Clear Roads Research Proposals
2014

Page	Title	Est. Cost	Est. Duration	Project Summary	Proposed by
4	Diesel Particulate (DPF) Filter Reliability Enhancement in High Elevations and Cold Weather Conditions	TBD	18 months	The goal is to determine if the use of standalone engine heaters and cab heaters (alone or together) will significantly reduce the occurrence of Diesel Particulate Filter failures. The project would also assess whether these solutions were cost-effective.	David Frame, California DOT
5	Use Of Equipment Lighting During Snow Plow Operations	$40,000	12 months	This project would develop a summary of best practices in use today by state DOTs for the use of headlights, work lights, and LED warning light technology in snowplow operations.	David Frame, California DOT
7	Synthesis of Best Practices on Multi-Purpose Trucks for Snow and Ice Control	$30,000	12 months	The purpose of this project is to document the use of different dual-purpose trucks by state DOTs and others. The resulting synthesis would include pictures, discuss costs and identify the manufacturers and body companies that develop these trucks.	Tim Peters, Illinois DOT
8	Development of a Winter Driver's Education Program	$25,000	6 months	The goal of this project is to develop comprehensive winter driving training materials for use by Driver's Education Courses. It would include winter driving tips, operating a motor vehicle around snow plows and winter safety tips.	Tina Greenfield, Iowa DOT
9	Snow Plow Route Optimization	TBD	12 months	To determine a routing formula that provides guidance on how to best deploy snow-fighting resources in the most optimized possible way.	Clay Adams & Peter Carttar, Kansas DOT
10	Developing a Training Video and Manual for Best Practices and Techniques in Clearing Different Interchange Configurations and Other Geometric Layouts	$100,000	6 months	This proposal is to develop a video, including training materials, to instruct new snowplow operators on the best practices for clearing different interchange configurations (Diamond, Cloverleaf, SPUI, Roundabout, Michigan Left, Diverging Diamond, etc).	Justin Droste, Michigan DOT & David Wieder Colorado DOT

Clear Roads Research Proposals
2014

Page	Title	Est. Cost	Est. Duration	Project Summary	Proposed by
11	Determining the Best Method for Pre-treating Salt	$125,000	12 months	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.	Justin Droste, Michigan DOT
12	Identifying Successful Practices for Staffing Winter Operations	$100,000	12 months	The goal of this project is to better understand costs associated with using full time and permanent workers in order to aid managers in developing staffing plans. The project would also identify maximum shift lengths to help agencies standardize practices statewide and nationally.	Justin Droste, Michigan DOT
14	Assessing Snow Plow Weight and Function	$50,000	12 months	The purpose of this project would be 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.	Tim Chojnacki, Missouri DOT & David Wieder Colorado DOT
16	Section (Garage)/ Route Optimization	$25-50,000	12 months	This project would identify best practices for garage placement and route optimization, including the use of Commercial Off-The-Shelf (COTS) software.	Brad Darr, North Dakota DOT
17	Synthesis on GPS/AVL Equipment Used for Winter Maintenance	$60,000	6 months	The goal of this project would be to develop a “consumer reports” type of digest analyzing the different GPS/AVL systems out there, including how well each one performs, systems requirements and constraints.	Patti Caswell, Oregon DOT
18	Best Methods and Practices for Sleet and Ice Storm Management, Phase I	$100,000	12 months	The purpose of this project would be to develop a best practices manual that includes specific recommendations for planning, preparing and executing a sleet and ice storm response	Lynn Bernhard, Utah DOT

Clear Roads Research Proposals
2014

Page	Title	Est. Cost	Est. Duration	Project Summary	Proposed by
20	Quantifying the Impact that New Capital Projects will have on Roadway Snow and Ice Control (RSIC) Operations	$150,000	18 months	The goal of the project is to develop an automated method of quantifying the anticipated impact that new capital projects will have on total vehicle hours of travel for the winter maintenance fleet.	Wayne Gammell, Vermont DOT
22	Plug and Play Phase II	$250,000	18 months	This project would build on the efforts of both the Plug and Play initiative and the Connected Vehicle project to develop an expanded protocol or set of protocols. These would include a standardized set of data (attributes and units of measure) available from winter operations equipment, transmission options for data from vehicle to point location and standardized set of protocols for data from vehicle to point location. This would also allow DOTs to share data within systems and between systems.	Allen Williams, Virginia DOT
24	Snow Removal Performance Metrics	$150,000	12 months	The purpose of this project would be to determine the most successful and accurate performance measures for snow removal operations being utilized throughout the world. Deliverables would include an implementation guide for establishing a successful program within a transportation agency and a summary of the costs associated with implementation.	Allen Williams, Virginia DOT
26	Winter Severity Mapping Enhancement	$5,000	3 months	The goal of this project is to develop individual state maps (image files) from the national maps created through the Weather Severity Mapping project.	Cliff Spoonemore, Wyoming DOT

2014 Research Proposal Form

Proposer name: David Frame
Organization: California Department of Transportation

Title of proposed research synthesis or project:
Diesel Particulate (DPF) Filter Reliability Enhancement in High Elevations and Cold Weather Conditions

Topic Area (check one): Methods **Equipment** Materials Training Technology

1) Explain the specific problem or issue.
DPF tend to quickly plug and fail in cold weather and high elevations. The problem is compounded with equipment such as sand house loaders that have low cycle times not allowing the equipment to reach full operating temperatures and in equipment that operators leave idling for periods of time during storms to stay warm.

2) What is the goal of the project?
To determine if the use of available stand-alone heaters (heaters that rely solely on the vehicle's power and fuel) to 1) Keep the vehicle engine at operating temperature so there are no cold starts and ensuring the engine remains at full operating temperature and 2) provide a heat source to passengers without the vehicle running at idle.

3) List the specific research tasks that would form the scope of work.
Determine if the use of the engine heaters and cab heaters, alone or together will significantly reduce the occurrence of DPF failures. Determine if the use of engine heaters and cab heaters, alone or together will represent a cost benefit.

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
The expected deliverable would be a recommendation to incorporate engine and cab heaters alone or together on vehicles operating in high elevation and cold temperatures to reduce the occurrence of DPF plugging/failure.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
Each DOT would implement as needed on affected vehicles. The benefits include the reduction of vehicle out of service time and a reduction in repair (parts and labor) costs.

6) Estimated funding needed. TBD

7) Estimated timeline for completing the research.
- Six (6) months _____
- Twelve (12) months _____
- **Eighteen (18) months __X___ The research should encompass one full winter season**
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
Not aware of any other research by any DOT on this topic

2014 Research Proposal Form

Proposer name: David Frame
Organization: California Department of Transportation

Title of proposed research synthesis or project:
Use Of Equipment Lighting During Snow Plow Operations.

Topic Area (check one): Methods **Equipment** Materials Training Technology

1**) Explain the specific problem or issue**.
The California Department of Transportation is installing LED warning lights on its fleet of new vehicles including snow plow trucks. Equipment operators in the snow areas are reporting warning lights being too bright, especially for plow truck drivers following behind during train-type snow removal operations. Additionally, snow plow operators are experiencing bounce back off the plow from headlights on their own vehicles.

2) What is the goal of the project?
To conduct a study on other states' procedures for snow removal operations and the types of headlights, work lights, and warning lights used; if LED, how are they accommodating for increased brightness especially in snow plow operations? Also, to determine if there is a preferred wavelength or type of light and optimum mounting position that minimizes the negative effects.

3) List the specific research tasks that would form the scope of work.
Conduct a literature search. Survey other states for best practices in their use of headlights, work lights, and LED warning light technology during snow removal operations. Determine number of different headlight bulb types currently available and test each one for light bounce back in snow conditions. Also, look at various mounting configurations to determine optimum position to clear plow and provide best visibility for plow operator in snow storm conditions.

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
A summary of best practices in use today by other state DOT's in their use of headlights, work lights, and LED warning light technology in snow plow operations. Recommendation of lighting technology used, as well as mounting location guidelines. The information would be used by the DOT as a guide for light purchasing and installation on plow trucks and other snow removal equipment. Snow plow operators, engineers, and equipment suppliers would benefit directly.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
DOTs would consider updating their technology and/or practices to those having success in other states and have the information needed to do that efficiently. The benefit would be increased operator visibility during a snow storm.

6) Estimated funding needed. $40,000

7) Estimated timeline for completing the research.
- Six (6) months _____
- **Twelve (12) months __X___**
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
None.

2014 Research Proposal Form

Proposer name: Tim Peters
Organization: Illinois Department of Transportation

Title of proposed research synthesis or project:
Synthesis of Best Practices on Multi-Purpose Trucks for Snow and Ice Control

Topic Area (check one): Methods **Equipment** Materials Training Technology

1) Explain the specific problem or issue.
The purpose of this project is to document agencies that are using multipurpose snow and ice trucks. These multi-purpose trucks may be landscape body trucks with drop sides and low platform heights or they may be trucks where bodies are removed and replaced. The trucks should be configured so either they can be repurposed by adding and removing accessories or they should have a primary use like landscaping or sign shop use, but they are converted to snow and ice operations during winter months.

2) What is the goal of the project?
The report should document different dual-purpose trucks and show pictures and discuss costs and manufacturers and body companies that develop these trucks.

3) List the specific research tasks that would form the scope of work.
Contact state DOTs and other major users of snow and ice trucks such as toll highway department and large cities, body companies and manufacturers to gather information on dual use trucks. Synthesize the information, including (but not limited to) pictures, user comments, technical specifications and costs.

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
The expected outcome is a report and presentation to Clear Roads.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
The report and information gathered in this project would help DOTs know where dual use trucks are being used.

6) Estimated funding needed. $30,000

7) Estimated timeline for completing the research.
- Six (6) months _____
- **Twelve (12) months __X___**
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
No

2014 Research Proposal Form

Proposer name: Tina Greenfield/Craig Bargfrede
Organization: Iowa Department of Transportation

Title of proposed research synthesis or project:
Development of a Winter Driver's Education Program

Topic Area (check one): Methods Equipment Materials **Training** Technology

1) Explain the specific problem or issue.
There are very limited to non-existent winter driving training materials for Driver's Education classes

2) What is the goal of the project?
To provide a more comprehensive Driver's Education program of instruction package to Driver's Education instructors.

3) List the specific research tasks that would form the scope of work.
Develop Winter Training materials
Develop Winter Driving Video's
Develop Winter Driving scenarios that can be utilized in a driving simulator during classes

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
The expected outcome would be the development of a more comprehensive Driver's Education course. It would include winter driving tips, operating a motor vehicle around snowplows and winter safety tips.

The intended audience would be high school students who are taking the required drivers education course.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
The products developed would be incorporated into the current curriculum by the Motor Vehicle Division. They would then be responsible for distribution to the instructors across the state.

6) Estimated funding needed. $25,000

7) Estimated timeline for completing the research.
- **Six (6) months __X___**
- Twelve (12) months _____
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
Not aware of any similar research currently being conducted.

2014 Research Proposal Form

Proposer name: Clay Adams
Organization: Kansas Department of Transportation

Title of proposed research synthesis or project:
Snow Plow Route Optimization

Topic Area (check one): **Methods** Equipment Materials Training Technology

1) **Explain the specific problem or issue**.
Is there a better way to determine where and how many plow trucks should be deployed for a given area? Is there a specific order of routes to be plowed that makes a snow and ice operation more efficient?

2) What is the goal of the project?
To determine a routing formula that provides guidance on how to best deploy snow fighting resources to provide the best, optimized, plan.

3) List the specific research tasks that would form the scope of work.
Start with a literature search, then a survey of the states on how they determine their equipment needs by location and if they use any tools to plan route optimization. This could be followed by a study of current vendors that provide this type of tool. Determine if they have been applied to a State Highway system or even a small sub-section of a state system, and if so the results.

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
A program that would allow you to enter different variables such as route length, width, shoulders or not, ramps, direction of road, traffic counts, etc. and graphically show you the order in which the routes should be plowed, based on the number of trucks available. It would also be good to optimize starting and ending locations and the optimum locations for locating stockpiles of materials.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
It should be tested by some States in some sub-sections of the systems to see how it works.

6) Estimated funding needed. TBD

7) Estimated timeline for completing the research.
- Six (6) months _____
- **Twelve (12) months __X___**
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
I have attached a couple of related items that would become part of the literature search.

2014 Research Proposal Form

Proposer name: Justin Droste
Organization: Michigan Department of Transportation

Title of proposed research synthesis or project:
Developing a Training Video and Manual for Best Practices and Techniques in Clearing Different Interchange Configurations and Other Geometric Layouts

Topic Area: Methods Equipment Materials **Training** Technology

1) Explain the specific problem or issue.
There are currently many types of existing and new interchange configurations (Diamond, Cloverleaf, SPUI, Roundabout, Michigan Left, Diverging Diamond, etc) that provide challenges for operators and managers to clear. With different approaches to clear these various geometrics it would be beneficial to have training materials, including a video to instruct new operators and managers on best practices.

2) List the proposed research objectives.
- Create a 15-20 minute video showing the different interchange configurations with overhead diagrams on how to effectively clear them. Actual footage of trucks performing work could also be used. Instructions could also show the plow underbody, addition of right/ left wing plows, or tow plow.
- Survey/Research for best methods to clear each given geometric configuration.

3) List the tasks that would form the scope of work.
- Literature search
- Survey other agencies (states, countries).
- Determine most efficient clearing method for each interchange/ geometric configuration.
- Provide training materials (manual and video (real life and animation of overhead passes needed to clear the geometry)).

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
Training manual and video for operators and supervisors and managers.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
It would be presented in annual training programs. Benefits include effectively and consistently maintaining all interchanges in a more timely manner.

6) Estimated funding needed. $100,000

7) Estimated timeline for completing the research.
- **Six (6) months** __X___
- Twelve (12) months _____
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
No, however, this project concept received the most votes and was listed as a top priority for clear roads to undertake at the 2013 Peer Exchange.

2014 Research Proposal Form

Proposer name: Justin Droste
Organization: Michigan Department of Transportation

Title of proposed research synthesis or project:
Determining the Best Method for Pre-treating Salt

Topic Area (circle one): **Methods** Equipment Materials Training Technology

1) Explain the specific problem or issue.
There are currently many methods to mix or pre-treat dry rock salt (including but not limited to stockpile injecting, onboard pre-wet, prewetting each truck load with spraybar, other). Which method is most effective in delivering the best pre-treated product to the roadway.

2) List the proposed research objectives.
- Identify all current practices for pre-treating salt.
- Picture inventory of equipment used.
- Evaluate each method to test various sample moisture content/ composition to judge uniformity and optimal composition.

3) List the tasks that would form the scope of work.
- Literature search
- Survey other agencies (states, countries).
- Field/ lab test methods and results.
- Create a report/ graphics summarizing results and recommendations and associated costs to implement each practice.

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
The results would include a field guide/ manual, for supervisors and management to use in developing treatments plans for garages.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
These informational guides can be used for training purposes, and provide substance for decision makers to implement a BMP for prewetting salt. This could allow regions/ districts, or statewide operations to become more uniform.

6) Estimated funding needed. $125,000

7) Estimated timeline for completing the research.
- Six (6) months _____
- **Twelve (12) months _X____**
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
No

2014 Research Proposal Form

Proposer name: Justin Droste
Organization: Michigan Dept of Transportation

Title of proposed research synthesis or project:
Identifying Successful Practices for Staffing Winter Operations

Topic Area: **Methods** Equipment Materials Training Technology

1) Explain the specific problem or issue.
Most winter agencies utilize permanent and temporary workers to perform winter maintenance. What is the appropriate ratio for winter staffing and what are the costs associated with each type of worker? (training, accidents, benefits, unions, salaries, effect on summer programs, etc). Other issues include shift schedules, overtime, and continuous working hours, which causes fatigue and safety concerns.

2) List the proposed research objectives.
- Provide information on different classifications of operators, and associate costs per class across various parameters.
- Determine an optimum ratio of permanent to part time staff required to effectively perform winter operations to meet various levels of service.
- Determine generic shift schedules required to meet various levels of service (# of shifts, start/ stop times, overtime, etc).
- Utilize previous research on driver fatigue and shifts lengths to determine a universal standard for agencies to use as it pertains to maximum continuous working hours.

3) List the tasks that would form the scope of work.
- Literature search
- Survey other agencies (states, countries).
- Create a report and presentation for sharing the information on staffing costs, and optimum staffing levels per LOS.
- Provide a universal standard, based on sound research, for implementing a universal maximum continuous shift length for operators for clear roads to endorse.

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
A better understanding of costs associated with using full time and permanent workers will help aide managers to more effectively set the operations. Providing a maximum shift length recommendation will help supervisors and managers realize what limits are acceptable.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
Findings can be utilized by state agencies to promote regional/ district levels to influence/ improve staffing practices and provide consistency statewide. A recognized maximum shift length (continuous work hours) could help state agencies instrument policies in their state that are universal across the nation.

6) Estimated funding needed. $100,000

7) Estimated timeline for completing the research.

- Six (6) months _____
- **Twelve (12) months** _X____
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
The driver fatigue study, and true costs associate with winter maintenance project should be beneficial.

2014 Research Proposal Form

Proposer name: Tim Chojnacki and Dave Weider
Organization: Missouri Department of Transportation and Colorado Department of Transportation

Title of proposed research synthesis or project:
Assessing Snow Plow Weight and Function

Topic Area (check one): Methods **Equipment** Materials Training Technology

1) Explain the specific problem or issue.
In an effort make snowplow trucks as versatile as possible, owners have expanded the types of materials carried on and the number of various plow attachments on their snow plow trucks. This versatility comes at a cost with regard to additional weight of the truck. It is possible to exceed the gross vehicle weight rating (GVWR) of a plow truck when it is loaded with snow and ice chemicals. In order to operate below the GVWR, provisions must be made so the operators can easily tell how much material to load. The question is whether it is more advantageous to carry a full load of chemicals, or have the various attachments available?

SNOW PLOW TRUCK

Photo courtesy of the North Dakota Department of Transportation

2) What is the goal of the project?
The goal of this project would be to explore this issue with equipment manufacturers, operators and owners to see if there are any best practices available for quickly assessing the weight of plow trucks (barring weighing every truck). Owners could analyze the options "on paper" before ordering new trucks to ensure they have selected the best configuration for their application. Owners could also analyze existing fleet to determine appropriate use.

3) List the specific research tasks that would form the scope of work.

1. Literature search
2. Possible survey of manufacturers and owners
3. Share or develop a tool for owners to use to assess existing and new equipment.
4. Recommend guidelines for owners

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?

The expected outcomes would be a simple tool to analyze loaded weights of snow plow trucks, some trade-off comparisons for owners to use to make decisions about plow attachments and/or material carrying capacity and guidelines for vehicle configurations based on desired LOS on certain types of roadways.

5) How would the products/deliverables be implemented? How would they benefit DOTs?

The deliverables would give DOTs a tool for analysis of their fleet and recommendations on truck configuration.

6) Estimated funding needed. $50,000

7) Estimated timeline for completing the research.

- Six (6) months _____
- **Twelve (12) months __X___**
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.

No

2014 Research Proposal Form

Proposer name: Brad Darr
Organization: North Dakota Department of Transportation

Title of proposed research synthesis or project:
Section (Garage)/ Route Optimization

Topic Area (check one): Methods Equipment Materials Training **Technology**

1) Explain the specific problem or issue.
States have Sections(Garages)/Personnel in less than ideal locations with a variety of roads with different levels of service. A review is needed to look at the system as a whole for efficiencies/optimization. This was done in North Dakota in 2006 by hand. It has yielded limited results due to politics and buy-in for a number of reasons. Rural areas need to be considered.

Also, in conjunction with and after Section selection, Route prioritization can occur. This has its own challenges when the Section is not in the ideal location based on Levels of Service and number of personnel assigned to the Section.

2) What is the goal of the project?
Find out other states best practices and successes, including Commercial Off the Shelf (COTS) software availability and usefulness.

3) List the specific research tasks that would form the scope of work.
- Literature search
- Survey/ best practices/examples.
- Conduct a COTS Review for applicability and usefulness. Perhaps including GIS application.

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
The outcome would be a document showing best practices/examples/successes of what has worked in other states as well as whether there is proven COTS software to assist.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
Implementation would be up to each state. States would benefit by having a statewide solution to sell to policy makers.

6) Estimated funding needed. $25,000-$50,000

7) Estimated timeline for completing the research.
- Six (6) months _____
- **Twelve (12) months ___X__**
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
Jim Sullivan from the University of Vermont Transportation Research Center recently posted a survey to the Snow and Ice Listserv that may be relevant.

2014 Research Proposal Form

Proposer name: Patti Caswell
Organization: Oregon Department of Transportation

Title of proposed research synthesis or project:
Synthesis on GPS/AVL Equipment Used for Winter Maintenance

Topic Area (check one): Methods Equipment Materials Training **Technology**

1) Explain the specific problem or issue.
Many states are testing or using GPS/AVL systems to gather information relative to their winter maintenance program. There are a variety of moving parts to consider including truck controllers, data collection devices, cell phone or wi-fi, plow sensors, and data schemas that allow synthesis of a lot of individual data collected. States are learning/seeking information from each other ad hoc but there is no clearinghouse of information in terms of which controller or system might work better for different situations or truck configurations.

2) What is the goal of the project?
To identify and describe the various hardware and software options for DOTs in the GPS/AVL arena, their limitations or constraints, the plus and minus of the system(s), compatibility issues, and data retrieval or website access issues.

3) List the specific research tasks that would form the scope of work.
- Describe available GPS/AVL hardware including controllers, sensors, AVL/GPS technology/vendor, and reporting mechanism (wi-fi or cell phone, other).
- Describe desired attributes of system and inquire with users how well the system met their needs (hardware, software, website, accessibility to data, etc.)
- Rank cost of each system requirement

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
Product would be a 'consumer reports' type digest of the different hardware out there and how well it performs, systems requirements and constraints. Intended audience would be DOTs and public work agencies (City, County).

5) How would the products/deliverables be implemented? How would they benefit DOTs?
The 'consumer digest' would be made available to DOTs to aid in determining whether AVL/GPS is right for them and which hardware or software package they should consider or what performance measures to write into an RFP.

6) Estimated funding needed. $60,000

7) Estimated timeline for completing the research.
- **Six (6) months __X___**
- Twelve (12) months _____
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
Only a lot of anecdotal inquiries via Clear Roads.

2014 Research Proposal Form

Proposer name: Lynn Bernhard
Organization: Utah Department of Transportation

Title of proposed research synthesis or project:
Best Methods and Practices for Sleet and Ice Storm Management, Phase I

Topic Area: **Methods** Equipment Materials Training Technology

1) Explain the specific problem or issue.
Sleet and freezing rain have devastating impacts on transportation systems. These events are forecast accurately, but still the affected areas seem to have major delays in restoring mobility after the event. Government agencies at many levels appear impotent in the face of these events. No compendium of scalable best practices exist.

2) What is the goal of the project?
Identify best storm management practices. Identify and map out research into new ice-fighting techniques that may work to restore mobility sooner.

3) List the specific research tasks that would form the scope of work.
1. Survey snow belt and mid-south DOTs for their methods. One question to be answered is: Has anyone been successful in fight ice storms on a local, area, or multidistrict area? If so, obtain case history for evaluation.
2. Examine frequency, localization, prediction, intensity, and impacts of historic sleet, freezing rain, and ice storms. Is there a pattern either spatially, chronologically, meteorologically, or climatologically? Does Knoxville TN get hit more often than Harrisburg PA? Are Sioux City or Seattle immune?
3. Compile and publish a manual of current best practices.
4. Do a gap analysis of current practice and idealized performance to determine choke points or seemingly insurmountable problems blocking improvement.
5. Prepare a recommended research plan to either develop new models, new methods, or new operational strategies to limit impacts of sleet and ice storms on transportation.

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
Expected outcomes: Specific recommendations as to how to plan, prepare, and execute Ice storm response. Contingency plans would be prepared on local, area, or regional bases supported through emergency management agencies. Clearer guidance would emerge for when a predicted event has gone from a routine snowfighting problem to a potential disaster level

The audience is snowfighting officials and managers for planning and management Issues, and supervisors/operators for specific implementable tactics.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
Sleet, Freezing Rain, And Ice Storm BMP Manual would be published by Clear Roads. Clear Roads would advertise and distribute it as widely as possible.

Publish in industry press. Clear Roads TAC members seek to present findings at local, regional, and national snowfighting venues in a coordinated manner

6) Estimated funding needed. $100,000

7) Estimated timeline for completing the research.

- Six (6) months _____
- **Twelve (12) months __X___**
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.

No

2014 Research Proposal Form

Proposer name: Wayne Gammell
Organization: Vermont Agency of Transportation

Title of proposed research synthesis or project:
Quantifying the Impact that New Capital Projects will have on Roadway Snow and Ice Control (RSIC) Operations

Topic Area: **Methods** Equipment Materials Training Technology

1) Explain the specific problem or issue.
New capital projects increase the time and money required to complete RSIC operations. Unfortunately this increased RSIC burden is rarely quantified and therefore is not considered during the early stages of the capital project development process. Our proposal is to support RSIC operations by developing a new method for estimating the increased burden placed on these operations by new capital projects. Two general types of new projects will be investigated:

1) Additions of new roadway capacity such as new lanes, new shoulders, and new roadways
2) New roadway configurations such as new striping plans, new curb-cuts, new bulb-outs, etc.

The goal of the project is to develop an automated method of quantifying the anticipated impact that new capital projects will have on total vehicle-hours of travel (VHTs) for the RSIC fleet. We believe that this method can be used in the early stages of project development to determine if the Agency will need additional resources, such as trucks, salt, fuel, and manpower to provide RSIC after the project is completed.

2) What is the goal of the project?
The goal of the project is to develop an automated method of quantifying the anticipated impact that new capital projects will have on total VHTs for the RSIC fleet.

3) List the specific research tasks that would form the scope of work.
For the first type of project, we will use an optimized routing tool that was developed in a previous research project funded by Vermont. We propose to expand the functionality of this routing tool by connecting it to our statewide travel model, where new roadway projects are routinely evaluated for their impact on passenger-car travel. Integrating the routing tool with the travel model will give us a way of repeating the routing on hypothetical future network configurations. We will use new roads currently being constructed or planned in Vermont to quantify their impact on RSIC operations by running the routing tool with and without the new project. We will then be able to automate the output of the expected increase in VHTs associated with new network configurations.

For the second type of project, we will examine test cases in the field to quantify the expected impact of new configurations. For example, we might compare the effort needed to maintain clear pavement for a roundabout with the effort needed for a traditional intersection of comparable volume, to quantify the increased burden expected when converting a traditional intersection into a roundabout. We also might compare the effort needed to maintain clear pavement at an intersection approach before and after a new turning lane has been added. These comparisons will require field observation at the project site, along with driver interviews and/or ride-alongs to better understand the challenges presented by the new configuration. For example, we would need to know what challenges drivers face and what concerns they might have with respect to different types of configurations. We expect to conduct 4-5 case studies on configuration changes that are

common to all of Clear Roads' member states. A preparatory survey using the list serv will be conducted to vote on a final list of sites.

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
The information gained from successful completion of the project will help directors and managers of the Operations Divisions of state DOTs argue for appropriate increases in resources that are consistent with the construction of different types of new capital projects. Our experience in Vermont has been that the resources needed for RSIC operations may be overlooked when resources are allocated to different types of capital projects, although the Operations Division is expected to take responsibility for managing RSIC operations on any and all new capital projects. This could potentially create a budget misalignment scenario where RSIC operations do not have the resources needed to manage new capital projects.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
Our methodological approach can be incorporated directly for DOTs that use a statewide travel models. We will also prepare a report that describes the steps taken to develop and implement the RSIC tool, so that other states can follow those steps in developing their own version of the tool.

The case study results will be described in terms so that the knowledge gained from the field studies in Vermont can be transferred to other states based on the project configuration-type. For example, if our results show that a new turning lane creates a burden of additional VHTs on the RSIC operations, then it is reasonable to believe that a similar capital project would create a similar RSIC burden elsewhere. Any DOT could use the VHT burden to quantify the increased monetary costs on their specific operations, based on their specific costs for fuel, salt, labor (loaded rate), and vehicle (loaded rate). These costs can then be annualized by factoring up for the average (or maximum) number of winter-storm dispatches experienced per year.

6) Estimated funding needed. $150,000

7) Estimated timeline for completing the research.
- Six (6) months _____
- Twelve (12) months _____
- **Eighteen (18) months _X__**
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
We are not aware of any similar research in this area. The research team has conducted research projects related to optimized RSIC routing for VTrans in the past. There are existing studies which have focused on quantifying the benefits of RSIC operations on the state economy, with the goal of improving performance measurement. This project, however, focuses specifically on the capital project development process. This ensures that the expected increased costs of RSIC operations associated with any and all new capital projects are considered.

2014 Research Proposal Form

Proposer name: Allen Williams
Organization: Virginia Department of Transportation

Title of proposed research synthesis or project: Plug and Play Phase 2

Topic Area (check one): Methods Equipment Materials Training **Technology**

1) Explain the specific problem or issue.
Clear Roads has developed the In-Cabin Protocols and in the process of developing the test-bed for the protocols. The next step will be transmitting the data from the truck to a location where the data can be used to improve winter operations.

2) What is the goal of the project?
Develop a listing of all potential data attributes to be transmitted to and from any type winter operations equipment. Explore the data transmission options with pro and cons of each. Develop the data protocols to the transmission and storage of the data.

3) List the specific research tasks that would form the scope of work.
I) Nation and International literary search for:
   a) Data transmission from vehicle to point location
   b) Data utilized in winter operations
   c) Protocols being utilized for vehicle to point transmission and winter weather systems such as MDSS
II) Survey of states and municipalities to determine the use of data transmission between vehicle to point location. This should include all vehicles utilized public service to include transit
III) Survey of major trucking manufactures and trucking companies to determine the data types with attributes and unit of measure, transmission type and protocols utilized in their operations.
IV) Synthesize survey responses to develop categories of data transmission types with pro and con, data types with attributes and unit of measure and protocols by Industry type.
V) Compile a complete listing of all data types attributes with unit of measure currently being collected in winter operations
VI) In collaboration with Clear Roads, develop a complete listing of all potential data type attributes and units of measure for all types of winter operations equipment with usefulness I the support of winter operations
VII) Provide recommendations for transmission methods relative to varying conditions
VIII) Provide a recommendation for the protocols for vehicle to point location for all data types being transmitted from a winter operations vehicle.
IX) Recommendation of a plan for the steps to standardization of each deliverable

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
A listing of all potential data types with attributes and units of measures that provide information to support winter operations. A listing of recommended data transmission types for varying conditions. A recommendation for protocols for all data transferred from vehicle to point location and systems currently supporting this protocol. States, Federal Government, Municipalities, systems developers, equipment manufactures and the public

5) How would the products/deliverables be implemented? How would they benefit DOTs?
Researcher to provide a plan for standardizing results of this research into the winter operations community. DOT's would have a standardized set of data (attributes and units of measure) available from winter operations equipment, transmission options for data from vehicle to point location and standardized set of protocols for data from vehicle to point location. DOT's could share data within systems and among systems.

6) Estimated funding needed. $250,000

7) Estimated timeline for completing the research.

- Six (6) months _____
- Twelve (12) months _____
- **Eighteen (18) months __X___**
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
Connected Vehicle Project

2014 Research Proposal Form

Proposer name: Allen Williams
Organization: Virginia Department of Transportation

Title of proposed research synthesis or project: Snow Removal Performance Metrics

Topic Area (check one): **Methods** Equipment Materials Training Technology

1) Explain the specific problem or issue.
States all measure their snow removal success in some way or the other but few have a consistent measure and few know if their measure is an accurate description of the success of the program.

2) What is the goal of the project?
Determine the most successful and accurate performance measures for snow removal operations being utilized throughout the world. Detail the process put in place to capture the data required to assess the measure during snow removal operations. Are the measures shared with the public and if so, how are they shared. What does success of an effective snow removal operation look like and how is it communicated?

3) List the specific research tasks that would form the scope of work.
A. World-wide literature search of effective performance measure in transportation operations specifically snow removal
B. Survey of world-wide transportation organizations to determine the performance measures they use for snow removal, their effectiveness and the method of communications.
C. Select the top 3 or 4 methods of performance measure. For those methods, detail how the data Is collected, how the data is manipulated to reach the performance measure and to whom and how is the information communicated.
D. Assemble a communication plan detailing how a transportation organization would Implement such a program and the associated costs.
E.

4) Describe the expected outcomes or products/deliverables of the research? Who is the intended audience for the products/deliverables?
- A detailed description of the most accurate and useful performance measure program for snow removal operations.
- An implementation guide for instituting such a program within a transportation agency and the cost associated with implementation.

5) How would the products/deliverables be implemented? How would they benefit DOTs?
The proposer would provide the implementation plan for transportation agencies. DOT's would have the ability to implement a effective performance management program in their organization. They would know the cost of implementation and be able to determine the best fit performance measure system for their situation.

6) Estimated funding needed. $150,000

7) Estimated timeline for completing the research.

- Six (6) months _____
- **Twelve (12) months _X____**
- Eighteen (18) months _____
- Other: _____ months

8) Are you aware of any similar or related research on this topic? If so, please list below.
Various reports detail performance metrics but none I know of determines the most accurate metrics being utilized today.

2014 Research Proposal Form

Proposer name: Clifford Spoonemore
Organization: Wyoming Department of Transportation

Title of proposed research synthesis or project:
Winter Severity Mapping Enhancement

Topic Area (check one): Methods Equipment Materials Training **Technology**

1) Explain the specific problem or issue.
There has been several Power Point presentations that have included the Winter Severity Maps. Then the presenter appears to try and use clip art to make a slide of their home State (in this case WY). Not a bad idea for the presentation, but there may be a better solution. Have Clear Roads enhance the maps for each state. This would allow the state to first show a slide of the entire Nation and then the next slide is just of their state. The scale, title, credits and other items that are on the National Maps are also on the state Maps. This will make the individual state maps look professional and not a best fit clip art.

2) What is the goal of the project?
This enhancement would make the Winter Severity Maps more informative and Clear Roads can maintain the integrity of the product. By providing the severity maps for each individual State the user can draw more attention to the location of interest within each State. Possible add the State Highway System to the State maps and show the effects of winter on the State system.

3) List the specific research tasks that would form the scope of work.
No new research just add a layer of flexibility to the research that has already been completed.

4) Describe the expected outcomes or products/deliverables of the research?
This would add at least 78 individual state maps to our list of available maps. It may be worth the time and energy now to include the northern half of the USA to include states that are not part of Clear Roads.

Who is the intended audience for the products/deliverables?
This enhancement would be for anyone that is making a Power Point presentation and wishes to include the Winter Severity Maps. This would give greater flexibility of this product.

5) How would the products/deliverables be implemented?
Access all maps from the Clear Roads website.

How would they benefit DOTs?
Using the individual State maps would help the presenter draw a clean clear picture for their audience. This would put the research up close and in their back yards.

6) Estimated funding needed. $5,000

7) Estimated timeline for completing the research.
- Six (6) months _____
- Twelve (12) months _____
- Eighteen (18) months _____
- **Other: __3___ months**

8) Are you aware of any similar or related research on this topic?
Source material is the Clear Road Winter Severity Maps