MINUTES

Clear Roads 2015 Technical Advisory Committee Spring Meeting:

Pooled Fund Project #TPF-5(218)

Tuesday – Thursday, March 17-19, 2015
Best Western Plus Coeur d'Alene Inn – Coeur d'Alene, ID

Attendees:

David Frame, California DOT
Kyle Lester, Colorado DOT
John DeCastro, Connecticut DOT
Ron Wright, Idaho TD
Harold Dameron, Illinois DOT
Craig Bargfrede, Iowa DOT
Clay Adams, Kansas DOT
Brian Burne, Maine DOT
Paul Brown, Massachusetts DOT
Justin Droste, Michigan DOT
Tom Peters, Minnesota DOT
Tim Chojnacki, Missouri DOT
Justun Juelfs, Montana DOT
Tom Renninger, Nebraska DOR
Mike Lashmet, New York State DOT
Caleb Dobbins, New Hampshire DOT
Scott Lucas, Ohio DOT
Patti Caswell, Oregon DOT
Daryl St. Clair, Pennsylvania DOT
Joe Baker, Rhode Island, DOT
John Mehlhaff, South Dakota DOT
Wayne Gammell, Vermont AOT
Allen Williams, Virginia DOT
James Morin, Washington State DOT
Jeff Pifer, West Virginia DOT
Mike Sproul, Wisconsin DOT
Cliff Spoonemore, Wyoming DOT
Michael Coffey, Alaska DOT
John Scharffbillig, APWA
Rick Nelson, AASHTO
David Wieder, Colorado DOT
Gabe Guevara, FHWA
Dennis Jensen, Idaho TD
Jason Minzghor, Idaho TD
Steve Spoor, Idaho TD
Monty Mills, Washington State DOT
Jay Wells, Washington State DOT
Colleen Bos, CTC & Assoc.
Kim Linsenmayer, CTC & Assoc.
Greg Waidley, CTC & Assoc.

Materials Distributed

Meeting Participants
Operating Procedures
Clear Roads Budget Overview
Projects/Subcommittees
Project Mgmt – Roles/Responsibilities
MnDOT RFP Development
2015 Research Proposals
First Scoping Mtg Questions (example)
Clear Roads Implementation Survey Results
Project Closeout Form (example)
Post Project Survey (example)
Winter Maintenance Statistics

Tuesday, March 17, 2015

Welcome

Ron Wright from the Idaho Transportation Department welcomed the Clear Roads Technical Advisory Committee (TAC) to Coeur d'Alene, Idaho with some slides of state facts, some of them little-known.

Introductions and Meeting Objectives

Chairperson David Wieder kicked off the day with introductions of all the attendees, an overview of the Clear Roads Pooled Fund program, and a review of objectives:

- Select new projects for funding and RFP development
- Provide updates on research in progress
- Provide state reports from ID, MN, IA, and MT
- Provide updates on the 2015 Peer Exchange and SICOP and PIARC activities

Clear Roads Budget

Colleen provided an overview of the Clear Roads budget, including amounts committed and obligated by the states, as well as the expenses from research, meetings, and administration. Clear Roads has $538,609 to spend on research this year.

Discussion and Ranking of Research Proposals

The 2015 research proposals were presented and discussed by the TAC. The notes detailing the proposals and the discussions that followed can be found at the end of the minutes. After all the proposals (17 in total) were presented, each voting member of the TAC submitted rankings for each proposal presented. The rankings were then tallied, and those projects with the highest average scores were considered for approval based on the available funds. The TAC voted unanimously to approve five projects for funding using $475,000. The following projects and subcommittees were approved:

Pacific Northwest Snowfighters (PNS)
Subcommittee: Ron Wright
Funding: $30,000

2015 Peer Exchange
Subcommittee: Rick Nelson* (Champion), Patti Caswell, Allen Williams, and Tom Peters
Funding: $45,000

Synthesis of Best Practices for Material Application Methodology in Winter Operations COMBINED WITH Salt Brine Primer
Subcommittee: Paul Brown* and Jeff Pifer (Champions), John DeCastro, Justun Juelfs, Tom Peters, Monty Mills* and Rick Nelson* (observer). Invite Max Perchanok to participate. Also invite Dave Wieder* and Mark DeVries to participate after contract has been awarded.
Funding: $125,000

Identification and Correction of Equipment Factors Causing Fatigue in Snowplow Drivers
Subcommittee: Allen Williams (Champion), Cliff Spoonemore, Patti Caswell, Tim Chojnacki, Tom Renninger, and Wayne Gammell.
Funding: $200,000

Comprehensive Study on Contracting Snow and Ice Response
Subcommittee: Harold Dameron (Champion), Justin Droste (Supporting Champion), Paul Brown*, Daryl St. Clair, Caleb Dobbins, Joe Baker, Allen Williams, and Mike Lashmet.
Funding: $75,000

*Denotes that a subcommittee member is a non-voting member.

On-Call Synthesis and Data Gathering Reports
The TAC also voted to amend the CTC & Associates contract with MnDOT for Clear Roads to include a $50k cap (which can be rolled over) for the purpose of crafting, compiling, disseminating, and summarizing survey information for synthesis topics that are requested and voted on by the TAC. This amendment also includes maintaining a database of all surveyed information. The amended tasks would eliminate the need to advertise traditional requests for proposal for these selected topics.

Yes: 28
No: 1

A subcommittee will work with CTC & Associates to scope and complete synthesis projects requested by the TAC on a rolling basis. The TAC agreed to move forward with scoping the first project on winter data statistics, below.

Gathering Winter Statistics
Subcommittee: Scott Lucas, Brian Burne, Allen Williams, James Morin, Justin Droste, Jay Wells, and Tom Peters.
Funding: TBD

ACTION ITEM:
- CTC: Follow up with members of the subcommittees to continue scoping projects and work with MnDOT to get RFPs posted.

Role of Project Champion and Subcommittee Members
Per the document entitled (Project Management – Roles and Responsibilities), Dave Wieder emphasized the important role of a project champion and a co-champion in terms of keeping the project on track and the importance of selecting committee members that are highly interested and fully engaged in the project. The group acknowledged these important roles and considered the time commitments needed to fulfill them when volunteering to serve on the new project subcommittees.

Wednesday, March 18, 2015

Research In-Progress Project Updates

- ***Synthesis on GPS/AVL Equipment Used for Winter Maintenance*** (Patti Caswell)
    - Contractor: SRF.
    - A synthesis of what other states are doing and a consumer reports-style guide on the AVL systems, including pros and cons.
    - Working out the technical terminology.
    - Survey will go out soon.
- ***Quantifying the Impact that New Capital Projects Will Have on Roadway Snow and Ice Control (RSIC) Operations*** (Wayne Gammell)
    - Contractor: Univ. of Vermont.
    - Contract in negotiations.
- ***Developing a Training Video and Manual for Best Practices and Techniques in Clearing Different Interchange Configurations and Other Geometric Layouts*** (Justin Droste)
    - Contractor: Southern Illinois University, Edwardsville.
    - Just getting started. MLT Group is a subcontractor working on the videos. Survey went out and selected 10 layouts for the video each in a chapter. Ted is starting to collect footage. There will be animations for front/underbody and right wing plow setups. Survey to S&I community to register the best methods of clearing each geometry coming up soon. Two minute chapters. Post end results on our site and use Google Analytics to track it. Have it available in a format where you can download it and save it to a DVD.
- ***Plug and Play Initiative*** (David Wieder)
    - Progress continues. Has been out for 2 rounds of public comment. Specification is pretty much done. Main hold up is the Test Bed Software.
- ***Plug and Play Test Bed*** (David Wieder)
    - Test Bed Software went through an alternate RFP process. It should be out shortly.
- ***Plug and Play Phase II*** (Allen Williams)
    - Contractor: SRF.
    - Gabe Guevara would like to be added to the Phase II subcommittee.
    - Contract in negotiations.
- ***Snow Removal Performance Metrics – Phase I: Synthesis*** (Allen Williams)
    - Contractor: WSU.
    - Add Rick Nelson to this subcommittee.
    - Contract in negotiations.
- ***Use Of Equipment Lighting During Snowplow Operations*** (David Frame)
    - Contractor: WTI.
    - Testing out the survey. [*The survey was distributed March 26.*]
- ***Snowplow Route Optimization*** (Clay Adams)
    - Contractor: WSU.
    - Goal is to understand a practical way to optimize plow routes to make the best use of trucks and staffing.

- Deliverable will be a matrix of pros and cons. Gabe notes that he just saw an international paper on route optimization that he'll send us the link.

  ACTION ITEM:
  Gabe Guevara: Send the group the link to the international paper on route optimization.

- ***Winter Severity Mapping Enhancement*** (Cliff Spoonemore)
  - Project is complete. Posted them on the public version of the website. Hits will be tracked by Google Analytics.

- ***Development of a Winter Driver's Education Program*** (Craig Bargfrede)
  - Still interest in the project. Needs a new champion. Many materials already exist, just need to work with ADTSEA and DSAA on whether they are interested in partnership on distribution. Could we just put something out via Clear Roads and then talk to the national orgs about getting it out there? Move the $25K into the existing Training project and just add it to the contract and make it a module? Could it include a 1-2 page summary for DMV on Winter Driving Tips? A basic start and then each state would tailor it. Can we get a copy of what Mike Coffey put together and each tailor it? Make this subcommittee the point people for the module when the time comes. There was a motion to develop winter driver education program to the training project – motion and second.

    ACTION ITEM:
    CTC: Query the group for their Driver Education materials and then get one subcommittee member to sort them out.

- ***Roadway Salt Best Management Practices for Snow and Ice Control*** (Gabe Guevara)
  - Contractor: University of Iowa.
  - Many issues across the country with salt shortages, salt prices and logistics in 2013-14. FHWA decided to fund a project to assess BMPs for handling salt shortages. What can we learn from those who fared well? What can we learn from those who did not? MnDOT put in matching funds. Develop a short (20 pages) handbook on procurements, storage, technology, etc.

- ***Environmental Best Management Practices Manual*** (Brian Burne)
  - Contractor: WTI.
  - A guide that helps answer a lot of common environmental questions. Lit review, survey is done. Analysis is done. We have an outline and a sample chapter. Do need more info on the costs of CMA. Brian asked for information on CMA usage from the members. [*A draft of the guide has since gone out to the subcommittee and TAC for their review.*]

- ***Snowplow Operator and Supervisor Training*** (Mike Sproul)
  - Contractor: University of Minnesota.
  - 20+ modules. They are doing 18 and then will give us a price for the additional ones. And we'll add the Driver Training Education information in as well. Clear Roads gathered and sifted through materials. Gave them to the PI, and she is working through the modules one by one. They look very good.
  - Keep finished modules in house for the first year. After that consider sharing them more broadly. Gives us a chance to vet them. The group would like to see a Train the Trainer session rather than a final presentation.

  ACTION ITEM:
  CTC and Subcommittee: Let Connie know about the group's thoughts on the final presentation.

- ***Cost Benefit Analysis of Various Winter Maintenance Strategies*** (Ron Wright)
    - Contractor: WTI.
    - The research team is following up via phone calls to survey respondents, due to the gaps in the survey results.
- ***Best Practices for the Prevention of Corrosion to DOT Equipment: A User's Manual*** (Justin Droste)
    - Contractor: WTI.
    - Looking at ways to reduce corrosion impacts. Worked with them to pare it down and make it easy to navigate. Almost complete. Final webinar in May.
- ***Understanding the Effectiveness of Non-Chloride Liquid Agricultural By-Products and Solid Complex Chloride*** (Ron Wright)
    - Contractor: WTI.
    - Trying to sort out what these chemicals really do.
    - Heading into Task 4 mechanical testing. Getting interesting results.
- ***Establishing Effective Salt and Anti-icing Application Rates*** (Monty Mills)
    - Contractor: Blackburn and Associates.
    - Ended this project early, because we didn't think we were going to get the end product we really wanted. The proposed project, *Synthesis of Best Practices for Material Application Methodology in Winter Operations*, will pick up where this left off. As long as Blackburn is OK, post all 3 deliverables.

      ACTION ITEM:
      CTC: Confirm with Bob Blackburn that it's okay to post project deliverables.
- ***Understanding the Chemical and Mechanical Performance of Snow and Ice Control Agents on Porous or Permeable Pavements*** (Mike Lashmet)
    - Contractor: WTI.
    - Different types of pavements function differently in snow and ice situations. They are doing the lab testing now. Some testing done and doing some follow-up testing now. End date in September.
- ***Pacific Northwest Snowfighters*** (Ron Wright)
    - PNS provides third party testing on the QPL list. Send some testing to an independent laboratory in addition to what they do in-house. 8 products waiting for evaluation. About 10K left in the coffers. This amount would fund testing for about 3 more years. Requested additional Clear Roads support to continue testing and website maintenance.
    - Many states rely on the QPL. And the QPL has identified some vendor fraud. This just validates what the vendors are already reporting themselves. A safety net.

2015 Peer Exchange

- Rick reviewed the survey going around now regarding the Peer Exchange. Would like everyone to respond. Want to hear from multiple people per agency. Responses are anonymous.
- Reviewed the Peer Exchange agenda and goals of various segments. For example, emphasis on integrating with traffic operations, state best practices, breakout sessions. Facilitated debriefing at the end.
- Will send notice to the CEO at each state to invite people. Also send invitation to all levels to help facilitate approvals. Address letters to executive director and cc the rest. Needs to go out ASAP.

- Organizations involved include Clear Roads, Aurora, SICOP, FHWA, and AASHTO. All Clear Roads, Aurora and SICOP members are invited. In addition, each member of Clear Roads and Aurora can invite one additional guest, presumably from their central office. If a state DOT is a member of both Clear Roads and Aurora, then they get to invite 2 guests (one for each member). Some states that have combined traffic operations and winter operations positions will also be invited to send a traffic/winter representative. Funding for the invited attendees and sponsoring attendees has been outlined by the Peer Exchange Planning Committee. CR and Aurora to split the costs for the additional attendees.

State Reports

Idaho's Winter Performance Measurement System, Dennis Jensen

- Normalize events through a storm severity formula
- Indexes performance to compare foreman areas
- Identified best practices to share among crews

State Report: Minnesota, Tom Peters

- 2013-2014 winter maintenance costs - $136,228,359
- Dollars spent on deicing/anti-icing materials - $37,241,276
- Statewide average snowfall – 78.2"
- Lane miles – 30,616
- No. of snowplow trucks - 814
- No. of priority 1 drivers – 1,233
- No. of priority 2 drivers – 297
- No. of garages - 158
- Price of salt (2013-2014) - $69.90
- Total dry materials used in season – 344,982 tons
- Liquid deicers used in season – 2,648,865 gal
- Types of liquids used: salt brine, Magnesium Chloride, Calcium Chloride, Potassium Acetate, and liquid corn salt.
- Changes:
    - Purchased 3 Raiko Ice Breaker units
    - LEDs on Snowploys
    - Tow Plows (about a dozen statewide)
- Innovations:
    - Liquid Chemical Blending and Dispensing System
        - Allows for accurate blending and dispensing of up to 5 different winter chemicals
    - Road Condition Monitor (RCM) 411
        - Road friction measuring device to help operators determine slipperiness of the road surface
    - High Sierra Road Surface Sentinel
        - Provides real time surface weather condition of the roadways
    - New "Falls" Plow Design
        - Uses wind direction to cast snow from the road without impeding traffic or the operator's view
    - Snow King
        - Combination blades controlled hydraulically via remote control

- New research ideas (2014)
    - Posi Shell: coating to be applied during summer months to seal salt pile
    - Solar-powered Culvert Heat Tape System: uses solar or wind energy to heat tape placed through the center of a drainage structure
    - Salt Brine Blending to Optimize Deicing and Anti-Icing Performance and Cost Effectiveness
    - Estimation of Winter Snow Operation Performance Measures with Traffic Flow Data

State Report: Iowa, Craig Bargfrede

- Budget - $43 Million
- Maintenance Facilities – 109
- Staffing:
    - Permanent staff – 1,051
    - Seasonal staff – 462
- Staff-Hours:
    - Total snow/ice hours – 278,052
    - 5 year avg – 409,090
- Primary Roadway Responsibilities:
    - Lane miles – 24,122
    - Lane miles of Interstate (ramps included) – 3,687
    - Centerline miles of roadway – 9,403
- Equipment:
    - Snowplows – 892
    - Motor graders – 53
    - Endloaders – 133
    - Heavy duty self-propelled snow blowers – 12
    - Snow blower attachments for loaders/tractors – 76
    - Tow plows – 12
- Salt Summary
    - 5 year avg salt usage – 166,539 tons
    - Avg price per ton (2015) - $75.01
- Brine and Sand Summary
    - 5 year avg use:
        - Salt brine – 17,816,775 gals
        - Calcium Chloride Brine – 45,924 gals
        - Sand – 25,028 tons
- Plow Cam and Track-A-Plow
    - Technology that captures, uploads, and geographically displays photos taken from snow plow trucks during winter ops (available for internal and public use).
- Craig also pointed out that the AASHTO Sub Committee on Maintenance will be in Des Moines, IA on July 19-23, 2015 in the Downtown Marriott.

State Report: Idaho, Ron Wright

- Total ITD FY 15 - $517 million
    - In the past:
        - Maintenance operations - $83 M
        - Winter operations - $30 M
        - Presently: it takes what it takes and the dollar amount is being reduced due to the new Winter Performance Measures.

- Employee allocation
    - Total full time in 2009 – 1833
    - Total full time after 2009 realignment – 1814
    - Total full time approved FY15 – 1724
- Land area – 82,690 sq. mi.
- Lane miles – 12,248
- Centerline miles – 4,983
- Bridges – 1,820
- Counties – 44
- Population – 1,608,000
- District offices – 6
- 2013
    - Salt – 84,000 tons at $58/ton
    - Salt brine – 3,891,934 gals at $.07-$.11/gal
    - $MgCl_2$ – 6,794 tons at $150/ton
- 2014
    - Salt – 104,000 tons at $58/ton
    - Salt brine – 4,409,000 gals at $.07-$.11/gal
    - MgCl2 – 7,798 tons at $152/ton
- Maintenance sheds – 80
- Foreman areas – 41
- Trucks 443
- Loaders – 175
- RWIS stations – 125
- Transportation technician – Operations
    - New level of employee
    - Directed to report from Nov. to April for winter operations
- Transportation Asset Management System (TAMS)
    - Maintenance Management System (MMS)
    - Fleet Manager System
- Winter Automated Report System (WARS)
    - Provide the operator with a view of the data
    - Import Cirus Controller Data directly into MMS

State Report: Montana, Justun Juelfs

- 5 districts/10 divisions/126 maintenance sections
- 25,000 lane miles
- 627 snowplows
- $20M snow and ice budget, exceed if necessary. Overruns covered by pavement preservation funds
- 765 total FTEs
- Material usage:
    - 192,550 tons of salt/sand at $22.25 per ton
    - 6 million gallons inhibited salt brine at $.26 per gallon
    - 2.8 million gallons inhibited MgCl2 at $.90 per gallon
- New tools:
    - Live View (pilot project with ten trucks): provides video as well as still pictures close to real time for streaming (not storage). Plan is to provide to public.

- Tow Plows – eight in service. Plan to order 5 more.
- Salt brine production – 5 Varitech SB 600s and 1 Henderson Brine Extreme in service. Produced approximately 6 million gallons in FY14.
- Salt Leaching: salt/sand containment pads with covered storage in high precipitation areas.
- MDT Truck Fabrication - $149,000/truck

SICOP and PIARC Report

- PIARC is the international winter maintenance organization. SICOP was created after an international scan of the Scandinavian countries.
- SICOP has 28 member states. $4,000 to join.
- Reviewed SICOP's ongoing 4–year plan. Gets reviewed and approved by the Standing Committee on Highways every three years.
  - MDSS issues
  - TRB project on facility design and operation
  - 2015 Winter Maintenance Peer Exchange
  - PR – Media Relations – requests from both press and agencies; act as a resource but may point agencies back to their own staff, if appropriate
  - Support SCOM, Safety and Reliability TWG
- Working on an AASHTO Winter Maintenance Survey. Please participate. If you want to be on the list, let Rick know.
- PIARC operates on a 4-year cycle. Focus on "winter service" Strategic projects are:
  - Crisis management of unusually severe and sustained snow events
  - Sustainability and climate change considerations in winter operation
  - Advanced technology for data collection and information to users and operators
  - Winter Road Congress Planning – 2013 Andorra – 240 technical papers presented
- Reviewed the Snow and Ice Data Book – a short report based on 27 countries and how they handle the worst weather conditions.
- Put on 2 seminars every 4 years for technology transfer. Presentations available via PDF. Ask Rick if you are interested. Clear Roads would like to post these on the internal website.
- Working on the next 4-year cycle. Pull from slide.

Thursday, March 19, 2015

Implementation and Technology Transfer

Subcommittee has been brainstorming Implementation and Technology Transfer. The following are their recommendations:

- Annual Implementation Survey - Tracking data on how deep implementation is and also track our implementation over time. Shows that we need more quantifiable results. And need to build deliverables that help with implementation into the project up front.
- Looking at surveys – also need to find out how other people are using Clear Roads research results. Get into Google Analytics and start tracking that data on website use, too.
- Looking at implementation as a part of project scoping – Need to think about this from the beginning of the project. Draft list of questions was provided.
- Close Out meeting and forms led by the Project Champion – May be more emphasis on the summarizing what we got out of a project. Need to make sure we understand what the process for

this is and how the information gets used. Consider adding a "Lessons Learned" – though not focused on a particular PI or anyone else per se.

Further discussion:

- Want to capture some of the TAC discussions that happen via email.
- Everyone will send in reports from the Cost-Benefit Toolkit – send them to Greg to distribute to the group. Post examples on the public website, if states are OK sharing their data.
- Suggestion to start project cycle earlier and get input from others and post them early and be able to consolidate thoughts and ideas in advance.
    - Need to find ways to sell ideas to management. How can we quantify the benefits?
- May need a scoping document to develop the initial proposal to a robust scope. Can use the Cost-Benefit toolkit to provide a cost-benefit calculation for new projects to build into contracts.
- Emphasize how results will be used – "why are we doing it" and "how will it be implemented" should be part of the project updates at each meeting.
- Survey the winter maintenance community 1-2 years after the project is complete. Get more exposure to the research and try to measure impact beyond Clear Roads.
- Need a standard business card, which includes the Clear Roads logo and website.
- Focus State Reports on Implementation of Clear Roads Results – Record webinars (already doing) and post. If the PI needs to re-record to have a clean copy, we will do that.
- Consider putting on national webinars of research results.
- Tracking & Reporting website and You Tube traffic stats. Google Analytics reports/updates to show traffic for each project.

ACTION ITEMS:

- CTC: Send out the following forms for review and comment.
    - First scoping meeting questions
    - Project closeout form
    - Post project survey
- CTC: Create and print the Clear Roads business cards.
- CTC: Report Google Analytics and You Tube traffic at each meeting.
- TAC members: Send Greg any reports developed using the Cost-Benefit Toolkit for sharing with other members.
- CTC: Distribute reports on Cost-Benefit Toolkit use provided by the states.

RFP Development and Implementation Process

There have been many questions about the MnDOT RFP development and proposal evaluation/selection process. The goal today was to provide some guidance, training and answer questions about what can and can't be done within the process. Ashley Duran from MnDOT joined the meeting via conference phone to provide this guidance and answer questions posed by the group.

ACTION ITEMS:

- CTC: Ask the subcommittees when developing the new RFPs if there are any desired changes to the evaluation criteria for proposals.
- CTC: Draft a new paragraph for inclusion in future RFPs that reminds proposers of the importance of providing all requested information. The information (or lack thereof) will impact their scores.

- CTC: Draft a new bullet for inclusion in future RFPs (paragraph 4) that includes the hours assigned to each individual (bolded). The goal is to provide a clear checklist for what proposers are being scored on.

Future Meetings

- The fall 2015 Clear Roads Meeting will be held the week of September 21st in Minneapolis, MN in conjunction with the Peer Exchange. Clear Roads will meet first on September 21 and 22, followed by the Peer Exchange on September 23, 24, and 25.
- The spring 2016 Clear Roads meeting is planned for Rhode Island.
    - If Rhode Island doesn't pan out, look to Pennsylvania or Connecticut as backups.
    - Invite appropriate east coast states that are not already members to attend.

ACTION ITEMS:

- CTC: Send a letter to Rhode Island DOT requesting they host the spring 2016 meeting.

Collecting Winter Maintenance Program Information (first synthesis project for CTC & Associates as approved by the TAC)

- In order to alleviate survey burnout, try to collect key stats once per year and use as a resource for members but also for researchers so they can trim down their surveys.
- Some data points may need to be updated annually. This might be done around August each year as people will likely have their previous winter seasons stats in hand by then.
- Clear Roads will develop a proposal for the TAC to consider.
- The subcommittee members will be Scott Lucas, Brian Burne, Allen Williams, James Morin, Justin Droste, Jay Wells, and Tom Peters.
- Look at Tim Peters' summary from the Salt Containment survey.

ACTION ITEM:

- CTC: Set up a conference call with subcommittee to discuss the project and move forward with developing a brief proposal.

Presentation on Clear Roads

The group decided that developing a standard PPT and webinar to post to the Clear Roads website would be helpful such that TAC members can use them to present about Clear Roads to their own research departments and perhaps to other national committees.

ACTION ITEMS:

- CTC and Justin: Work to post a standard PPT on the Clear Roads website. A recorded version targeted to specific audiences may also be developed and posted.

Election of Vice Chair

- Justun Juelfs elected Vice Chair.
- Justin Droste is the new Chair.
- Brian Burne suggested as next Vice Chair. He will consider it.

FHWA Report

Gabe Guevara presented an update on Data Collection and Connected Vehicle initiatives. They include:

- Weather Data Environment –
    - Provides a data and interoperability platform to meet weather-related research needs, specifically for Connected Vehicles and ITS.
    - Builds on Clarus but much improved.
- Integrated Mobile Observations –
    - Partnership with MI, MN, and NV
    - Working with NCAR to further enhance
        - Vehicle Data Translator
        - Enhanced MDSS
        - Motorist Advisories and Warnings Application
- Performance Measures Management Tool
    - Takes advantage of mobile data (as well as traditional data sources)
    - Makes use of CAN-bus data and pavement friction as derived from wheel slip differential
    - 18 month contract awarded to Battelle
- Integrated Modeling Travel Conditions Prediction Tool
    - Known internally as the "Holy Grail"
    - Tactical and strategic prediction of travel conditions taking into account a holistic view of all possible issues affecting the transportation system and their associated models: climate/weather; travel demand; incidents; special events…
- Pavement Friction Characterization
    - Determined from CAN-bus information: differential rotation of driven Vs. non-driven axles
    - VTTI is the prime; experiments at SmartRoads test bed in Blacksburg, VA
- Working with OEM Consortia – VIIC and CAMP
- Transition of the former Clarus System to MADIS
- Miscellaneous Connected Vehicle efforts to be aware of:
    - Connected Vehicle Pilot Deployments
    - Research Data Exchange
    - Open Source Application Development Portal
- Projects
    - Weather Responsive Traffic Management
        - Development and implementation of South Dakota DOT Weather-Responsive Regional Traveler Information System
        - Working with Wyoming DOT on a mobile data collection application for WRTM purposes
        - Completed development and began production of the Michigan DOT advanced Weather-Responsive Traveler Information and Traffic Management System.
        - Completed Utah DOT Signal Timing TrEPS application and published project report on the NTL website.
        - Developed analysis plan for the Chicago AMS Testbed for weather-related Connected Vehicle DMA and ATDM Applications
        - Initiated planning for the 3rd National Stakeholder Meeting on Weather Responsive Traffic Management
    - Road Weather Performance Measures
        - Published the RWM Benefit Cost Analysis (BCA) Compendium
        - Completed implementation plan for the Road Weather Management Performance Measures Update

        - Developed topics for the Road Weather Management Benefit Cost Analysis technical briefs
        - Promoted the RWM Benefit Cost Analysis Technical Support to State DOT's
        - Conducted a T3 webinar on RWM Benefit Cost Analysis
        - Identified locations and data sources for analysis to evaluate impacts of weather on freight performance
    - Stakeholder Coordination
        - Road Weather Management Stakeholder meeting
        - Completed the Road Weather Capability Maturity Framework (CMF)
        - Continued to execute the Pathfinder project
        - Continue to engage TRB, AASHTO, and PIARC

APWA Report

- Winter Maintenance Supervisor Certificate
    - 1,495 people have attended as of August 2014
    - 2014 workshops:
        - Cincinnati, OH (May)
        - Loveland, CO (Sept)
        - Kansas City, MO (Oct)
    - 2015 workshops
        - Grand Rapids, MI (April)
        - Loveland, CO (Sept)
        - Manitoba (fall – tentative)
    - Snow and Ice modules have been combined into a single section
    - New module has been added that is a "what happens when…" for operations outside of the norm
    - Policy module has been updated and refreshed
    - Evaluation of potential to be offered online is still ongoing

State Reports

State Report: Ohio, Scott Lucas

- Annual snow and ice budget - $82,221,363 (5 yr avg)
- ODOT spent just under $52 million on deicing and anti-icing materials for 2013-2014 season
- Lane miles – 49,250 (total); 43,308 (snow and ice)
- Full service facilities – 93
- Outposts – 132
- Snow plows – 1,628
- Tow plows – 3
- Permanent operators – 2082 full time highway technicians and 200 auxiliary drivers
- Seasonal operators – 408
- Material usage (2013-2014 season)
    - 1,052,782 tons of salt
    - 8,022,539 gallons of liquid materials
- Salt price - $75.03 per ton avg for FY 2015 winter fill up
- Active research in 2015

    - Evaluation and Analysis of Liquid Deicers for Winter Maintenance
    - Protective Coatings – reviewing best coatings for snow and ice equipment
    - GPS/AVL – Univ. of Akron project using various controller systems
    - Wash Water Reuse-Implementation
    - EPOKE System – Implementation project
    - Investigate Plow Blade Optimization
    - Salt Storage Optimization
    - Ice Sheading on the Veteran's Glass City Skyway
- In-House Research
    - Cameras on Wing Plow Trucks
    - Lasers on Wing Plow Trucks
- Future Research
    - Review salt purchasing practices
- Future program goals:
    - Increase the use of liquids
    - Roll out our GPS/AVL program

State Report: Virginia, Allen Williams

- Snow and Ice budget - $145.5 million
- Lane miles – 126,793
- Snow equipment – 3442
- Contract equipment – 8907
- Operators – 2500
- Maintenance area headquarters – 248
- Dry materials used – 550,294 tons
- Liquid deicers – 1,664,405 gallons
- Material cost - $13 million
- Changes and innovations
    - Extreme brine unit
    - Recycling loading pad runoff
    - Rear-facing cameras
    - iPhones for AVL tracking
    - Vaisala non-intrusive grip meters
    - Idle Free
    - Direct liquid deicing – trying a few liquid-only routes
- Operations
    - 2 twelve hour shifts
    - Statewide coordination conference calls – before events
    - All solid chemicals stored inside building with loading pads
    - All liquid chemicals stored inside double containment
    - Providing active plow route data to public in Nova
- Future Goals
    - Will develop metrics for snow removal operations
    - Will outfit entire fleet with AVL and MDC ability

State Report: Maine, Brian Burne

- Annual budget - $600 million
- Snow and ice budget - $34 million
- Centerline miles – 8,800
- Bridges – 2750
- Miles of railroad lines – 300
- FTE positions – 2100
- Five regions
- Plow trucks – 424
- Permanent operators – 900
- No. of crews and locations – 48 crews, 100 +/- locations
- Dry materials used – salt: 111k tons; sand: 16k tons
- Liquids used – salt brine: 350k gals; Ice B'Gone: 179k gallons; 70:30 blend: 397 gallons
- Employ
    - Variable speed signs – radar, solar, speed, cameral
    - Cirus System Transition
    - Salt stockpile status
    - High performance plow blades

State Report: Wyoming, Cliff Spoonemore

- Annual Maintenance Budget - $120 million
- Lane Miles – 913 interstate; 5,828 2-lanes
- Material costs
    - Sand – used: 251,052 tons at $34.26/ton
    - Salt – used 4860 tons at $73.98/ton
    - Salt brine – used 1209 gallons at $.21/gal
    - GeoBrine – used 324,421 gallons at $.50/gal
    - Mag Chloride – used 225,583 gallons at $.84/gal
- Equipment
    - No. of tow plows – two more in 2016
    - No. of tandems – 346
    - Bid cost per unit - $107,825 each
    - Rigging time – 229 hours at a cost of $8800 each
    - Number of single – 61
    - Maintenance force – 463 (WyDOT – 1980)
    - 58 shops
- Using MDSS: limited because of patent issues.
- Using tankers for salt brine and Mag Chloride: expanding our chemical use, but still an abrasive state.
- Traffic Management Center:
    - use of tablet to report road conditions - I-80 is the test section using about 12 tablets. see PPT for the screens available.
    - Reset variable speed limits - one screen allows the operator to change or request a change to the current VSL. As they pass the VSL the current speed shows in the upper corner.
    - Change digital message boards - this is a recommendation and can only be done from a stationary point. Touch screen button will gray out when truck is in motion. This reduces the

distractions/demands on the operator. Should he want to change messages he has to find a safe place to pull over and stop.

- See RWIS data - can call on the RWIS site in the trucks area to see current wind speed and some other information. Trucks have temp sensors and this is just a confirmation item.
- Report crash locations - use the touch screen to mark a GPS point for the location of a crash or stalled vehicle. This is sent to the TMC and they can begin to contact WHPatrol or call for more information of the driver. GPS point is tied to a Linear Reference System in the TMC so they can report the general location by mile post.
- Pre-trip inspection reports for mechanics - this screen was asked for by maintenance to begin the process of creating a mechanic work order for the truck. The truck may not need to be taken out of service at that point but the truck is now scheduled for routine maintenance based on this report.
- All the data sent from the truck uses the digital radio (WYOLink). Radar image is an internet connection the tablet uses by cell phone connection.

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
1	Understanding the Relationship between Various Agency Resources, Focusing on Equipment Availability and Ability to Perform Winter Maintenance Operations (WMO).	$100,000; 18 months	Dave Frame, California DOT	This project would develop tools that can help winter maintenance administrators optimally allocate resources and would demonstrate the level-of-service impact of not having mechanics, parts, or equipment. **Overview** How to make sure that the field has the resources they need for winter operations. Trying to help equipment make sure they have the resources needed. **Questions** How would this be used? To get more funds. How many states are separated like CalTrans? **Discussion** Seems like it's more of a part of a cost-benefit study. AASHTO is working on an equipment project very much like this. Rick will send a link to the AASHTO study. http://maintenance.transportation.org/Documents/2015%20Work%20Plan%20-%20Equipment%20TWG.pdf SCOM submitted to NCHRP a Guidelines for the Development of State DOT's Equipment Replacement Funds. Can we get Erle Potter to move this to include winter maintenance? KDOT is co-chair and is also involved. Cost-Benefit toolkit could be a tool to help support this kind of need. It isn't complete enough yet though. Might be more than just cost-benefit, but what is the negative impact on LOS of not having equipment running?	No

2	Research Options for Bi-fuel and/or Blended Fuel Diesel/CNG for Snow Fighting Equipment.	$50,000; 12 months	Kyle Lester, Colorado DOT	The goal of this project is to research options and solutions for a bi-fuel or blended fuel (diesel and CNG) for use in heavy-duty applications and equipment for snow removal on highway systems. **Overview** Originated with AASHTO. Lots of studies on CNG in particular, but none address this in snow plows in particular. There is a push to implement CNG in the CDOT fleet. Many states are getting that push. But what is the true cost-benefit for snow plows. Step1 – synthesis – international Step 2 – engage vendors to review testing; horse power; diagnostics; Step 3 – other factors – costs of stations, access to other fuels, etc. Several states have tried it and abandoned it. But lots of people have governors pushing CNG. Great for trash trucks, but doesn't apply to snow plows. **Questions** Are people looking at LNG or other fuels? What is bi fuel? Dual fuel – diesel and CNG **Discussion** No one seems to have done this successfully. And the equipment manufacturers are not studying it. Resources being put into CNG – Fill time and so many other issues. So many drawbacks. Just a synthesis to put together on all the successes and failures. Sounds like a lot of failures. Maybe only a synthesis is needed? A lot of push for dual-fuels too. It would be nice to learn more about that. 2x the cost on dual-fuels. Training is another factor that needs to be considered. Many costs to that. LNG could also be considered. Great value in an unbiased pros and cons. Lots of states have tried so a great pool to pull from. But most of the experience is from pickups. This would be a synthesis and a state of the state?	No

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
				Document the fact that the industry is not interested in pursuing this.	
3	Pacific Northwest Snowfighters (PNS)	$30,000; 3 years	Ron Wright, Idaho TD	The purpose of this project is to continue to support PNS with funding, which will be used to conduct quality assurance testing of QPL candidate products, develop new product testing protocols, develop new product specifications and categories, and conduct associated product category testing. **Overview** Continued support for PNS and the QPL website and third party testing on the QPL list. Send some testing to an independent laboratory in addition to what they do in-house. 8 products waiting for evaluation. About 10K left in the coffers. This amount would fund testing for about 3 more years. **Questions** No questions. **Discussion** A valuable resource to have a central authority via the QPl. Many states rely on the QPL. And the QPL has identified some vendor fraud. This just validates what the vendors are already reporting themselves. A safety net.	Yes

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
4	Comprehensive Study on Contracting Snow and Ice Response	$75,000; 12 months	Tim Peters/ Harold Dameron, Illinois DOT	The goal of this project is to analyze and document state efforts to privatize snow and ice control. **Overview** Trend toward legislators and economic staff to make decisions about resources on winter maintenance. A literature search on the impact of contractors, especially out east where they had to use a lot of such resources. Try to learn from the states with experiences – best practices, success stories, failures, etc. Performance issues, contract issues and what level of service and what was the impact? **Discussion** No success stories. Ten states at the table doing contractors. NCHRP report on this – privatization best practices (need link). Contractors want no risk –just paid by the hour and the truck. Could be a resource for people who have no choice, because they don't have enough resources available, because the DOT doesn't pay competitively. Look at both 2013-14 and 2014-15. Try to include information on adequate staffing. Also look at states that are moving away from contracting. Lots of states supplement private on an hourly basis vs. contracting out. Would also like this to look at inadequacies of contracting with other local agencies too. Might work best to look at all the different kinds of contracting and identifying the data that they needed in advance, then have the states go forth and collect that data for a season to make good comparisons.	Yes

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
5	Tow Plow Safety Analysis	$75,000; 12 months	Tim Peters, Illinois DOT	The purpose of this project is to analyze and document the safety of tow plows and to document the best practices of the agencies using them. **Overview** Chicago office is considering a Tow Plow in some configuration. Very money driven decisions being made. Equipment only replaced if there is a catastrophic failure. Looking at Best Practices and Safety if you choose to purchase a tow plow. **Questions** How are people best using them? Should this be a synthesis on looking at all the states that use tow plows? Does this have to be a formal report, or could this be an informal survey of Clear Roads states? **Discussion** Cost-Benefit toolkit already has a tow plow module. A way to use staff more efficiently. Safety is a concern though. Just depends on how formal you want the output of the project to be in order to share within your organization. Everyone does something different with lighting packages to ensure safety. Noted that lighting packages don't translate well to tow plows. Could be a user manual for tow plows, applications, safety, modifications. Training manual.	No

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
6	Synthesis of Best Practice for Material Application Methodology in Winter Operations	$100,000; 12 months	Paul Brown, Mass DOT	This project would result in a comprehensive synthesis of best practices for anti-icing/deicing material application for varied weather events, road types, traffic considerations, and environmental concerns. **Overview** The anti-icing and deicing project was not headed in the right direction. Want is a synthesis of current best practices. First step is this synthesis. Then we can come up with a new methodology for a new TE 28. **Discussion** Everyone uses these guidelines and will be interested in new techniques. People want updated standards on brines and alternative materials. Need to survey to identify the most widely used products across the country. It would be too much to do every single product and mix. Looking at families of chemicals. Make sure we identify the failures and learn from them. Eventually create a deliverable as a Phase 2 that's a Snowfighters Handbook. No recommendations out of this phase just a synthesis.	Yes, combined with Salt Brine Primer

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
7	Identifying Successful Practices for Staffing Winter Operations	$100,000; 12 months	Justin Droste, Michigan DOT	The goal of this project is to determine the optimum ratio of permanent to part-time staff to effectively perform winter operations. The project would also develop generic shift schedules for meeting various levels of service and identify maximum shift lengths to help agencies standardize practices statewide and nationally. **Overview** Related to the question about contractors and determining the most cost-effective way of staffing. Want to consider factors, such as safety, unions, accident rates, etc. **Discussion** Tennessee DOT does a "marriage" of construction and maintenance forces. Could be included in this – whether that blend of staff has any value. There are challenges because they do different types of work. Colorado has had limited success recruiting people to hybrid positions. Can also be hard to recruit people to temporary benefit-less positions. What's the proper blend of permanent staff? Shift lengths would also be included. Value in exploring how each state hires temp staff.	No

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
8	Determining the Best Method for Pre-treating Salt	$125,000; 12 months	Justin Droste, Michigan DOT	This project would identify and evaluate the range of different methods for mixing or pre-treating dry rock salt (including but not limited to stockpile injecting, onboard pre-wet, pre-wetting each truck load with spray bar, etc) to determine which method is most effective at delivering the best pre-treated product to the roadway. **Questions** Will there be a line between pre-treating and pre-wetting? What is the definition of best? Could this be combined with Mass DOT"s synthesis? Or could this be an informal inquiry to the Clear Roads group? **Discussion** A primer of pre-wetting and pre-treating salt. Not technical research, but more of an understanding of current practices. Lots of possible measures. Performance should be the most important issue, but there are pros and cons to each.	No

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
9	Assessing Snow Plow Weight and Function	$50,000; 12 months	Tim Chojnacki, Missouri DOT	The purpose of this project is to develop a simple tool to analyze the loaded weights of snowplow trucks "on paper," including all attachments and materials. The tool would support trade-off comparisons to help agencies make decisions about plow attachments and/or material carrying capacity, and provide guidelines for vehicle configurations based on desired LOS on certain types of roadways. **Overview** Look at all the stuff being attached to a plow. Makes it versatile, but also is really weighing them down. With salt probably sending trucks over the GVWR. In addition, need them to run a long time, you are doing wear and tear on the equipment. Want maintenance engineers and equipment people to understand what the trade-offs are. **Questions** Aren't these things also spec'd out in advance? Not all factors always taken into account. They outfitter/ seller should be able to provide all this information up front. **Discussion** Maybe this is a good option for the SCOM Equipment TWG. Clay could talk to the TWG about that.	No
10	2015 Peer Exchange Funding	$45,000; 12 months	Patti Caswell, Oregon DOT	This project would provide funding needed to put on the 2015 Winter Maintenance Peer Exchange in Minneapolis, Minnesota. **Overview** Need to fund the Peer Exchange **Discussion** How many can attend per state? Defer to include Rick. Would like to include an Operations type person if an operations person exists. ITS people. Lots of discussion about what is included in the costs and not.	Yes

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
11	Understanding the Impact of Product Design Features on Winter Maintenance.	$100,000; 12 months	Patti Caswell, Oregon DOT	The goal of this project is to evaluate certain design features, such as rumble strips and pavement markings, to determine their effects on winter maintenance and to recommend alternative designs where appropriate. **Overview** Maybe a lot like Wayne's project, but the scope would really focus on pavement markings and rumble strips. How could the equipment be modified if certain damaging elements can't go away? **Discussion** AASHTO is currently revising the Manual for Maintenance and trying to share that back with construction.	No
12	Assessing the Value of Residual Salt Left on the Road after Storm Events.	TBD; 12 months	Brandon Klenk, Utah DOT	This project would attempt to determine the value (lb/ft) of the salt left over on the roadway after treating a storm event and how fast is it worn off by traffic. **Overview** Measuring how much value (in terms of effectiveness) there is to the salt left behind on the road. Do we account for that when we decide how much to put down. **Discussion** Yes – So if it's white we don't brine. If not they do. Perhaps this could be included in the Brine Primer project. Technology may not realistically be there right now to measure the available salt. How do the agriculturals fit into all this?	No

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
13	Identification and Correction of Equipment Factors Causing Fatigue in Snow Plow Drivers	$200,000; 24 months	Allen Williams, Virginia DOT	This project would identify equipment factors causing snow plow driver fatigue, provide recommendations to reduce, eliminate or correct the equipment issues, develop cost/benefit data for each recommendation, and develop training materials. **Overview** Follow up to the original snow plow driver fatigue project. This is looking specifically at equipment. Looking at the detailed equipment-related issues. Make it a very narrow scope. **Discussion** Drivers need to be fused on the road, but they end up focused on all kinds of things. Click buttons and pre-sets decrease fatigue. How do you take this information and get it into specifications? Blade types and sound could also be included. Would be important to really focus this narrowly and create a template project for looking at other factors later. Do 5 factors first and then 5 more factors in another phase. Looking to produce specifications and recommendations. Plows could be a whole separate investigation – looking at belly vs front. Limit this to "in cab" features.	Yes

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
14	Reducing Snow Plow Driver Fatigue by Modifying Human Behavior	$200,000; 24 months	Allen Williams, Virginia DOT	This project would confirm or reject the link between drivers' quality of rest and driver fatigue. If confirmed, the investigator would develop a series of training materials to help identify driver fatigue, improve driver rest, and relieve fatigue during operations. **Overview** More training focused. And maybe recommendations on shift. **Discussion** You can't control what the employees do off-hours, but you can provide training and reinforce expectations on paper. Almost need a marketing campaign to help promote it to the drivers. Important to recognize that in a bad storm, you can't always do the ideal rest break. What are some mitigating things that they can do? Could this tie in with the Winter Staffing project? Build on a North American Fatigue Management program.	No

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
15	Basic Snow Fighting Video	$75,000; 12 months	Jeff Pifer, West Virginia DOH	The purpose of this project is to develop a video and guidebook that explains the latest innovative approaches and tools available to winter maintenance professionals and provide resources for learning more about them. The materials will cover chemicals, pavement sensors, RWIS, plow blades, etc. and will reference the latest state and national research. The goal is to encourage agencies to move from a basic level of snow and ice control to higher level of service. **Overview** Video and guide book for the use of materials and other techniques to increase their level of service. **Discussion** Almost a video of the CBTs. Could be a basic training tool that goes to non-maintenance personnel. Alaska just did a 15 minute brining and anti-icing video: http://dot.alaska.gov/stwdmno/ Might need to be more generic than the one Alaska did. Hard to make a single video that fits a group like this. 30,000 foot view on what we do.	No
16	Salt Brine Primer	$75,000 to $100,000; 12 months	Jeff Pifer, West Virginia DOH	The purpose of this project is to develop a booklet or "primer" on best management practices for utilizing salt brines for snow removal and ice control (SRIC). **Overview** Just trying to be a comprehensive look at salt brine use with a video. Strictly focused on salt. **Discussion** Seems a lot like Paul's project. Would like to see a look at broader materials. Could we also add in pre-treating? Combine Salt Brine with Pre-treating and Paul's synthesis.	Yes, combined with Material Applic. project

2015 Clear Roads Project Proposals – Notes from TAC Discussion

#	Title	Est. Cost and Duration	Presented by…	Project Summary	Funded
17	Electric Plug and Socket Connectors for Truck Mounted Accessories (Wing Plows)	$50,000 to $80,000	Cliff Spoonemore, Wyoming DOT	This project would determine the number of different setups for wing plow lights that are used by Clear Roads members. It would also determine if there are options that show success in keeping the lights operating for more than a month during all storm events. The goal would be to find a setup that is able to operate for an entire snow season. **Overview** Problems with wing plow connectors, causing lots of downtime. Just need a solution on the market or influence the market. No need to invest in something new. **Discussion** Synthesis of the states might yield what we want. Rick thinks he could get a part number for a solution he saw on a scanning tour. Nebraska does a junction box. Penn DOT specs are a good standard. Could be a simple survey for a much lower price. CDOT will request a synthesis via his research department. This could also be a simple internal survey. **Action Item** – each person will go back and query their equipment folks for the answer. Then we come back to CDOT or other solutions as needed. Colleen will remind.	No