Clarus Initiative

Read Ahead Package
For

Clarus Initiative Coordinating Committee
Meeting #4

August 8-9, 2006
Falls Church, VA

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Initiative Coordinating Committee Meeting #4
Draft Agenda
August 8-9, 2006
Falls Church, VA

Objective of the ICC Meeting #4
This ICC Meeting will focus the progress of the Proof of Concept and discuss the approach for the *Clarus* Multi-state Regional Demonstration.

Tuesday, August 8

8:00–8:30 AM	Registration & Refreshments	
8:30-9:00 AM	Welcome/Introductions Progress Since ICC Meeting #3 Basis for the Meeting	FHWA
9:00-9:30 AM	NOAA Surface Weather Program Update MADIS Transition Update	*NOAA*
9:30-10:00 AM	*Clarus* Background Briefings • Guiding Principles • End User Agreement • Data Provision Agreement	*FHWA*
10:00 - 10:30 AM	Break & Refreshments	
10:30 - 11:30 AM	Breakout Session #1 – Background / Policy Documents	*Facilitated Breakout Session*
11:30 – 12:30 PM	*Lunch – MTS Cafeteria*	
12:30 - 1:00 PM	*Breakout 1 Report*	Breakout Participants
1:00-2:00 PM	Report on the status of the Proof of Concept • Demonstrate Proof of Concept • GUI Demonstration	*Clarus System Developers*
2:00-2:30 PM	Quality Checking Task Force Discussion	*NCAR & Mitretek*
2:30-3:00 PM	*Break & Refreshments*	
3:00-3:30 PM	Metadata Discussion	FHWA
3:30-4:30 PM	Breakout #2 – Proof of Concept/ Quality Checking Task Force / Metadata Issues	*Facilitated Breakout Session*
4:30-5:00 PM	Breakout 2 Report	*Breakout Participants*
5:00 PM	Adjourn for the day	

Wednesday, August 9

8:30 - 9:30 AM	Structure of the *Clarus* Multi-State Regional Demonstration	FHWA
9:30 - 10:00 AM	Break & Refreshments	
10:00 -11:30 AM	Breakout #3 – Regional Demonstration	*Facilitated Breakout Session*
11:30 – 12:30 PM	*Lunch – MTS Cafeteria*	
12:30 – 1:00 PM	*Breakout 3 Report*	*Breakout Participants*
1:00 - 1:15PM	CCTV Research for *Clarus*	MIT/LL
1:15 - 2:15 PM	*Clarus*-Related VII Applications • Mitretek Mobile Sensor Report • NCAR/VII Task • VII Day 1 Applications for Clarus • Clarus & VII => Concept of the WDT	*Mitretek, NCAR, FHWA*
2:15-3:00 PM	*Breakout Session #4*	Facilitated Breakout Session
3:00 - 3:30 PM	*Break & Refreshments*	
3:30 - 4:00 PM	*Breakout 4 Report*	*Breakout Participants*
4:00 – 5:00 PM	Wrap Up	
5:00 PM	Adjourn	

Summary of *Clarus* Guiding Principles, Data Provision Agreement, and End-User License Agreement

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Guiding Principles

Scope

Describes what *Clarus* is intended to be and not intended to be.

Key things that it **is** intended to be are (1) an interconnection of autonomous North American environmental data collection networks including raw and post-processed data from fixed and mobile sources; (2) available on the internet in real- or near real-time in one common protocol; (3) accessible by provided data retrieval tools that allow users to determine parameters and geographical boundaries for data retrieval. Key things that it **is not** intended to be are decision support systems, forecasts, models, archives, or individual sensors.

Goals

Key goals are to help transportation and "environmental information" enterprises achieve their goals and support safety and commerce. Achieving the goals will require transportation industry leadership.

Policy

The *Clarus* System will be based on voluntary participation by data providers and users and run as a shared asset of the public/private/academic weather enterprise partnership. It will be based on consultation with stakeholders. It is not be intended to generate revenue, and will try to provide data at the lowest possible cost to users

Roles and Responsibilities

Described in the Data Provision Agreement and End User License Agreement

System Performance

System design will be optimized with a focus on timeliness, reliability, security, and access.

Data Provision Agreement

Purpose

Facilitate data-provision while ensuring that contributors' rights in their data are protected.

Key Provisions

- Data Provider to specify which data will be provided and whether it is available for any use or solely for governmental use.
- Data Provider retains ownership of data
- *Clarus* will disseminate the data in accordance with the terms of the End User License Agreement
- Entities receiving data through *Clarus* may only use that data as specified in their Data Use Agreement
- The CSO will assess the quality of the data and provide reports to the Data Provider of the results of its assessment
- Data Provider has no liability related to the performance or non-performance of the Agreement

End User License Agreement

Purpose

Provides a way for the CSO to protect contributors' data rights while disseminating data as widely as possible.

Key Provisions

- Envisioned to be a "click-through" agreement
- Neither the CSO nor the Data Providers warrant the quality, accuracy, or reliability of the data
- Licensee will not use data that is provided solely for government uses for any other purposes
- Licensee accepts the data as is, and neither the CSO nor any data provider will be liable for any damages

Clarus System Guiding Principles

Working Definition of "Guiding Principles"

The following definition of guiding principles was obtained from the Google search "define: guiding principles." This definition is the most applicable and complete definition appropriate to the topic of guiding principles for a complex system such as *Clarus*.

> *"The consequence of an action plan intended to inform or shape all subsequent decision-making, which also provides normative criteria allowing policy-makers to accept, reject or modify policy interventions and activities."*

Guiding Principles Areas

- Scope: What the *Clarus* System is and isn't
- Goals
- Policy Principles
- Roles and Responsibilities
- System Performance
- Reference Guidelines

Scope

- The *Clarus* System is envisioned to be:
  - An interconnection of autonomous environmental data collection networks…
  - Of weather, pavement and water level observations…
  - North American in scale…
  - Including raw and post-processed data…
  - From fixed (in situ) and mobile sources…
  - In real-time or near real-time…
  - Available from a one-stop Internet portal…
  - In one common, vendor-neutral, protocol based on recognized standards, formats and metadata descriptions…
  - Including quality assessment flags derived from *Clarus* System quality checking…
  - Accessible by provided data retrieval tools…
  - That allow data users to determine geographical boundaries and parameters for data retrieval.
- The *Clarus* System is not envisioned to be:
  - Decision support systems to make use of the data…or
  - Forecasts based upon on the data…or
  - Models that make use of the data…or
  - A historical archive of the data…or
  - Specific environmental sensor stations or observation points.

Goals

- To help both the transportation enterprise and the broader "environmental information enterprise" achieve their goals and missions, particularly in the areas of safety and commerce; both enterprises' goals are equally important, but transportation industry leadership will help ensure transportation-related goals are adequately addressed.
- To increase the effectiveness of transportation enterprise environmental data collection investments, both by state and local agencies and at the federal level, by:
    - Allowing weather providers to develop better nowcasts and forecasts of road and weather conditions;
    - Making available to ESS operators quality checking of observations; and
    - Improving access to adjacent system observations to agencies and/or their weather providers, thereby improving transportation system management, operations, and planning.

Policy Principles

- The *Clarus* System will adhere to all applicable federal statutes, regulations, executive orders, and agency policies, including the Paperwork Reduction Act and OMB Circular A-130.
- The *Clarus* System will be an operational service and be operated consistent with NOAA's Policy on Partnerships in the Provision of Environmental Information, enacted January 19, 2006.
- Participation by data providers and data users will be voluntary.
- The *Clarus* System will be developed, deployed, operated and managed as a shared asset of the public/private/academic weather enterprise partnership.
- The Federal Government is facilitating creation of the *Clarus* System and will consult with stakeholders in open forums as decisions are made regarding the design, implementation, operations, sustainability and governance of the *Clarus* system.
- Operating the *Clarus* System is not intended to be a revenue generating enterprise; the *Clarus* System shall endeavor to provide data at the lowest possible cost to users.

Roles and Responsibilities

- Rights and responsibilities of participants in the *Clarus* System shall be codified in specific bi-lateral data provision and data use agreements between data providers and the *Clarus* System Operator and the *Clarus* System Operator and data users, respectively.
- ESS data will be accepted from data providers, subject to terms agreed in the *Clarus* System data provision agreement, regardless of its content, quality or format. Ownership of the data and control over who has access to the data, unless specified otherwise in data provision agreements, will be retained by the organization providing data to *Clarus* system.

- ESS data will be available to data users, subject to terms, restrictions and acknowledgements agreed in the *Clarus* System data user agreement and consistent with the terms of all relevant data provision agreements.
- The *Clarus* System will operate in the best collective interests of data providers and data users.
- The *Clarus* System will make available to both providers and users quality checked data, but neither the System nor individual data provider are accountable for the actual quality, completeness or reliability of the data provided.

System Performance

- The *Clarus* System design will be optimized to the maximum extent possible, based upon the best techniques and technologies applicable within the available resources, focusing on four key areas:
    - Timeliness – Minimizing the latency introduced by making data available through the *Clarus* System;
    - Reliability – Minimizing the impact on data availability;
    - Security – Minimizing possible disruptions due to security breaches; and,
    - Access – Establishing access controls consistent with these principles, system requirements and design.

Reference Guidelines

- To support improving the overall quality of data available through the *Clarus* System, reference guidelines will be established and ESS operators will be encouraged – but not required – to consider these guidelines in expansion and improvement of their networks. Areas of focus will include ESS siting guidance, reporting, data and metadata formats, data quality checking and calibration.

Clarus Data Provision Agreement

Preamble

This data provision agreement is intended to provide a framework for transportation agencies and others to provide surface weather conditions data to the *Clarus* System Operator. This agreement is entered into as of the _____ day of ___, 20__, between _____ ("Data Provider") and the *Clarus* System Operator ("CSO").

1 Purpose

1.1 *General*. The purpose of this Agreement is to facilitate data-provision to enable the *Clarus* program to meet its objectives of collecting data on weather conditions on the surface transportation network of the nation to enable transportation agencies to better manage their systems.

1.2 *Protect Contributors' Interests.* A key element of this Agreement is to ensure that the contributors' rights in their data are protected.

1.3 *Allow Clarus' use of data internally and externally.* The other key element of this Agreement is to ensure that *Clarus* has the ability to use the data to accomplish its mission.

2 Data to be Provided

2.1 *Surface Condition Data.* Data Provider will specify in Appendix A *(Note: Appendix A not featured in this read ahead package. Such an appendix will depend on the specified Metadata list that will be included in the Clarus System Design Description.)* which types of data it will provide. For each data type that it provides, it will specify whether the data shall be restricted to government use or whether it will be available for all uses.

2.2 *Metadata*. In addition, Data Provider will provide associated metadata to ensure that Clarus will be able to assess the quality of the underlying data and convert the data into meaningful information.

2.3 *Data Appendix*. The types, specifications, and associated metadata for all data covered by this Agreement are set out in Appendix A. *(Note: Appendix A not featured in this read ahead package. Such an appendix will depend on the specified Metadata list that will be included in the Clarus System Design Description.)*

2.4 *Planned Outages.* Data Provider will inform the CSO in advance of any planned periods of data outages.

2.5 *Unplanned Outages.* Data will report to the CSO as soon as practical any unplanned data outages.

3 Data Ownership and Use

3.1 *Ownership.* The Data Provider shall retain ownership of all that it provides to the CSO.

3.2 *Clarus' Use of Data. Clarus* will disseminate the data in accordance with the terms of the Data Use Agreement. The CSO, in its sole discretion, will decide which data to disseminate. *Clarus* will inform Data Provider of its policies and criteria related to deciding which data to use.

3.3 *Notification of Use.* The CSO will inform Data Provider when it accepts and uses Data Provider's data.

3.4 *Others' Use of Data.* Entities receiving data through *Clarus* may only use that data for the purposes specified in their Data Use Agreement.

4 Data Quality Checking

4.1 *Quality Checking.* The CSO will assess the quality of the data before using it to provide information related to the surface transportation system. This assessment will include parameters such as latency, accuracy, reliability, and any other factors deemed important by the CSO.

4.2 *Known Errors.* Data Provider shall inform CSO about any known errors or other problems with its data.

4.3 *Reporting.* The Data Provider will be able to subscribe to regular reports from the CSO that will describe the results of the CSO's quality assessment as well as successes and failures in data transmission. The Data Provider may use these reports to support its own data quality initiatives.

5 Coordination of Activities and Communications

5.1 *Contact People.* The primary contact for the Data Provider and the CSO and additional personnel authorized to act on behalf of each party are identified in Appendix B to this Agreement. The Data Provider and CSO shall inform each other of changes to their authorized personnel or offices.

5.2 *Ongoing Negotiations.* Data Provider will inform other data providers of negotiations that might change the rights and privileges conferred by this Agreement.

5.3 *Public Awareness.* The Data Provider shall publicize its involvement in *Clarus* and will work with the CSO to enhance public understanding of the *Clarus* system and program.

6 Indemnity and Liability.

6.1 *Indemnification (General).* Each party to this agreement agrees to indemnify and hold harmless the other from and against all claims and demands, losses, costs, damages, actions, suits or other proceedings by whomsoever made brought or prosecuted in any manner attributable to this Agreement.

6.2 *Indemnification (Decision to Not Use Data).* Data Provider agrees to indemnify and hold harmless the CSO from and against all claims and demands, losses, costs, damages, actions, suits or other proceedings related to the CSO's decision to not use Data Provider's data.

6.3 *No Liability.* Data Provider will have no liability with respect to any claims related to the performance or non-performance of the obligations specified under this Agreement.

7 Application of Statutes, Regulations, Policies, and Rules

7.1 *General.* Nothing in this Agreement shall be construed to require parties to the agreement to violate any existing statutes, regulations, policies, or rules governing their collection and use of data.

7.2 *Notification*. If a party to this Agreement believes that a provision does require them to violate any statues, regulations, policies, or rules, that party shall notify ___ according to the provisions set out in Section __.

7.3 *References*. All references in this Agreement to statutes, regulations, policies, or rules shall be a reference to the most recent version thereof.

8 Security

8.1 *Office of Management and Budget.* This Agreement shall operate under the U.S. Government information technology security requirements as outlined in Office of Management and Budget Circular A-130, Management of Federal Information Resources, Appendix III, Security of Federal Automated Information Resources.

8.2 *National Institute of Standards and Technology.* This Agreement shall operate under the U.S. Government information technology security requirements as outlined in National Institute of Standards and Technology (NIST) Guidelines, Departmental Information Resource Management Manual, and associated guidelines.

8.3 *Department of Transportation.* This Agreement shall operate under the U.S. Government information technology security requirements as outlined in Department of Transportation Order 1630.2B, Personnel Security Management.

9 General Terms

9.1 *Applicability of existing law.* Nothing in this Agreement will release the parties hereto from any other obligation under existing municipal, state, or federal laws.

9.2 *Conflict of Interest.* No individual who is affiliated with Data Provider shall derive a direct benefit from this Agreement unless that individual is in compliance with all applicable statutes, regulations, policies, and rules related to employment and conflict of interest.

9.3 *Changes to Agreement.* Data Provider shall not change the terms of this Agreement without the written consent of the CSO.

9.4 *Severability.* If it is determined that a provision of this Agreement is invalid or unenforceable, that provision shall be severed from the Agreement and the rest of the Agreement shall remain in force.

9.5 *No Bribe Requirement.* Data Provider hereby warrants that no bribe, gift, commission, or other inducement has been paid, promised, given, or offered to any authorizing official or employee in exchange for entering into this Agreement.

9.6 *Assignment.* No party to this Agreement may transfer or assign its obligations hereunder without the written consent of the other party or parties.

9.7 *Termination.* Either party may terminate this Agreement with 90 days written notice to the other party. Upon termination of the Agreement, each party's rights under the agreement shall end.

Clarus End-User License Agreement

This end-user license agreement governs the licensee's use of surface transportation weather data that the user receives from the *Clarus* System Operator (CSO). The following terms apply:

1. *No Warranty*. Licensee understands that the CSO gets data via voluntary participation from Data Providers, and that neither the CSO nor the Data Providers provide any warranty, express or implied, as to the quality, accuracy, or reliability of the data.

2. *Restrictions on Data Use.* Licensee will not use data that is provided solely for government uses for any other purposes. Doing so will be cause for immediate termination of Data User's rights to access *Clarus* data.

3. *Limitations of Liability.* Licensee agrees that it accepts the data as is, and at its own risk. Neither the CSO nor any data provider will be liable for any direct, indirect, special, or consequential damages in connection with, or arising from the Licensee's use of, the data. Data User will have no cause of action for any damages, other liability, or injunctive relief against the CSO or any Data Provider for anything related to the data provided by the CSO.

4. *Credit for Data Use*. Licensee shall provide credit to the CSO when it uses *Clarus* data. Such credit could take many forms, but one example would be including the notation "Surface transportation weather information provided by *Clarus*" on web pages or other dissemination media.

5. *No Support*. CSO shall not provide Licensee with any support, maintenance, or consulting services for the data unless otherwise agreed to by the parties in a separate written agreement.

6. *Termination.* This Agreement may be terminated by either party upon thirty days prior written notice.

7. *Indemnification*. Licensee shall indemnify CSO and the data providers and hold them harmless from and against any and all claims of loss, cost, damage, and expense, including reasonable attorneys' fees, arising from or related to made against CSO or the data providers as a result of Licensee's use of the data.

8. *Notice*. The primary contact for the Licensee is the person completing this form on behalf of the Licensee. Licensee shall notify the CSO should the contact person or contact information change.

Clarus Quality Checking

The *Clarus* Initiative, which is sponsored by the Federal Highway Administration (FHWA), is dedicated to acquiring, organizing and distributing environmental sensor station data in support of diagnosing and predicting atmospheric and road conditions that impact the surface transportation industry. The primary element of this initiative is the development of the *Clarus* system, a network designed to collect, quality check, and disseminate atmospheric, hydrologic, and pavement data through on-demand and subscription-based services. The success of the *Clarus* system is based, in part, on the system's ability to provide accurate information regarding the quality of observations being supplied to the surface transportation and meteorological communities. In an attempt to address this issue, the *Clarus* system will implement a quality checking (QCh) service that will examine the observations through a series of QCh procedures. The *Clarus* system will have the capacity to deliver feedback concerning data quality to the system administrator, data contributors, and subscribers.

In an effort to ensure that the deployed *Clarus* system will be equipped with the optimal set of QCh algorithms, a task force was established to review, discuss, and make recommendations concerning the following:

- Nine QCh procedures being implemented as part of the *Clarus* Proof of Concept
- Seven supplemental QCh algorithms that were included in the Clarus Detailed Requirements Document
- QCh procedures that are a part of current operational and demonstration data ingest and delivery systems (MADIS, MesoWest, Oklahoma Mesonet, RWIN, etc.)
- QCh summary reports from the aforementioned systems and the potential for *Clarus* to provide accurate and timely information about data quality to end-users.
- Potential for new QCh procedures that could be part of *Clarus*, as well as other systems.
- Development of new QCh algorithms that use complementary datasets.

The task force met on May 31 and June 1 of this year to discuss current QCh algorithms, algorithm gaps and recommendations for improvement, and the formatting of QCh summaries. Information gathered during this meeting, along with additional research being conducted by the National Center for Atmospheric Research, will be used in the production of a white paper aimed at documenting the scientific merit of the proposed *Clarus* QCh tests, proposing supplemental QCh processes that could improve the QCh service, and recommending the most robust combination of QCh tests for the *Clarus* system. Presentations from this meeting can be found on the *Clarus* website (www.clarusinitiative.org).

During the ICC #4 meeting, participants will be provided with an update of activities associated with the development of the *Clarus* quality checking white paper.

Commonality of Metadata for Environmental Sensor Stations

During one of the afternoon sessions on Tuesday, August 8th, you will be asked to participate in a discussion that will focus on the issue of striving for "Commonality Of Metadata For Environmental Sensor Stations (ESS)". The goal of this discussion will be to review and discuss a FHWA proposal that recommends creating a common set of standard ESS metadata elements that can be applied nationwide.

In preparation for this discussion, you have been sent four spreadsheets. Two of them refer to a comparison of eight existing metadata sets that will be addressed during a presentation that will be given just prior to the group discussion. The other two include the FHWA's proposed list of common metadata elements and comments that have been received on this proposal.
In order to ensure a productive discussion, we encourage each and everyone of you to look over these spreadsheets prior to the meeting on Tuesday, August 8th. We would also greatly appreciate it if you could print out your own copies of these documents and bring them with you to the meeting."

Proposed Metadata Content

Site I.D. Information
Platform ID / Site Number
Plain Text Location Information
Highway and Milepost Marker
City/Borough/County Name
Latitude/Longitude (of the tower base)
Site Elevation (@ tower base)
Latitude/Longitude of each sensor
Datum
RPU Make
Date of ESS Installation
Date of Last Metadata Evaluation
State/Province ID
Country ID
Power Type (e.g., Solar, Hard Line)

Instrumentation
Thermometer/Humidity Type/Model
Anemometer Type/Model
Rain Gauge Type/Model
Barometer Type/Model
Road Sensor Type/Model
Number of Road Sensors
Number of Bridge Deck Sensors
Subgrade Probe Type/Model
Sensor Serial Numbers
Visibility Sensor Type/Model
Present Weather Sensor Type/Model
Units of measurement for each sensor
Sensor Measurement Range
Sensor Manufacturer
Sensor Resolution
Sensor Accuracy
Sensor Display/Test Limits
Plain Text Comments on Instruments

DOT Camera
Camera Make/Model
Camera Type (fixed, PTZ)
Camera ID
Camera Link URL
Camera View Description
Camera Optical Zoom Specs

Communications
Type of Comms (e.g., Hard Dial)
Phone Number
IP Address
Observation Collection Frequency
Observation Transmission Frequency
Daylight Savings Time Usage
Time Zone Offset
Output Data Format

Site Layout
Description of Site (plain text)
Surface Sensor (puck) layout
Digital Image of Site
Location on a Road Map
Digital Panoramic Image of Site
ESS Distance to Center of Road
ESS Base Height above/below Roadway
Representativeness
Obstructions
Landscape Features
Lane Direction of pavement sensor
Terrain Slope (Degrees)
Terrain Slope (Direction)
Road Surface Material
Type of soil (below station)

Maintenance
Maintenance Area Designator
Date of Calibration of each sensor
Date of Maintenance of each sensor
Contact Information for Maintenance

Comments Received for Proposed Metadata

Proposed Metadata Contents	Comments
Site I.D. Information	
Platform ID / Site Number	
Plain Text Location Information	Size of field? Some DOT use the RWIS site name as the plain text location information, e.g., Sterling Highway @ Jean Lake Hill MP 61.8. Is this what is meant by this field?
Highway and Milepost Marker	Comment 1: Some of our highways have numbers, but cover multiple routes. The State's Milepost Magazine and tourists use the numbers but not the DOT. Most of the RWIS are located on roads that have mileposts. However, the DOT does not use mileposts as a reference location system. The DOT uses the route/milepoint as the RWIS reference location. Where available, the milepost reference location is included in the RWIS site name, e.g., Glenn Highway @ Thunderbird Falls MP 24". Comment 2: Drop milepost. That's not something we have in our database, and I doubt it has much meaning to the meteorological community that would be using the information. You could probably then combine highway with the plain text information in the line before it.
City/Borough/County Name	Three fields all in one? We have cities within boroughs and also in non-borough areas. To complicate this even more, we tend to go with census areas, which covers the whole state. For boroughs, the census name is the same. So in short, we use both the census areas and boroughs in our metadata.
Latitude/Longitude (of the tower base)	Do we really need to be that specific on latitude/longitude for each sensor? For one, the atmospherics are generally on the tower. Two, getting GPS records for the pavement sensors would require shutting down lanes of traffic. Although I see the reasoning behind this (like what if a sensor is far away from the tower) but doing this for every sensor could be difficult.
Site Elevation (@ tower base)	Which system - English or metric?
Latitude/Longitude of each sensor	The spatial coordinates that our DOT has is from various sources: handheld, estimated from road inventory, etc. Is the data source for the coordinates important? Since most of the sensors are on the tower and the RPU is close to the tower, does it really make sense to require the lat/long of all the sensors? If we assume some degree of coordinate accuracy (DOT assumes +/- 15 feet on the coordinates for most of the road inventory work), isn't there the potential to place the non-tower sensors on the wrong side of the tower? Is this going to be a multi-valued field? Should only the lat/longs be required when there is a sensor that is some distance away from the RPU, e.g., a pavement sensor?
Datum	
RPU Make	
Date of ESS Installation	By date of installation, I hope you mean year. Some of ours are so old, I'm not sure we even have that information.
Date of Last Metadata Evaluation	Sort of an ongoing activity
State/Province ID	Not sure what this means?
Country ID	
Power Type (e.g., Solar, Hard Line)	Comment 1: Very well could be multiple fields here. We have power module and solar sources right now and may expand to wind as well. Will this be a code table field? Comment 2: Not sure we need power type. Is that really of any value to the data user? It is to me internally for maintenance tracking, etc., but I don't know why a user would need that information.

Proposed Metadata Contents	Comments
Instrumentation	
Thermometer/Humidity Type/Model	
Anemometer Type/Model	
Rain Gauge Type/Model	Are there fields for heated versus non-heated and whether a wind (alter) shield is installed?
Barometer Type/Model	
Road Sensor Type/Model	
Number of Road Sensors	
Number of Bridge Deck Sensors	Is this different from the pavement sensor?
Subgrade Probe Type/Model	May be multiple sub-surface temperature sensors. DOT has an extensive deployment of temperature data probes. Do you want to make this field mult-value or create a separate instrumentation?
Sensor Serial Numbers	May take a while to get these
Visibility Sensor Type/Model	
Present Weather Sensor Type/Model	
Units of measurement for each sensor	
Sensor Measurement Range	
Sensor Manufacturer	
Sensor Resolution	
Sensor Accuracy	Is the assumption here that this is 100 percent equal to accuracy? If so, I'll change ours to match; if not, this needs further discussion.
Sensor Display/Test Limits	May have more to do with the delivered data field than the sensor display (reference Surface System's SCANX data exporter function).
Plain Text Comments on Instruments	Comment 1: What would you like here? Comment 2: Although this information can be included in this section, you may consider adding the following about the pavement sensor in the "Site Layout" section: Pavement type; sensor color in relation to the pavement color e.g., darker, lighter, same; pavement sensor slope e.g., "face of puck points slightly to the south".
DOT Camera	
Camera Make/Model	
Camera Type (fixed, PTZ)	
Camera ID	
Camera Link URL	May be multiple links here. The camera line item is different than in the spreadsheet: "URL to access image database" which to me is different than "Camera link URL". We store the image on a ftp site, but keep it only for 24 to 48 hours. The web site serves the most current images.
Camera View Description	The PTZ cameras can bring back up to 8 views; our DOT may decide not to have all 8 views. DOT can also control the number of images to bring back on each data poll (1-8); does this need to be in the metadata? Some cameras have an artificial lighting source which makes nighttime images possible. I think this should be a metadata field.
Camera Optical Zoom Specs	
Communications	
Type of Comms (e.g., Hard Dial)	May be multiple types of communication involved for each site. This makes a big difference on the layout of the metadata field
Phone Number	
IP Address	Type of IP address - what hardware does it go to: router, rpu, secure console modem
Observation Collection Frequency	Is this at the rpu level? If so, then it should be identified.
Observation Transmission Frequency	There are two types here: the observation transmission frequency from the rpu to the database server and the one that is delivered to a data archive and the web site
Daylight Savings Time Usage	
Time Zone Offset	
Output Data Format	From where?

Proposed Metadata Contents	Comments
Site Layout	
Description of Site (plain text)	Length?
Surface Sensor (puck) layout	Picture or image?
Digital Image of Site	Our DOT also includes the 8 quadrants.
Location on a Road Map	Desirable but a good ways off. Our RWIS and TDP sensors are included in the geodatabase design, but it will be a good bit of time before we get accurate coordinates and GIS deployment.
Digital Panoramic Image of Site	Our DOT includes images of the 8 quadrants.
ESS Distance to Center of Road	
ESS Base Height above/below Roadway	
Representativeness	Please provide guidelines
Obstructions	Please provide guidelines
Landscape Features	Please provide guidelines
Lane Direction of pavement sensor	Code table?
Terrain Slope (Degrees)	* (See Comment 2 for "Type of soil".)
Terrain Slope (Direction)	* (See Comment 2 for "Type of soil".)
Road Surface Material	Code table?
Type of soil (below station)	Comment 1: Code table? * Comment 2: Eliminate terrain slopes and type of soil under station. The former two can be covered under the digital panoramic. The latter is unimportant unless there are sensors in the ground and, I'm not aware of anything like that on RWIS.
Maintenance	
Maintenance Area Designator	Comment 1: Code table? Comment 2: Not sure what the "maintenance area designator" is?
Date of Calibration of each sensor	This will be a records keeping chore!
Date of Maintenance of each sensor	The Aurora RWIS Site Monitoring System (by Meridian Environmental) will significantly help keep up with this. Otherwise, this also becomes a records keeping chore.
Contact Information for Maintenance	
Elements To Consider	
Contact for RWIS System	The contact for maintenance information and the overall RWIS program could be the same person, but not necessarily so.
Judd Sonic	used to measure water height & snow depth.
General	This is an extensive list and would levy a lot of work on State DOTs to come up with everything. We are in the process of doing much of this now, but even then, I see things we don't have. I had been loosely basing my metadata gathering on the ESS Siting Guidelines but, see now that it might not be enough.
	There absolutely needs to be some standard for RWIS metadata. I suppose the question is, where do we make the standard? Tight, or loose? I'm not really sure…
	Having a guideline to determine what to collect is a good idea. At this point, I don't have an opinion on what elements of this list are good or bad but, the concept of standardizing is good.
	Something that I do not see addressed in this list is how the metadata should be presented. Should you create spreadsheets, text strings, data array files, or free-form information pages and what are the advantages/disadvantages of each method? There may be a benefit in investigating XML tags, formatting, unit standards, or other arrangement schemes for automatic injestion by a computer for at least some of the metadata fields. I think this will become increasingly important for efficient updating, integration, and redistribution of metadata in large systems like *Clarus*.

Composite Metadata List – Sorted by Ranking

Metadata Parameter	Utah DOT	Meridian Enviro Technology	Washington State DOT	ESS Siting Guidelines	WMO	Alaska DOT&PF	Canada CMML 2.0	Clarus	Total
Platform ID / Site Number	√	√	√	√	√	√	√	√	8
Plain Text Location Information	√	√	√	√	√	√	√	√	8
Latitude/Longitude (of the tower base)	√	√	√	√	√	√	√	√	8
Site Elevation (@ tower base)	√	√	√	√	√	√	√	√	8
Highway and Milepost Marker	√	√	√			√	√	√	6
Thermometer/Humidity Model	√			√	√	√	√	√	6
Anemometer Model	√			√	√	√	√	√	6
Representativeness		√	√	√	√			√	6
Obstructions	√	√	√	√	√			√	6
Landscape Features	√	√	√	√	√			√	6
City/Borough/County Name			√	√		√	√	√	5
RPU Make	√				√	√	√	√	5
Rain Gauge Model	√			√	√	√		√	5
Rain Gauge Type (e.g., Tipping Bucket)	√			√	√	√		√	5
Barometer Model				√	√	√	√	√	5
Road Sensor Model	√			√		√	√	√	5
Number of Road Sensors	√		√	√		√	√		5
Subgrade Temperature Probe	√			√		√	√	√	5
Sensor Serial Numbers	√			√	√	√		√	5
Units of measurement for each sensor				√	√	√	√	√	5
Sensor Manufacturer	√			√	√	√		√	5
Plain Text Comments on Instruments	√			√	√	√	√		5
Observation Collection Frequency				√	√	√	√	√	5
Description of Site (plain text)	√	√	√	√	√				5
ESS Base Height above/below Roadway		√	√	√			√	√	5
Lane Direction of pavement sensor	√		√	√		√	√		5

Metadata Parameter	Utah DOT	Meridian Enviro Technology	Washington State DOT	ESS Siting Guidelines	WMO	Alaska DOT&PF	Canada CMML 2.0	Clarus	Total
Date of ESS Installation	√			√			√	√	4
State/Province ID		√				√	√	√	4
Rain Gauge with Heating Element				√	√	√		√	4
Road Sensor Type (e.g. puck, thermistor)				√		√	√	√	4
Sensor in Bridge Deck			√	√		√	√		4
Sensor Measurement Range				√	√	√		√	4
Sensor Resolution				√	√	√		√	4
Sensor Accuracy				√	√	√		√	4
Type of Comms (e.g., Hard Dial)	√				√	√		√	4
Observation Transmission Frequency					√	√	√	√	4
Digital Image of Site	√	√	√	√					4
Digital Panoramic Image of Site	√	√	√	√					4
ESS Distance to Center of Road		√	√	√				√	4
Terrain Slope (Degrees)			√	√			√	√	4
Terrain Slope (Direction)			√	√			√	√	4
Latitude/Longitude of each sensor			√	√			√		3
Datum	√				√			√	3
Owner Contact Information				√			√	√	3
Air Quality Sensor Model						√	√	√	3
Sensor Display/Test Limits				√		√		√	3
Existence of Camera						√	√	√	3
Camera Type (fixed, PTZ)						√	√	√	3
Phone Number	√						√	√	3
Power Type (e.g., Solar, Hard Line)	√					√		√	3
Surface Sensor (puck) layout	√		√	√					3
Location on a Road Map	√		√			√			3
Fenced Site	√		√		√				3
Road Surface Material							√	√	3
Type of soil (below station)				√	√			√	3

Metadata Parameter	Utah DOT	Meridian Enviro Technology	Washington State DOT	ESS Siting Guidelines	WMO	Alaska DOT&PF	Canada CMML 2.0	Clarus	Total
Maintenance Area Designator			√			√		√	3
Date of Calibration of each sensor					√		√	√	3
Date of Maintenance of each sensor					√		√	√	3
Date of Metadata Evaluation	√	√							2
Country ID							√	√	2
Climatic Zone							√	√	2
Station Type (perm, mobile, transportable)							√	√	2
Metadata Administratior POC	√			√					2
Radiation Sensor Model							√	√	2
Visibility Sensor Model							√	√	2
Present Weather Sensor Model							√	√	2
Instrument Installation Date							√	√	2
Sensor Commission Date						√		√	2
Camera ID						√		√	2
Camera Link URL						√		√	2
Number of Control Cards	√							√	2
IP Address							√	√	2
Daylight Savings Time Usage				√				√	2
Time Zone Offset							√	√	2
Output Data Format					√			√	2
Data Output Filename	√							√	2
Nearest AWOS/ASOS ID		√		√					2
Four Quadrant Site Layout		√	√						2
Wind Roughness Classification				√				√	2
Associated Route Number	√					√			2
Date that metadata first becomes valid	√			√					2
Contact Information for Maintenance				√			√		2
Frequency of Preventive Maintenance					√			√	2
Calibration Frequency					√			√	2

Metadata Parameter	Utah DOT	Meridian Enviro Technology	Washington State DOT	ESS Siting Guidelines	WMO	Alaska DOT&PF	Canada CMML 2.0	Clarus	Total
Milepost Direction (increasing, decreasing)			√						1
Related Roadway Type/Qualifier			√						1
Access Directions	√								1
MesoWest ID	√								1
ATMS Map ID	√								1
Associated NWS Forecast Zone						√			1
Offset distance from puck to ESS								√	1
Height of Sensor on Tower								√	1
Output Averaging Time					√				1
Corrections Applied to Data					√				1
Camera View Description						√			1
Camera Optical Zoom Specs						√			1
URL to access image database								√	1
Video of the Site	√								1
Distance of pavement sensor from fog line			√						1
Type of nearby water (if present)			√						1
Shadow start date/time							√		1
Shadow end date/time							√		1
System Operational Status						√			1
Mean Time Between Failure				√					1
Calibration History							√		1

Composite Metadata List – Sorted by Category

Metadata Parameter	Utah DOT	Meridian Enviro Technology	Washington State DOT	ESS Siting Guidelines	WMO	Alaska DOT&PF	Canada CMML 2.0	Clarus	Total
I.D. Information									
Platform ID / Site Number	√	√	√	√	√	√	√	√	8
Plain Text Location Information	√	√	√	√	√	√	√	√	8
Highway and Milepost Marker	√	√	√			√	√	√	6
Milepost Direction (increasing, decreasing)			√						1
City/Borough/County Name			√	√		√	√	√	5
Related Roadway Type/Qualifier			√						1
Latitude/Longitude (of the tower base)	√	√	√	√	√	√	√	√	8
Site Elevation (@ tower base)	√	√	√	√	√	√	√	√	8
Latitude/Longitude of each sensor			√	√			√		3
Access Directions	√								1
Datum	√				√			√	3
RPU Make	√				√	√	√	√	5
Date of ESS Installation	√			√			√	√	4
Date of Metadata Evaluation	√	√							2
MesoWest ID	√								1
ATMS Map ID	√								1
State/Province ID		√				√	√	√	4
Country ID							√	√	2
Associated NWS Forecast Zone						√			1
Climatic Zone							√	√	2
Station Type (perm, mobile, transportable)							√	√	2
Site Ownership									
Owner Contact Information				√			√	√	3
Metadata Administratior POC	√			√					2
Instrumentation									
Thermometer/Humidity Model	√			√	√	√	√	√	6
Anemometer Model	√			√	√	√	√	√	6
Rain Gauge Model	√			√	√	√		√	5

Metadata Parameter	Utah DOT	Meridian Enviro Technology	Washington State DOT	ESS Siting Guidelines	WMO	Alaska DOT&PF	Canada CMML 2.0	Clarus	Total
Rain Gauge Type (e.g., Tipping Bucket)	√			√	√	√		√	5
Rain Gauge with Heating Element				√	√	√		√	4
Barometer Model				√	√	√	√	√	5
Road Sensor Model	√			√		√	√	√	5
Road Sensor Type (e.g. puck, thermistor)				√		√	√	√	4
Number of Road Sensors	√		√	√		√	√		5
Offset distance from puck to ESS								√	1
Height of Sensor on Tower								√	1
Sensor in Bridge Deck			√	√		√	√		4
Subgrade Temperature Probe	√			√		√	√	√	5
Sensor Serial Numbers	√			√	√	√		√	5
Radiation Sensor Model							√	√	2
Visibility Sensor Model							√	√	2
Air Quality Sensor Model						√	√	√	3
Present Weather Sensor Model							√	√	2
Units of measurement for each sensor				√	√	√	√	√	5
Sensor Measurement Range				√	√	√		√	4
Sensor Manufacturer	√			√	√	√		√	5
Sensor Resolution				√	√	√		√	4
Sensor Accuracy				√	√	√		√	4
Sensor Display/Test Limits				√		√		√	3
Output Averaging Time					√				1
Corrections Applied to Data					√				1
Plain Text Comments on Instruments	√			√	√	√	√		5
Instrument Installation Date							√	√	2
DOT Camera									
Sensor Commission Date						√		√	2
Existence of Camera						√	√	√	3
Camera Type (fixed, PTZ)						√	√	√	3
Camera ID						√		√	2
Camera Link URL						√		√	2
Camera View Description						√			1

Metadata Parameter	Utah DOT	Meridian Enviro Technology	Washington State DOT	ESS Siting Guidelines	WMO	Alaska DOT&PF	Canada CMML 2.0	Clarus	Total
Camera Optical Zoom Specs						√			1
Communications									
Number of Control Cards	√							√	2
Type of Comms (e.g., Hard Dial)	√				√	√		√	4
Phone Number	√						√	√	3
IP Address							√	√	2
Observation Collection Frequency				√	√	√	√	√	5
Observation Transmission Frequency					√	√	√	√	4
Daylight Savings Time Usage				√				√	2
Time Zone Offset							√	√	2
Output Data Format					√			√	2
Data Output Filename	√							√	2
Power									
Power Type (e.g., Solar, Hard Line)	√					√		√	3
Site Layout									
Description of Site (plain text)	√	√	√	√	√				5
Surface Sensor (puck) layout	√		√	√					3
Digital Image of Site	√	√	√	√					4
Location on a Road Map	√		√			√			3
Digital Panoramic Image of Site	√	√	√	√					4
URL to access image database								√	1
Video of the Site	√								1
Nearest AWOS/ASOS ID		√		√					2
ESS Distance to Center of Road		√	√	√				√	4
ESS Base Height above/below Roadway		√	√	√			√	√	5
Representativeness		√	√	√	√			√	6
Obstructions	√	√	√	√	√			√	6
Landscape Features	√	√	√	√	√			√	6
Four Quadrant Site Layout		√	√						2
Fenced Site	√		√		√				3

Metadata Parameter	Utah DOT	Meridian Enviro Technology	Washington State DOT	ESS Siting Guidelines	WMO	Alaska DOT&PF	Canada CMML 2.0	Clarus	Total
Lane Direction of pavement sensor	√		√	√		√	√		5
Distance of pavement sensor from fog line			√						1
Type of nearby water (if present)			√						1
Terrain Slope (Degrees)			√	√			√	√	4
Terrain Slope (Direction)			√	√			√	√	4
Wind Roughness Classification				√				√	2
Road Surface Material							√	√	3
Type of soil (below station)				√	√			√	3
Associated Route Number	√					√			2
Shadow start date/time							√		1
Shadow end date/time							√		1
Maintenance									
Maintenance Area Designator			√			√		√	3
Date of Calibration of each sensor					√		√	√	3
Date of Maintenance of each sensor					√		√	√	3
Date that metadata first becomes valid	√			√					2
Contact Information for Maintenance				√			√		2
Frequency of Preventive Maintenance					√			√	2
Calibration Frequency					√			√	2
System Operational Status						√			1
Mean Time Between Failure				√					1
Calibration History							√		1

Approach for *Clarus* Regional Multi-State Demonstration

The progress of the *Clarus* Initiative has advanced to a stage in which the USDOT is seeking to conduct a *Clarus* Multi-state Regional Demonstration. Through the *Clarus* Multi-state Regional Demonstration the USDOT aims to achieve the following objectives:

(1) Demonstrate that the *Clarus* System functions as designed by incentivizing a large number of state and local agencies to contribute data from their Environmental Sensor Stations (ESS);
(2) Enable proactive transportation system management through utilization of the *Clarus* System; and,
(3) Provide an environment so that private sector service providers can innovate and create new and improved products that will benefit the public, academic and other private industries.

The challenge is to balance state and local agency needs for enhanced weather information services with software and system application development. The approach described here is one in which the state and local agencies have a direct hand in defining applications and services. Then the USDOT will work with the private sector to develop the solutions that achieve the vision set forth by the state and local agencies.

The *Clarus* Regional Multi-State Demonstration thus will be executed in the following manner:

Clarus Regional Multi-State Demonstration: Concept of Operations

USDOT will issue a Request for Application (RFA) for states and local agencies to develop a Concept of Operations. The Concept of Operations will describe the agreement partners' current capabilities and system characteristics with respect to the use of surface transportation weather information and its application to transportation system operations. The Concept of Operations will also describe an envisioned future state in which there are information products, services, tools and decision support mechanisms that fully incorporate *Clarus*-enabled surface weather information into transportation system operations. The agreement partners shall be engaged and proactive among themselves to articulate the Concept of Operations. USDOT will provide assistance throughout the Concept of Operations

Clarus Regional Multi-State Demonstration: Development and Deployment

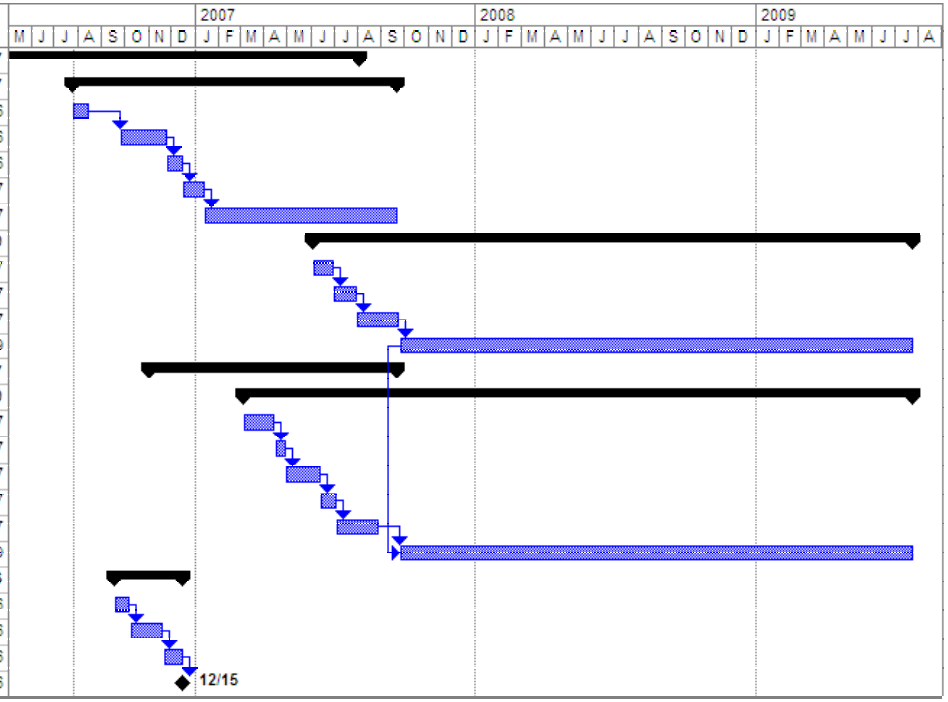
The resultant Concept of Operations document will describe an aggregation of effective "Business-to-Government" solutions that are desired by the public sector. Such "Business-to-Government" solutions may entail actual products and tools that are consumed directly by state and local governments. The USDOT will then conduct a full-and-open competition to build the desired solutions. One or more of the Concept of Operations participants will be asked to remain as an active test bed for the development and deployment activities.

Clarus Connection Incentive Funding Program

The USDOT will issue a Request for Expressions of Interest to states and local agencies not engaged in the Concept of Operations and/or Development and Deployment effort to prepare their ESS output in a format that can be shared through the *Clarus* System. The Expressions of Interest respondents will receive a predefined amount of funds that can be used by the state or local agency for developing metadata and for making their collector sites compatible with the *Clarus* System interface specification.

Tentative Schedule of Activities for the *Clarus* Multi-State Regional Demonstration

ID	Task Name	Duration	Start	Finish
1	**System Design**	**594 days**	**Mon 4/25/05**	**Thu 8/2/07**
8	**Demonstration ConOps**	**303 days**	**Tue 7/25/06**	**Thu 9/20/07**
9	PR Package Development	3 wks	Tue 7/25/06	Mon 8/14/06
10	RFA Posting Period	60 days	Mon 9/25/06	Thu 11/23/06
11	Proposal Evaluation Period	3 wks	Fri 11/24/06	Thu 12/14/06
12	Award Period	1 mon	Fri 12/15/06	Thu 1/11/07
13	ConOps Period of Perf	9 mons	Fri 1/12/07	Thu 9/20/07
14	**Demonstration Development and Deployment**	**560 days**	**Mon 6/4/07**	**Fri 7/24/09**
15	Option SOW Development	1 mon	Mon 6/4/07	Fri 6/29/07
16	Option Response	30 days	Sat 6/30/07	Sun 7/29/07
17	Option Award	2 mons	Mon 7/30/07	Fri 9/21/07
18	Option Period of Perf	24 mons	Mon 9/24/07	Fri 7/24/09
19	**Mitretek ConOps Support**	**232 days**	**Wed 11/1/06**	**Thu 9/20/07**
23	**FHWA Development Contract**	**625 days**	**Mon 3/5/07**	**Fri 7/24/09**
24	SOW Preparation	6 wks	Mon 3/5/07	Fri 4/13/07
25	PR Package Development	2 wks	Mon 4/16/07	Fri 4/27/07
26	RFP Posting Period	45 days	Sat 4/28/07	Mon 6/11/07
27	Proposal Evaluation Period	3 wks	Tue 6/12/07	Mon 7/2/07
28	Award Period	2 mons	Tue 7/3/07	Mon 8/27/07
29	Contract Period of Perf	24 mons	Mon 9/24/07	Fri 7/24/09
30	**Connection Incentive Funding Program**	**65 days**	**Mon 9/18/06**	**Fri 12/15/06**
31	Draft RFEOI	3 wks	Mon 9/18/06	Fri 10/6/06
32	RFEOI Management Review	6 wks	Mon 10/9/06	Fri 11/17/06
33	Chief Counsel RFEOI Review	1 mon	Mon 11/20/06	Fri 12/15/06
34	Publication in Federal Register	0 days	Fri 12/15/06	Fri 12/15/06



Clarus ICC #4 List of Registrants

Last Name	First Name	Affiliation	Email
Abukar	Abed	Dallas Area Rapid Transit	aabukar@dart.org
Adams	Michael	WI DOT	michael.adams@dot.state.wi.us
Albright	Douglas	GeoDecisions	dwalbright@geodecisions.com
Anderle	Phillip	Colorado DOT	Phillip.Anderle@DOT.STATE.CO.US
Askelson	Mark	Univ of North Dakota	mark.askelson@und.nodak.edu
Ban	Ray	The Weather Channel	rban@weather.com
Belter	Dennis	Indiana DOT	dbelter@indot.gov
Berman	Michael	PBS&J	michaelberman@pbsj.com
Bingham	Darrell	Arizona DOT	dbingham@azdot.gov
Blaine	Tom	NMDOT ITS Bureau	tom.blaine@state.nm.us
Bowlby	David	New Jersey DOT	David.Bowlby@dot.state.nj.us
Boyce	Brenda	Mixon Hill	Brenda.Boyce@mixonhill.com
Cammack	Paul	Meridian Environmental Technology, Inc.	pcammack@meridian-enviro.com
Campbell	Mike	NOAA/NWS	mike.campbell@noaa.gov
Carttar	Peter	Kansas DOT	Carttar@ksdot.org
Chu	Mandy	California DOT	mandy_chu@dot.ca.gov
Cornett	David	Kentucky Transportation Cabinet	davidp.cornett@ky.gov
Cosby	Jason	City of San Antonio	jecosby7@sbcglobal.net
Costello	Pete	PBS&J	petecostello@pbsj.com
Estis	Frank	NOAA/OFCM	frank.estis@noaa.gov
Frazier	Jeff	Wyoming DOT	Jeff.Frazier@dot.state.wy.us
Garrett	Kyle	Mixon Hill	J.Kyle.Garrett@mixonhill.com
Goodwin	Lynette	Mitretek	lynette.goodwin@mitretek.org
Gouse	Bill	ITSA	bgouse@itsa.org
Greenfield	Tina	Iowa DOT	Tina.Greenfield@dot.iowa.gov
Groeneweg	Kevin	IWAPI, Inc	Kevin@iwapi.com
Hall	Ron	Kansas DOT	Ron.Hall@KSdot.org
Hallowell	Robert	MTI/Lincoln Laboratory	bobh@ll.mit.edu
Handman	Arthur	KMJ Consulting inc.	ahandman@kmjinc.com
Howard	Mark	Cambridge Systematics	mhoward@camsys.com
Huft	Dave	South Dakota DOT	Dave.Huft@state.sd.us
Hughes	David	PennDOT	dahughes@state.pa.us
Hunt	Bruce	FHWA	Bruce.Hunt@fhwa.dot.gov

Last Name	First Name	Affiliation	Email
Johnson	Joshua	Southwest Research Institute	josh.johnson@swri.org
Karimi	Sholeh	City of Grand Prairie	skarimi@gptx.org
Kennedy	William (Pat)	City/County of Denver	william.kennedy@ci.denver.co.us
Kennedy	Pat	FHWA	Pat.Kennedy@dot.gov
Kisse	Mike	North Dakota DOT	mkisse@nd.gov
Koonar	Awtar	Environment Canada	awtar.koonar@ec.gc.ca
Krechmer	David	Cambridge Systematics	dkrechmer@camsys.com
Lashmet	Mike	New York State DOT	mlashmet@dot.state.ny.us
Lasley	John	SAIC	lasleyj@saic.com
Lisle	Frank	TRB	flisle@nas.edu
Mahoney	Bill	NCAR	Mahoney@ucar.edu
Martsers	Robert	GeoDecisions	rmarsters@gfnet.com
Mayer	Kent	Nevada DOT	kmayer@dot.state.nv.us
McClellan	Tony	Indiana DOT	TMCCLELLAN@indot.state.in.us
McGuirk	Majorie	NOAA/NCDC	Marjorie.McGuirk@noaa.gov
Mckewon	Marty	DTN Meteorlogix	Marty.McKewon@dtn.com
McPherson	Renee	University of Oklahoma	renee@ou.edu
Middleton	Dan	Texas Transportation Institute	d-middleton@tamu.edu
Ogden	Tom	High Sierra Electronics	tomogden@highsierraelectronics.com
Osborne	Leon	Meridian Environmental Technology, Inc.	leono@meridian-enviro.com
O'Sullivan	Jim	NOAA/NWS	Jim.OSullivan@noaa.gov
Pape	Curt	Minnesota DOT	Curt.Pape@dot.state.mn.us
Parker	Regina	ITSA	rparker@itsa.org
Patterson	Ralph	Utah DOT	ralphpatterson@utah.gov
Pearson	Brooke	Vaisala Inc	brooke.pearson@vaisala.com
Petty	Kevin	NCAR	KPetty@ucar.edu
Phetteplace	Gary	USACE CRREL	gephet@crrel.usace.army.mil
Pisano	Paul	FHWA	Paul.Pisano@fhwa.dot.gov
Pol	James	FHWA	James.Pol@fhwa.dot.gov
Potter	Gregg	Anything Weather Communications	gregg@anythingweather.com
Rennie	Christopher	IWAPI, Inc	chris@iwapi.com
Ronnau	Dalyce	Nebraska Dept of Roads	dronnau@dor.state.ne.us
Roosevelt	Dan	Virginia DOT	dan.roosevelt@vdot.virginia.gov
Rossetti	Michael	DOT/Volpe Center	rossetti@volpe.dot.gov
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