	0	0	4/25/2007 9:42	Dry	350	32767	0	101	32767	101	440
351	0	1	4/25/2007 9:42	Dry	350	32767	0	101	32767	101	
351	1	0	4/25/2007 10:01	Wet	340	0	5	0	0	0	430
351	1	1	4/25/2007 10:01	Wet	330	0	5	0	0	0	
351	2	0	4/25/2007 10:01	Dry	460	32767	101	101	32767	101	530
351	3	0	4/25/2007 9:51	Dry	540	32767	101	101	32767	101	560
351	4	0	4/25/2007 10:02	Dry	540	32767	101	101	32767	101	460
351	5	0	4/25/2007 9:57	Dry	340	32767	0	0	32767	101	
351	6	0	4/25/2007 9:36	Dry	500	32767	101	101	32767	101	620
351	6	1	4/25/2007 9:36	Dry	510	32767	101	101	32767	101	
351	7	0	4/25/2007 9:10	Dry	670	32767	101	101	32767	101	810
351	8	0	4/25/2007 10:00	Dry	700	32767	101	101	32767	101	
351	8	1	4/25/2007 10:00	Dry	710	32767	101	101	32767	101	
351	9	0	4/25/2007 10:01	Wet	580	0	5	0	0	0	970
351	10	0	4/25/2007 10:01	Dry	510	32767	101	101	32767	101	710
351	11	0	4/25/2007 9:38	Error	390	32767	101	101	32767	101	550
351	11	1	4/25/2007 9:38	Wet	250	0	5	0	0	0	
351	12	0	4/7/2007 12:16	Trace Moisture	220	32767	5	101	32767	101	80
351	13	0	4/25/2007 10:01	Dry	620	32767	101	101	32767	101	620
351	13	1	4/25/2007 10:01	Dry	530	32767	101	101	32767	101	
351	14	0	4/25/2007 10:00	Wet	620	0	5	0	10	0	740
351	14	1	4/25/2007 10:00	Wet	580	-10	5	0	70	0	
351	15	0	4/25/2007 10:01	Dry	600	32767	101	101	32767	101	560
351	15	1	4/25/2007 10:01	Dry	500	32767	101	101	32767	101	
351	17	0	4/25/2007 9:35	Dry	770	32767	101	101	32767	101	900
351	17	1	4/25/2007 9:35	Dry	620	32767	101	101	32767	101	
351	18	0	4/25/2007 9:45	Dry	400	32767	101	101	32767	101	640

APPENDIX C - OBSERVATION TYPES

This is the list of all the observation types currently supported by the *Clarus* system. The list is a compilation of observation types from industry standards NTCIP 1204 and the Traffic Management Data Dictionary (TMDD), and from the weather community. The type labels may be used to describe contributor observation data for submission to the *Clarus* system.

Observation types commonly collected by the *Clarus* system are shaded. The applicable metric and English units are also shown.

Type	Description	M	E
essAdjacentSnowDepth	Depth of undrifted & unplowed snow off roadways	m	ft
essAirTemperature	Instantaneous dry-bulb temperature	C	F
essAtmosphericPressure	Force per unit area exerted by the atmosphere	mbar	inHg
essCloudSituation	Description of amount of cloud cover; see NTCIP 1204 for validation rules and text mapping		
essCO	Concentration of carbon monoxide in the air		
essCO2	Concentration of carbon dioxide in the air		
essDewpointTemp	Instantaneous dewpoint temperature	C	F
essIceThickness	Thickness of the ice	m	ft
essInstantaneousSolarRadiation	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	W/m2	W/m2
essLatitude	Latitude of the ESS station [observation] per WGS-84 datum	deg	deg
essLongitude	East longitude from the Prime Meridian of the ESS station [observation]	deg	deg
essMaxTemp	Maximum air temperature during preceding 24 hours	C	F
essMinTemp	Minimum air temperature during preceding 24 hours	C	F
essMobileFriction	Measured coefficient of friction		
essMobileObservationGroundState	Prevailing observed ground state of the surrounding environment as determined by the observer; an indicator of past weather conditions; see NTCIP 1204 for data validation and mapping		
essMobileObservationPavement	Prevailing observed conditions on the driving surface as determined by the observer; see NTCIP 1204 for data validation and mapping		

Type	Description	M	E
essNO	Concentration of nitrous oxide in the air		
essNO2	Concentration of nitrous dioxide in the air		
essO3	Concentration of ozone in the air		
essPavementSensorError	Type of pavement sensor error; see NTCIP 1204 for data validation and mapping		
essPavementTemperature	Current pavement temp. 2-10 cm below surface, specifically at pavementSensorTemperatureDepth	C	F
essPaveTreatmentAmount	Quantity of the treatment being applied	kg/km	lb/mi
essPaveTreatmentWidth	Width of the spread of treatment	m	ft
essPaveTreatProductForm	Condition of the treatment being applied to the road; see NTCIP 1204 for data validation and mapping		
essPaveTreatProductType	Type of treatment being applied to the road; see NTCIP1204 for data validation and mapping		
essPercentProductMix	Percentage of the total application mix by weight that is of the type specified in essPaveTreatProductType		
essPrecipitation24Hours	Total water equivalent precipitation over preceding 24 hrs	cm	in
essPrecipitationEndTime	Time when most recent precipitation event ended	s	s
essPrecipitationOneHour	Total water equivalent precipitation over preceding 1 hr	cm	in
essPrecipitationSixHours	Total water equivalent precipitation over preceding 6 hrs	cm	in
essPrecipitationStartTime	Time when most recent precipitation event began	s	s
essPrecipitationThreeHours	Total water equivalent precipitation over preceding 3 hours.	cm	in
essPrecipitationTwelveHours	Total water equivalent precipitation over preceding 12 hours.	cm	in
essPrecipRate	Rate of rainfall or water equivalent of snow	cm/hr	in/hr
essPrecipSituation	Description of precipitation type & intensity; see NTCIP 1204 for validation rules and text mapping		
essPrecipYesNo	Indicates whether or not precip is detected: (1) precip; (2) noPrecip; (3) error		

Type	Description	M	E
essReferenceHeight	Reference elevation of the ESS; height to base of station for permanent ESS height to the ground surface upon which the ESS resides for transportable ESS, or height to surface under vehicle for mobile ESS	m	ft
essRelativeHumidity	Relative humidity	%	%
essRoadwaySnowDepth	Depth of unpacked snow on roadway surface	m	ft
essRoadwaySnowpackDepth	Depth of packed snow on roadway surface	m	ft
essSnowfallAccumRate	Rate of snowfall accumulation	m/s	ft/s
essSO2	Concentration of sulfur dioxide in the air		
essSubSurfaceMoisture	Sub-surface moisture expressed as a percentage (e.g., 0 indicates dry, 100 indicates saturated)	%	%
essSubSurfaceSensorError	Type of sensor error; see NTCIP 1204 for data validation and mapping		
essSubSurfaceTemperature	Current sub-surface temperature	C	F
essSurfaceBlackIceSignal	Indicates whether or not black ice is detected; see NTCIP 1204 for data validation and mapping		
essSurfaceConductivityV2	Conductivity of the ice/liquid mixture on the pavement as detected by the sensor	mhos/ m	mhos/ ft
essSurfaceFreezePoint	Solution freeze point temperature	C	F
essSurfaceIceOrWaterDepth	Current ice thickness or water depth on roadway surface	m	ft
essSurfaceSalinity	Pavement [surface] salinity		
essSurfaceStatus	Describes pavement surface status; see NTCIP 1204 for validation rules and text mapping		
essSurfaceTemperature	Current pavement surface temperature	C	F
essTotalRadiation	Average total radiation during the radiation period	J/m2	J/m2
essTotalRadiationPeriod	Length of time essTotalRadiation is averaged [i.e., accumulated]	s	s
essTotalSun	Total amount of sunshine during preceding 24 hrs	s	s
essVehicleBearing	Current bearing of the vehicle	deg	deg
essVehicleOdometer	Current odometer reading of the vehicle	km	mi
essVehicleSpeed	Current speed being reported by the vehicle	km/h	mph
essVisibility	Surface visibility	m	ft
essVisibilitySituation	Describes visibility of travel environment; see NTCIP 1204 for validation rules and text mapping		

Type	Description	M	E
essWetBulbTemp	Instantaneous wet-bulb temperature	C	F
icePercent	Percent of ice cover on roadway	%	%
pavementSensorTemperatureDepth	Depth at which the pavement temperature is detected	m	ft
precip10min	Total water equivalent precipitation measured during the preceding 10 minutes.	cm	in
precipIntensity	Description of precipitation intensity		
precipType	Description of precipitation type		
waterLevelSensorReading	Depth of the water from a user-defined point	m	ft
windSensorAvgDirection	Two-minute average of wind direction (CW from North)	deg	deg
windSensorAvgSpeed	Two-minute average of the wind speed	m/s	mph
windSensorGustDirection	Direction of maximum wind gust during preceding 10 minutes.	deg	deg
windSensorGustSpeed	Maximum wind gust recorded during preceding 10 minutes.	m/s	mph
windSensorSituation	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		
windSensorSpotDirection	Instantaneous wind direction (CW from North)	deg	deg
windSensorSpotSpeed	Instantaneous wind speed	m/s	mph

APPENDIX D - OBSERVATION ACCESS FORM

Make one copy of this form for each observation data file to be described. The file description can be the constant character portion of the filename.

Contributor Name _____
File Description _____
Contact Name _____
Contact Email Address _____

For the file specification, specify both the constant string portion and the time-based variable portion, if any. Use the following notation to specify year, month, day, etc. A filename of "ssi.atmos.20070419.1523.txt" would be specified as "ssi.atmos.%Y%m%d.%H%M", for example.

%y	year without century as a decimal number [00,99]
%Y	year with century as a decimal number, i.e. 2007
%U	week number of the year (Sunday as the first day of the week) as a decimal number [00,53]
%j	day of the year as a decimal number [001,366]
%m	month as a decimal number [01,12]
%b	abbreviated month name (MAR, APR, MAY, JUN, etc.)
%B	full month name (MARCH, APRIL, MAY, JUNE, etc.)
%d	day of the month as a decimal number [01,31]
%e (not recommended)	day of the month as a decimal number [1,31]; single digits are preceded by a space
%H	24-hour clock as a decimal number [00,23]
%I (not recommended)	12-hour clock as a decimal number [01,12]
%p (not recommended)	a.m. or p.m. (used with %I)
%M	minute as a decimal number [00,59]
%S	second of the minute as a decimal number [00,61]

File Specification _____

Collection Method Pull/FTP ☐ Pull/HTTP ☐ Push/FTP ☐

Host Name or IP Address _____
Protocol Port No. _____
File Path _____
File Period (seconds) _____
Midnight Offset (seconds) _____
UTC Offset (hours) _____

Username case sensitive ☐ _____

Password case sensitive ☐ _____

APPENDIX E - DATA DESCRIPTION FORM

Make as many copies of this form as needed to completely describe the observation data format being used. Appendix C defines the values to be used for the obsTypeName field.

Contributor Name _____
File Description _____
Contact Name _____
Contact Email Address _____
Page 1 of _____

Header Total Record Count _____
Column Data Record No. _____

Column Label _____
obsTypeName _____
Null Value _____
Units _____
Scale Factor _____

Column Label _____
obsTypeName _____
Null Value _____
Units _____
Scale Factor _____

Column Label _____
obsTypeName _____
Null Value _____
Units _____
Scale Factor _____

Column Label _____
obsTypeName _____
Null Value _____
Units _____
Scale Factor _____

Column Label _____
obsTypeName _____
Null Value _____
Units _____
Scale Factor _____

DATA DESCRIPTION FORM CONTINUED

Contributor Name _____
File Description _____
Page _____ of _____

Column Label _____
obsTypeName _____
Null Value _____
Units _____
Scale Factor _____

Column Label _____
obsTypeName _____
Null Value _____
Units _____
Scale Factor _____

Column Label _____
obsTypeName _____
Null Value _____
Units _____
Scale Factor _____

Column Label _____
obsTypeName _____
Null Value _____
Units _____
Scale Factor _____

Column Label _____
obsTypeName _____
Null Value _____
Units _____
Scale Factor _____

Column Label _____
obsTypeName _____
Null Value _____
Units _____
Scale Factor _____