

Clear Roads Problem Statements
January 2007

Page	Title	Description	Estimated Cost	Estimated Duration	Proposer
3	Friction Measurements as a Winter Performance Measure	Document friction measurements recorded before and after winter operations to show that friction measurements are realistic and reliable winter performance measures.	\$25,000	One winter	Tom Martinelli, WisDOT
9	Cutting Edge Specifications and Testing	Develop a series of standard laboratory tests for snowplow blades that states could use to evaluate blades before purchase.	\$50,000	12-18 months	Tom Martinelli, WisDOT
11	PNS Partnership	Set aside funds that could be used for partnering with the Pacific Northwest Snowfighters on projects.	\$20,000 per year	ongoing	Tom Martinelli, WisDOT
15	Utilization of Propane for Snow and Ice Removal on Highway Bridges	Determine through laboratory testing the benefits of utilizing propane for removal of snow and ice from highway bridges. The Propane Education and Research Council will contribute \$50,000 towards project.	\$50,000 from Clear Roads.	2 years	Tom Martinelli, WisDOT
21	Control of Roosting Birds on Transportation Structures	Identify and evaluate current pigeon abatement strategies.	\$50,000	3 years	Lynn Bernhard, Utah DOT
23	Effective Anti-icing Strategies	Quantify the benefits and effectiveness of anti-icing for the different conditions (weather, roadway types and conditions, road classifications, material use and application rates).	\$100,000 - \$150,000	1 1/2 years (two winters)	Linda Taylor, Mn/DOT
27	Improved Winter Patching Products and Procedures	Evaluate materials and procedures for winter patching operations. Identify the quantitative and qualitative benefits.	\$100,000 - \$150,000	6 months – 1 year	Linda Taylor, Mn/DOT
31	Correct Recording of Material Usage for Snow & Ice Operations	Develop an automated program and printer for recording material usage at the end of operator shifts.	\$100,000 - \$150,000	1 year	Linda Taylor, Mn/DOT
33	Deicing Chemical, Additive or Mix Performance Standard	Establish laboratory tests that can be applied to all deicing chemicals, additives and mixtures to measure performance. Manufacturers would need to use these tests before marketing their products to states.	\$200,000	1 to 2 years	Dennis Burkheimer, Iowa DOT
35	Carbide Blade Wear and Alarm System	Develop a method to provide snow plow operators with a measurement of wear on carbide inserts used in snow plow blades and an alarm when the carbide reaches a specific threshold.	\$100,000	1 year	Dennis Burkheimer, Iowa DOT
37	National Winter Driver Safety Media Campaign	Purchase and distribute materials developed through the Clear Roads campaign already underway.	\$100,000	1 to 2 years	Dennis Burkheimer, Iowa DOT
39	Double-paned Windshield Test and Evaluation	Understand more about the effectiveness of double-paned windshields to help reduce winter precipitation through actual test and evaluation in the field.	\$10,000	1 year	Dennis Burkheimer, Iowa DOT
41	Combination Snowfence	Develop one fence that can be used to control blowing and drifting snow and livestock along existing right-of-way lines.	\$100,000	1 to 2 years	Dennis Burkheimer, Iowa DOT

Page	Title	Description	Estimated Cost	Estimated Duration	Proposer
43	Synthesis of Methods to Prevent Frost/Ice/Snow Formations on Bridge Decks or Roadways Using Alternative Energy Sources	Identify and compile research project results on the use of alternative energy sources to help eliminate or reduce the formation of winter precipitation from roadways or bridge decks.	\$25,000	1 year	Dennis Burkheimer, Iowa DOT
45	Development of Snow and Ice Removal Performance Standard	Develop a performance measure for snow and ice removal by comparing pavement conditions and traffic count data.	\$150,000	1 – 1 ½ years	Dennis Belter, Indiana DOT
47	The Effectiveness of Blending Agricultural Byproducts with more Traditional Liquid Chemicals	Determine if agricultural byproducts can lower the effective temperature, increase the residual value and/or decrease the corrosiveness when blended with more traditional liquid chemicals	??	1 year	Shane Larson, Illinois DOT
51	Transportation Synthesis Reports on Winter Maintenance Issues	Produce five quick-turnaround reports of research and best practices on current winter maintenance issues.	\$5,000	2-3 weeks for each report	Kim Linsenmayer, CTC & Associates LLC



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Tom Martinelli, WisDOT, Thomas.Martinelli@dot.state.wi.us

Title of proposed research project: Friction Measurements as a Winter Performance Measure

1) Background: Ohio and Utah DOT now have winter friction measuring devices that they use to monitor pavement friction values during the winter season. A similar research project was proposed to Clear Roads in April, 2004. Refer to the attached proposal. Now we have Clear Roads members with the friction measuring devices.

2) What is the specific problem or issue? Can friction measurements be used as a reliable winter performance measure. Refer to the attached proposal from April, 2004.

3) List the proposed research objectives and tasks. Refer to the attached proposal from April, 2004 for the research objectives. The tasks would include documentation of friction measurements recorded during and after winter operations.

4) What would be the product(s) of the research? Documentation that friction measurements are a realistic and reliable winter performance measure.

5) How would the results benefit DOTs? How would they be used? Documentation would show that friction measurements are an effective performance measure. The DOT would establish targets for friction values during and after a storm event and document how frequently crews were able to achieve those target.

6) List the estimated funding needed. \$25,000

7) List the estimated timeline for completing the research. One winter season (2007-2008)

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

Refer to the attached Clear Roads proposal from April, 2004 and the Aurora project proposal for 2007.

Evaluation of ODOT Roadway/Weather Sensor Systems for Snow & Ice Removal Operations

Research in progress – Ohio Department of Transportation

<http://rip.trb.org/browse/dproject.asp?n=10978>.

From Abstract: Phase 5: Vehicular Speed Associated with Winter Pavement Conditions - The purpose of this phase is to develop an objective standard for level of service first in terms of friction measurements and then in terms of RWIS station speed measurements. The aim is then for ODOT to objectively measure average vehicle speed and weather information on the RWIS network, thereby deriving the road friction and level of service for winter maintenance operations in that area. This research will determine the relationship between conditions such as travel speed, volume, RWIS weather data and friction during winter weather events and the drivers' comfort level and perceived level of service. Conditions affecting levels of service for winter weather events on selected highway sections in Ohio will be classified and the test/retest accuracy and reliability of the Halliday Technologies Inc. friction meter will be determined.

Discriminant Analyses of Winter Road Surface Conditions Using Vehicular Motion Data Based on Artificial Intelligence Techniques

Takashi Nakatsuji, Hokkaido University; Junpei Miyasaka, Docon Co. Ltd.; Akira Kawamura, Kitami Institute of Technology; Tatsuo Shirakawa, Kitami Institute of Technology; and Takashi Nakatsuji, Hokkaido University
TRB 84th Annual Meeting Compendium of Papers CD-ROM
Paper Submission Nov. 15, 2004 [No. 05-1589.pdf].

Abstract and Introduction: For road administrators in charge of winter maintenance operations, information on whether a road is slippery or not is insufficient. What is required here is a friction coefficient, preferably a few hours in advance so that necessary countermeasures to prevent slippery roads occurring can be taken. Vehicular

motion data have great potential for detecting road conditions in winter since they are mutually correlated. In order to discriminate road surface conditions from vehicular motion data, the authors examined some discriminant methods based on artificial intelligence techniques, such as the neural network model, the Kohonen feature map, and the genetic algorithm, comparing them with a linear discriminant function model. Prior to the comparative analysis, the three acceleration components in the longitudinal, lateral and vertical directions, as well as the slip ratios of both front and rear wheels, were selected as explanatory variables. Through applying discriminant methods to data measured on a test track and on arterial roads, the authors identified the neural network model combined with the genetic algorithm as working the best. The percentage of correct discriminations exceeded 90 percent not only for the data on the test track but also for the data on the urban streets. The lack of slip ratio data did not affect discrimination performance for the neural-based model.

Also see the companion paper:

Inverse Estimation of Friction Coefficients of Winter Road Surfaces: New Considerations of Lateral Movements and Angular Movements

Transportation Research Record 1911: Maintenance Management and Operations Services, February 2006
<http://pubsindex.trb.org/document/view/multi.asp?recordlist=767789>.

Abstract: The major concern remains one of how to estimate the friction coefficient of a winter road surface indirectly with the use of vehicular motion data. Similarly, in this paper, there is no change in the central structure of the argument; the friction coefficient is estimated as the solution to an optimization problem in which a tire model describing the interaction between tire and road surface is integrated into a genetic algorithm. The tire model differs from the previous method. The one-degree-of-freedom (1-DOF) model that formulated only longitudinal motion is replaced by a 3-DOF model, in which lateral and angular motions have also been taken into account. This revised method was applied to data measured at three sites: at intersections on a test track, on curved sections of the same test track, and at intersections on arterials in Sapporo, Japan. The friction coefficients estimated by the method were in relatively good agreement with those actually measured. Lateral and angular motions have contributed to the improvement.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com

Call 608-628-3806 or e-mail with questions.

**Test and Evaluation of Materials, Equipment and Methods
for Winter Highway Maintenance
Pooled Fund TPF-5(092)**

**PROJECT PROPOSAL
Federal Fiscal Year 2005**

- I. PROBLEM TITLE:** Friction Measurements as a Winter Performance Measure
- II. RESEARCH PROBLEM STATEMENT:** Highway maintenance managers need a tool to use as a performance measure when determining the level of service that is being provided by snowplow operators and whether that level meets the agencies goal for different levels of highway winter categories.
- III OBJECTIVE:** The objective of this study will be to determine the feasibility of using a friction meter currently available on the market at a reasonable cost for measuring pavement friction values during winter conditions as a winter maintenance performance measure.
- IV. RESEARCH PROPOSED:** Determine the options of friction measurement equipment available in the market; determine which friction meter would be the most appropriate for winter operations; test and evaluate the meter in the field under winter weather conditions.
- V. ESTIMATE OF THE PROBLEM FUNDING AND RESEARCH PERIOD**
- Recommended Funding:** To be determined.
- Research Period:** Fall, 2004-Summer, 2006 (including two winter seasons)
- VI. URGENCY AND PAYOFF POTENTIAL:** Winter maintenance managers could use this tool as soon as it is shown to be a reliable piece of equipment for determining winter maintenance performance. The payoff potential is great since knowing that pavement conditions meet a standard can result in the use less effort and less materials, such as salt, thus saving an agency a large amount of winter maintenance costs.
- VII. RELATED RESEARCH:**
- 1) "Automated Winter Road Maintenance Using Road Surface Condition Measurements", Rajesh Rajamani, Univ. of Minnesota Mechanical Engineering Department. Proposed Project, 2004
 - 2) "Feasibility of Using Friction Indicators to Improve Winter Maintenance Operations and Mobility", NCHRP 6-14, November, 2002
 - 3) "Highway Maintenance Concept Vehicle, Phase IV" DRAFT, CTRE, June, 2002
 - 4) "Relationship Between Winter Road Surface Conditions and Vehicular Motions Measured by GPS-Equipped Probe Vehicles", Takashi Nakatsuji & Akira Kawamura, TRB Annual Meeting, January, 2003

Project Outline

Aurora Project 2007-

Cold Weather Testing of the Halliday Road Grip Unit

Project Champion: Ohio Department of Transportation

Other Participating Agencies: University of North Dakota
North Dakota DOT
Iowa DOT (IDOT)
Halliday Technologies, Inc.

Project Areas: Equipment Evaluation/Decision Support Systems

Background: For the past several years, the Ohio Department of Transportation (ODOT) has been testing prototype road grip measuring devices, manufactured by Halliday Technologies, Inc., designed to be mounted on either the underside of a snowplow truck or as a separate unit attached to the tow hitch of a pickup or other conventional vehicle. Initial results of the tests, conducted both in real-time on various state highway routes and offline at ODOT's Transportation Research Center, have been quite encouraging, though there have been insufficient days with significant winter conditions to allow for intensive testing.

In cooperation with the University of North Dakota (UND)'s efforts to evaluate the Vaisala spectral pavement and temperature sensors at their Road Weather Field Research Facility (RWRF) as part of Aurora project 2006-04, ODOT has loaned UND one of their Halliday tow hitch road grip test units as a cross-validation tool. This partnership, however, can also allow UND and ODOT to conduct more extensive testing of the Halliday unit's performance under cold weather/winter conditions, given the much greater likelihood of such conditions at UND's RWRF along Interstate 29 in eastern North Dakota.

Purpose/Objectives:

The proposed project provides for more extensive testing of the Halliday unit, as well as allows for more extensive cross-validation and data analysis than possible with the limited funding for such work under Aurora project 2006-04. We propose that the project will involve three components:

- (1) In-depth experimental testing and cross-comparison (with the Vaisala and Aurora/IDOT LRSS spectral sensors) at the UND RWRF, where controlled experiments changing the road condition (e.g., from ice covered to slush to wet to bare pavement, in stages) will be conducted during the 2006-07 winter season. Measurements with the Halliday unit will be taken under the scope of these experiments for comparison with measurements from the remote sensors and with previous ODOT tests. An evaluation of the sensitivity of each device to changing conditions should be possible.
- (2) As part of other UND research activities involving surveys of roadway conditions (pavement condition and roadway visibility) along selected MDSS test routes (US Highway 2 and I-29), the pickup with the Halliday unit will be utilized for some of these surveys during the 2006-07 winter season, taking road grip measurements in real-time as an analog to ODOT's previous real-time tests. In tandem with real-time video as well as audio commentary and the air and road temperature measurements systems that are included on the ODOT pickup, this will allow for a more comprehensive picture of the roadway environment and provide a robust context for evaluation of Halliday performance in the more extreme North Dakota winter environment.
- (3) Testing of other tires for use with the Halliday unit. Virtually all ODOT testing with the Halliday unit thus far has utilized a single brand/type of tire, that being those tires commonly utilized on ODOT fleet vehicles. Communication with Halliday Technologies has indicated that testing of the unit with other tires is desirable and would be a valuable complement to the body of testing either previously completed or proposed herein, to determine the dependency of the unit performance (and thus the cross-validation with the other sensors) on specific tire characteristics. We propose to consult with Halliday

Technologies to determine at least one additional tire to use for testing during the 2006-07 winter seasons within the experimental framework discussed in bullet #1 above.

Deliverables/Products:

- 1) A report including a detailed evaluation of the performance of the Halliday road grip unit pursuant to the objectives (1) –(3) above, including any recommendations related to dependency of the results on the specific tire characteristics
- 2) Copies of journal articles, conference preprints, etc. arising from the project, including those related to the cross-validation activities related to Aurora project 2006-04 (i.e., the Vaisala and LRSS remote sensing units) and case study reports, articles, etc. related to an integrated analysis of roadway conditions during the real-time testing conducted under objective (2) above.

Estimated Project Completion Date: October 2007

Estimated Project Cost: \$40,000, which includes

- (1) Purchase of one or more tires to be used under objective (3) (\$800)
- (2) A \$27,000 subcontract to UND for personnel time (one research associate, 2 staff research assistants and one graduate student to:
 - a. Conduct the intensive experiments under objective (1) and the other testing under objectives (2) and (3).
 - b. Extract data from a UND-provided laptop as well as the associated web servers, data analysis of all tests, and production of the deliverables stated above
- (3) Routine costs (gas, minor vehicle maintenance on ODOT vehicles and the Halliday road grip unit) incurred during the winter 2006-07 testing phase. (\$1,200)
- (4) Management of the project by ODOT personnel, including travel funding for UND/ODOT face-to-face project update meetings (\$ 6,000)
- (5) Indirect costs appropriate to standard State of Ohio and University of North Dakota rates



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Tom Martinelli, WisDOT, Thomas.Martinelli@dot.state.wi.us

Title of proposed research project: Cutting Edge Specifications and Testing

1) Background: Many types of plow blades are being marketed with no standardized set of laboratory test procedures available to compare the blades before they are installed on snow plows. Durability of plow blades is currently determined by their performance life on the plow.

2) What is the specific problem or issue? No specific tests that would simulate field conditions are available to contact in a laboratory to measure the performance of snow plow blades

3) List the proposed research objectives and tasks.

Develop a series of standard laboratory tests for snowplow blades.

Tasks would include (1) a literature search to determine if standards already exist in the industry to measure hardness of the blades and/or blade inserts and other features of the blades.

(2) development of standardized tests to measure performance of snow plow blades for durability and minimum cutting power.

4) What would be the product(s) of the research? A list of standardized laboratory tests procedures for snow plow blades.

5) How would the results benefit DOTs? How would they be used? DOT's could determine more efficient snow plow blades before they were purchased and installed on snow plows. Potential cost savings could be substantial based on the number of snow plow trucks in the fleet and the number of blades normally used during a winter season.

6) List the estimated funding needed. \$50,000

7) List the estimated timeline for completing the research. 12-18 months

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

Refer to attached IowaDOT proposal dated January 26, 2005

Determination of Cobalt in Tungsten Carbide Inserts

The Missouri DOT's General Services Specifications for snow plow blades include the description of a procedure for determining the percent of cobalt in tungsten carbide inserts that utilizes Atomic Absorption Spectrophotometry. To review the procedure, click on the specification number of any of the four carbide blades

listed at <http://www.modot.org/business/materials/pdf/mgs/MGSINDEX.pdf> and scroll to page 3: Test Method MoDOT T21 Determination of Cobalt in Tungsten Carbide Inserts.

Evaluation of Wear Resistance of Snow Plow Blade Cutting Edges Using the Scratch Test Method

Wei Y, Nixon WA, and Shi Z: Journal of Testing and Evaluation, Vol. 26 / Issue 6, 1998

<http://journalsip.astm.org/JOURNALS/TESTEVAL/PAGES/446.htm>.

Abstract: The scratch test method was used to evaluate the wear resistance of snow plow blade cutting edges. A testing apparatus peculiar to the in situ scratch test of cutting edges was developed. Experimental results indicated that the scratch hardness correlated better to the wear resistance of cutting edges than did the indentation hardness.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com

Call 608-628-3806 or e-mail with questions.

Clear Roads Problem Statement
Pooled Fund #TPF-5(092)
Federal Fiscal Year 2006

I. PROBLEM TITLE

Carbide Blade Insert Standardized Performance Testing

II. RESEARCH PROBLEM STATEMENT

Currently most winter maintenance operations use plow blades with carbide inserts to help remove snow and ice. Most agencies specify dimensions for the inserts but little is done to determine the performance level of the inserts.

III. OBJECTIVE

The objective of this research project is to identify a test or set of tests that can be conducted in a lab to measure performance of carbide inserts. Once the appropriate tests are identified agencies can then ask manufacturers to have their inserts tested at independent labs to determine which blades to purchase based on performance results. The tests could be used as a national standard for carbide inserts.

IV. RESEARCH PROPOSED

The research would require a literature search to determine the standards already used in the industry to measure hardness of the carbide and other features of the insert. The research would then develop standardized tests to measure performance of carbide inserts for durability and cutting power at a minimum.

V. ESTIMATE OF THE PROBLEM FUNDING AND RESEARCH PERIOD

Recommended funding: \$100,000

Research period: 24-30 months

VI. URGENCY AND PAYOFF POTENTIAL

A set of carbide inserts cost approximately \$220 per plow and a truck may use 2-3 blades per year. Fleet size will determine the economic value of this project.

VIII. RELATED RESEARCH

"Evaluation Of Cracking In Pre-Service And In-Service Snow-Plow Carbide Wear Surfaces," Missouri Department of Transportation, December 2003.

Abstract:

http://trisonline.bts.gov/detail.cfm?ANNUMBER=00969836&STARTROW=1&CFID=1132812&CF_TOKEN=13852317. The purpose of this study was to determine the source of defect propagation in carbide/steel snowplow blade inserts and qualify a nondestructive testing technique that will: a) locate and determine whether or not defects originating in the manufacturing process have an impact on blade service life, b) monitor in-service blades to determine the rate of carbide insert and bond breakdown in the field, and c) evaluate various carbide insert configurations in the field.

Full report:

<http://168.166.124.22/RDT/reports/Ri01023/RDT03015.pdf>.

It is believed that manufacturing defects in the wear surface are present prior to state purchase, and that they are either caused by improper heat application during the brazing process, or excessive cold forming while straightening the finished blade at the manufacturer. We have known that ultrasound examination can divulge pre-service and in-service defects in single layered carbide insert blades. The inspection of these blades in the lab is easy, and the techniques work well in the field as long as the blade surface of the inspection area is not damaged. Ultrasound examination can divulge the cause of in-service defects so that engineering can; (a) require that the manufacturing process be changed if needed, (b) determine if the Rockwell hardness of the carbide inserts needs to be lowered, (c) recommend adding a protective cutting edge to the front of the carbide wear surface plate, and/or (d) recommend a change in snowplow operation practices. Such data would allow Missouri to improve the design, specifications and/or operational requirements for these products.

IX. DATE AND SUBMITTED BY

Dennis Burkheimer- Iowa DOT, January 26, 2005



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Tom Martinelli, WisDOT, Thomas.Martinelli@dot.state.wi.us

Title of proposed research project: PNS Project Partnership

1) Background: The Pacific Northwest Snowfighters (PNS) group is similar to the Clear Roads pooled fund group in organization and purpose (a group of states and Canadian providences that have joined together for the benefit of all members to develop salt testing specifications and undertake other projects related to the use of salt and alternative materials).

2) What is the specific problem or issue?: Refer to the attached list for project examples as proposed by Dan Williams, Montana DOT and the October 31, 2006 e-mail from Dan Williams for an example of an upcoming research project.

3) List the proposed research objectives and tasks: Will vary depending on the specific research projects that are proposed.

4) What would be the product(s) of the research?: Research reports and implementation plans.

5) How would the results benefit DOTs? How would they be used?: More efficient use of winter maintenance materials and procedures. Used as part of DOT's training programs at local garages to instruct operators on the use of various materials and methods for winter maintenance.

6) List the estimated funding needed: \$20,000 per year continuing indefinitely or till the Clear Roads group determines that the benefit/cost of the investment is no longer warranted.

7) List the estimated timeline for completing the research: To be determined by the principal investigator for each research project; normally 12-24 months depending on the project.

8) Are you aware of any related research on this topic? If so, please list below:
Similar to projects previously undertaken by the SICOP program.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com

Call 608-628-3806 or e-mail with questions.

6/14/06
Den Williams
Montana DOT

ATTACHMENT #2

Greetings PNS members,

I know our upcoming business meetings, both open and closed, will be short and jam packed with Conference info as well as regular kinds of items. I thought I would send this for your reference and reading before the meetings. I think this should be an open meeting agenda item.

Background

Montana State University is home to the Western Transportation Institute (WTI). WTI is a research based group of scientists whose focus is transportation issues. You are aware of, or have met some of their staff such as; Dr. Xianming Shi or Steve Albert. Their staff is quite large now with specialists from all over the world.

Recent developments find WTI with over 3 million dollars from both state and federal coffers. The federal dollars have a one to one match requirement and is quite attractive. State research dollars can be used for more process oriented research rather than product related. Another point of interest is their Cold Regions Research Facility being developed in Lewistown Montana. This is an old military airport that lends itself to "on the road" kinds of research. Actual field work, such as snow making machines creating snow or ice-packed roads are possible. Testing of pavement sensors side by side or performance of different chemicals and even create traffic loading to a degree.

WTI has developed study groups at Montana Dept of Transportation (MDT) to work with WTI's staff to try to drill down to the needs of good or appropriate research topics. One of those study groups is winter maintenance, hence this paper. Our most recent meeting, May 18th, came up with five potential topics of research. I told the group I would bring these topics to you for your input and advice. They are;

1. Performance measurement of different blends of the same Category of chemicals. We have been lobbied by manufacturers to give extra consideration for their products because of their formulation. They claim it works better and should not be judged the same as others in the same Category. We've always said "prove it" and we'll consider it. Our last meeting or two we have discussed a "certified eutectic curve" as being the potential to answer that question and maybe it is. However, that curve would give us the freeze point suppression and not an active deicing measurement. Perhaps developing some criteria to measure, and handing it over to WTI, is a solution. It may also help answer the question of "do organic inhibitors alone have benefits regarding melting snow or preventing ice"?
2. Dilution rates of chemicals leaving roadways and entering the environment. We use the rate of 100 to 1 to base our metals content on, while a Colorado study indicates a greater dilution rate of 500 to 1. Our rate looks at a single event while Colorado looked at a seasonal impact. We adjusted our ppm for a few metals recently to be consistent with our dilution rate. That rate excludes some products

or inhibitors. Do we want WTI to look at the issue from both a one time and a seasonal rate?

3. The "dippidy-doo" corrosion test we currently use has some issues. Dr. Shi has done some preliminary tests with electro-chemical corrosion testing as a support test to finger print the current procedure. MDT is quite supportive of finding another method to test for corrosion that is supportive of our current method. This test is not new technology but finding a correlation to our method is a new approach and would take running quite a number of samples to find that correlation. Having this procedure as an "either or" method to the dippidy-doo would offer some flexibility and option to industry as well as end users.
4. Longevity of organic corrosion inhibitors when applied to solid chemicals. If a Category IV is stored outside, maybe mixed with abrasives or straight, and is subjected to sun and the elements, does the inhibiting qualities diminish over time? If so, how long?
5. Can we chemically bond a florescent marker to the corrosion inhibitors in production of the brine? If so, we could quickly do a field test with a black light to determine presence of inhibitors instead of being out a month waiting for corrosion test results.

Well, here are the topics or potential research. Read 'em over and give them some thought. All, some, or none of them have value. MDT can act as lead state if any of you find merit and want to kick in some funds to help with the match if we look into these issues. Or, do you have suggestions for research that needs to be done?

I look forward to seeing you all next month,

Dan

Note from Dan Williams dated October 31, 2006 to Dewey Amsler related to Clear Roads project "Effectiveness of De-icing Materials and Procedures". PNS (Pacific Northwest Snowfighters) is very interested in determining performance of different chemicals. Solid chemicals are certainly of interest.

PNS is meeting in November to discuss a pooled fund to determine a couple things; longevity of organic corrosion inhibitors on the road and performance comparisons of winter maintenance chemicals. If there is support, we would likely be going out for an RFP for these items.

Some considerations come to mind when doing comparisons.

- equal application rates. (Different spreader trucks, even by the same manufacturer, apply in a slightly different ways and rates.)
- timing of applications need to be done simultaneously
- traffic volumes and speeds need to be the same
- the surface being used needs to be as flat as possible by limiting small surface undulations that will be affected by the plows
- snow making machines can standardize and coordinate events without waiting for Mother Nature.

The Western Transportation Institute (WTI), associated with Montana State University, has what they are calling their Cold Regions Test Bed in Lewistown, Montana and has plans to do this very thing.

Dan



2007 Research Proposal Form

Proposer name, organization and e-mail address:

R. Christopher Williams, Iowa State University, rwilliam@iastate.edu (via Tom Martinelli, WisDOT)

Title of proposed research project:

Utilization of Propane for Snow and Ice Removal on Highway Bridges

1) Background:

Bridges generally are the highest value asset in highways systems. Removal of snow and ice from bridge decks is necessary to maintain safety, yet most of the deicing strategies are heavily dependent upon a variety of salts. These salts are in many instances detrimental to the long term life of bridges as they are corrosive in nature and attack the embedded steel or may be incompatible with the contents of the portland cement concrete. The potential benefit of propane utilization would be a non-chemical means for snow and ice removal preserving the high value bridges. However, it would be necessary to examine whether or not adverse impacts would occur to the heated highway/airport pavements.

2) What is the specific problem or issue?

Deicers are effective at pre-treatment of highways and bridges prior to weather events. However, over time or through lack of pre-treatment, it can be expensive to bring a bridge to a pre-treatment condition utilizing deicers. The utilization of propane in combination with current deicers may be a more effective and economically feasible method of snow/ice removal.

3) List the proposed research objectives and tasks.

The specific objectives of the proposed research is to determine in a laboratory study the benefits of utilizing propane for removal of snow and ice from highway bridges. Often chemical deicers are used as pre-treatment of bridges prior to a weather event. However, it is well known that deicers are not as effective for removal without pre-treatment. The utilization of propane could represent a situation where a bridge surface could be returned cost effectively to a pre-treatment condition in combination with plowing and/or chemical deicers. However, the use of propane in combination with deicers as well as understanding application rates needs to be understood. It is proposed that this research work be done in a laboratory setting where the experimental variables can be controlled. The experimental variables that can be controlled are propane and deicer application rates, temperature, and snow/ice applications. There may be other variables that the Clear Roads research advisory group may find necessary to include in the experimental plan as well.

It is envisioned that the research will progress over the two year period with the following five tasks:

1. Literature Review
2. Development of Experimental Plan
3. Laboratory Testing
4. Analysis
5. Development of Final Report

A comprehensive research plan will be developed for laboratory testing portion as part of the development of the experimental plan. The research team's initial thinking is that laboratory PCC slabs will be procured and the impacts of treatments on the samples will be monitored for ice/snow removal as well as mechanical property effects on the PCC such as compressive strength. It is envisioned that a partial factorial experimental plan will be developed considering factors deem important by the Clear Roads research advisory group.

4) What would be the product(s) of the research?

The products of the research would demonstrate the feasibility of utilizing propane as a snow/ice removal and in combination with other deicing strategies.

5) How would the results benefit DOTs? How would they be used?

It is envisioned that propane may be more effective at removing snow and ice and possibly in combination with deicers. However the effectiveness needs to be determined and the corresponding application rates for effectiveness in snow/ice removal as well as determining no adverse impacts on the bridges.

6) List the estimated funding needed.

The proposal is for \$100,000 over two years. The Propane Education and Research Council will provide \$50,000 of the \$100,000 funding. The request is for Clear Roads to provide the remaining \$50,000 of the funding.

7) List the estimated timeline for completing the research.

The project will be initiated and completed in two years (24 months).

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

Pat Kennedy, FHWA Road Weather Management Program Team

We contacted FHWA's Road Weather Management Program (<http://www.ops.fhwa.dot.gov/Weather/index.asp>) to learn whether any members of the RWM team were aware of research or practices in the use of propane heat or flame to remove ice and snow from bridge decks. We were put in touch with Pat Kennedy of the team.

"I know there's equipment around that you can have a flame coming out, such as for putting down thermoplastic striping for pavement marking, but I haven't heard of anything being transcribed over to winter maintenance. Personally, I kind of wonder how well it could be applied to that, but you never know. Before starting here about a year ago, I came from Dulles International Airport. Part of my job there for 28 years was doing snow and ice removal. In my years of experience I've never really heard of anybody using a propane-fired technology. My understanding when I first started at the airport, was there was a fellow at one time who got hold of an old jet engine, and tried to get that converted over to be able to use it to generate heat to melt at least the snow and ice that would've been on the centerline of a runway. But that's about as close as I think I've come to hearing of using fire to melt snow and ice."

Pat suggested two resources for further investigation:

- FHWA's Road Weather Resource Identification Tool, Version 2.0 (November 2006)

<http://www.ops.fhwa.dot.gov/weather/rwri/registration.htm>.

We used the tool, but were unable to locate any pertinent information through a keyword search of the 650 winter maintenance resources in the Road Weather Management database.

- The SICOP Snow and Ice List-Serve.

Queries for list-serve members may be posted at http://www.sicop.net/snow_and_ice_list-serve.htm.

Melting Ice with Space Heaters

Robert Haehnel, F. Donald Haynes and Charles Clark, Cold Regions Research and Engineering Laboratory, 1997
<http://www.wes.army.mil/REMR/bulls/vol14/no3/text/ice.htm>.

Under the REMR (Repair, Evaluation, Maintenance, Rehabilitation) Research Program, the U.S. Army Cold Regions Research and Engineering Laboratory evaluated the performance of space heaters for melting ice. The purpose of these tests was to determine the effects of air temperature, wind speed and distance between the outlet and ice surface (standoff) with the use of hot air to melt ice. The tests were conducted outdoors, and a fan provided the desired wind speed. The ice blocks were 2 feet (0.61 m) square and about 3 inches. (76 mm) thick. Each block was placed on a wood frame that was suspended by two load cells. The hot air was provided by a propane-fired 150,000 BTU/hr (44 kW/hr) Universal TM heater (model no. 150- FAS).

Rehabilitation Strategies for Highway Pavements

NCHRP Web Document 35 (Project C1-38), 2001

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w35-a.pdf.

Click on "Go to Part C," scroll to Page B-13:

Heater scarification involves the following steps: Heating the existing pavement surface to about 110 to 150 degrees C using one or more propane-fired radiant heaters...

Asphalt Technology for Hot In-Place Surface Recycling

<http://pubsindex.trb.org/document/view/default.asp?lbid=370629>

This paper appears in Transportation Research Record No. 1337 (Flexible Pavement Construction, Performance and Recycling, 1992).

From Abstract: The heat reforming process for hot, in-place rehabilitation of deteriorated asphalt pavements consists of a heating system (up to three liquid propane gas infrared preheaters), which can effectively heat to a depth of 50 mm, and a reforming system...

Mastic Asphalt Concrete

Transportation Research Board Special Report, Issue No. 148, 1974

<http://pubsindex.trb.org/document/view/default.asp?lbid=25484>.

From Abstract: Mastic asphalt concrete was first placed in the United States on a mainline pavement in Pennsylvania in 1972. This paper describes that placement. The equipment used was specially constructed inasmuch as placement of mastic asphalt concrete required a propane-heated screen, chip spreader, and a crimper roll...

BareBlaster Ice Torch (hand-held unit)

<http://www.unique-idea.com/BB-100.htm>.

Immediate ice melting of dangerous icy areas. The focused flame burns through the toughest ice & snow! This torch has a full 31" reach so that you won't have to bend and stoop. It is made of nickel plated steel and brass to withstand the elements and weighs under 4 lbs., including the propane cylinder (cylinder not included). Use either the 14 oz. or 26 oz. propane tanks (available at most hardware stores). Adjustable flame control. Use on walkways, steps & driveways. Keep your property safe from accidental slips and falls. Lightweight and easy to use. Clean burning and inexpensive. Standard propane tanks just screw on. Precision flame gets rid of dangerous icy patches. Great for summer weed control. BONUS: Striker included at no charge.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com

Call 608-628-3806 or e-mail with questions.

Feasibility Study of Propane Utilization by Transportation Agencies in Road Construction and Maintenance Applications

Introduction

The evolution of the transportation industry coupled with changing energy markets has led to renewed interest in examining market opportunities for the propane industry. The transportation industry is generally heavily dependent upon energy pricing for maintenance and construction activities and these range from snow removal and maintenance activities associated with pavements to new or reconstruction of highways and airport facilities.

Preliminary discussions have identified some **potential research areas** which may be market opportunities for the propane industry and include the following:

- **Snow and ice removal on highway bridges,**
- Snow and ice removal on airport taxiways and runways,
- Temperature curing for concrete,
- Drying subbase/base pavement layers for accelerated construction,
- Energy alternatives for portable hot mix asphalt plants, and
- Utilization by hot in-place asphalt recycling.

The next section discusses each of these ideas further.

Background

Bridges generally are the highest value asset in highways systems. Removal of snow and ice from bridge decks is necessary to maintain safety, yet most of the deicing strategies are heavily dependent upon a variety of salts. These salts are in many instances detrimental to the long term life of bridges as they are corrosive in nature and attack the embedded steel or may be incompatible with the contents of the portland cement concrete. **The potential benefit of propane utilization would be a non-chemical means for snow and ice removal** preserving the high value bridges. However, it would be necessary to examine whether or not adverse impacts would occur to the heated highway/airport pavements.

Similar to highways, airports represent a market opportunity as there is a time lag in the placement of salts and the improvement of the pavement landing/take-off condition. Utilization of propane may represent one method of decreasing the delay for landing/take-off conditions thus realizing a significant improvement in user costs (airlines and travelers) and possibly improved safety.

Wintertime construction in northern climates for industrial and commercial facilities is often dependent upon temperature for placement and curing of concrete. It is common for temporary shielding for facilities such as a building to be established with plastic sheeting and heating provided for ambient temperatures to meet the minimum concrete placement temperature of 40 F. However additional heating during the initial set could accelerate curing and therefore increase the speed of construction. One example is the introduction of heat upon completion of “floating” and finishing a concrete slab on the float itself. Figure 1 below illustrates the finishing of a floor during commercial construction.



Figure 1. Finishing a concrete floor for commercial construction

Highway construction of base and surface layers of highways is dependent upon the construction and readiness of construction of supporting subbase and base layers. Moisture is one element that has considerable impact on the readiness of ensuing base and surface layers of highways. Optimum density of unbound layers such as soils, engineered fill, and varying types of granular materials are highly dependent upon moisture. Figure 2 illustrates the relationship between moisture density and compaction effort.

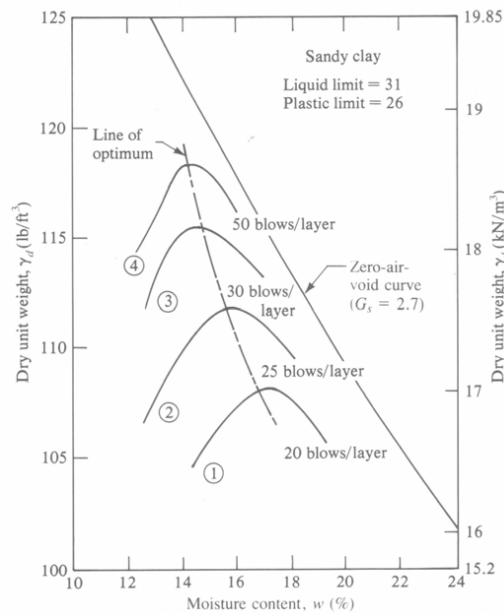


Figure 2. Effect of Moisture and Compaction Effort on Density of an Unbound Material

Figure 2 illustrates that for a target density, too much moisture may not make the density attainable and in fact added compaction effort can lead to a loss of density at relatively high moisture contents. Drying unbound materials which are beyond their optimum moisture content at a particular compaction effort could lead to faster construction of highways. Further, a drying system for bound materials in which additional bound layers (e.g. portland cement or hot mix asphalt) are to be placed could also speed construction.

A measurable proportion of hot mix asphalt plants are portable. Portable plants utilize a variety of fuels including diesel, recycled motor oils, and natural gas when available. Drum and batch type plants are both portable with the main difference being that a batch plant consists of a drum dryer and pugmill while a drum plant utilizes a single drum for drying and mixing the hot mix ingredients. Improved energy efficiency may be attained in portable plants by the use of propane. It would be important to examine the delivery quantity and system for propane to portable plants.

The substantial increase in the price of gasoline and asphalt has recently led to renewed interest in hot in-place recycling (HIPR) of asphalt pavements. Propane is currently used in HIPR, yet only one equipment manufacturer currently exists. Approaching other mainstream hot mix asphalt equipment manufacturers for producing HIPR equipment could lead to a substantial market increase in HIPR and thus propane utilization.

Center Description

The Center for Transportation Research and Education (CTRE) is a dynamic leadership of highly interdisciplinary research programs consisting of research and technology transfer over the broad spectrum of the transportation industry. CTRE's annual research expenditures of approximately \$11 million are enabled by a culture of teamwork and collaboration. CTRE's activity level and commensurate stature has significantly grown over the past two decades to the point that CTRE has become one of our nation's leading transportation research internationally recognized experts in transportation and civil engineering; including planning, safety, materials, bridges, systems management and operation, and policy. CTRE has produced great societal benefit from a unique ability to collaboratively leverage knowledge and resources with other universities, transportation agencies, extension services, consulting firms, and industry in a team oriented environment. By fostering collaboration

amongst Iowa State University researchers, the Iowa Department of Transportation, and leaders and associations in the transportation infrastructure and engineering industries, CTRE has broadened its capabilities to meet the research and technology transfer needs of local, national and international partners.



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Lynn Bernhard, Utah Department of Transportation, lynnbernhard@utah.gov

Title of proposed research project: Control of Roosting Birds on Transportation Structures

1) Background:

Birds, particularly pigeons, roost under bridges and inside open sheds. Pigeon excrement is known to carry pathogenic organisms. Pigeon excrement presents a hazard to maintenance personnel and pedestrians or bicyclists passing beneath their roosting areas. Destruction of nuisance birds presents serious public relations issues even though these birds are not protected under the Migratory WaterFowl Act. Many competing technologies exist for controlling roosting location and numbers of birds. These include passive measures such as using spikes or exclusion nets; active measures like sound cannons or chemical behavior modification; and biological control such as introducing predators or trapping birds for release elsewhere. Potential opposition to destroying bird populations may present political or environmental entanglements that are not anticipated.

2) What is the specific problem or issue?

Pigeon excrement landing on walkways, structure slope protection, and covering traffic and irrigation control boxes located beneath roosts presents health hazards. Pigeons roosting in open storage or equipment sheds leave their excrement on tools, materials, and equipment used by maintenance employees.

3) List the proposed research objectives and tasks.

- A. Identify current pigeon abatement operating practices
- B. Quantitatively evaluate competing abatement strategies and technology on long-term effectiveness

4) What would be the product(s) of the research?

- A. Synthesis of best management practices for pigeon abatement
- B. Printed report identifying current practices, recommended strategies, and resource bibliography

5) How would the results benefit DOTs? How would they be used?

- A. Employee exposure to harmful biologic agents contained in pigeon excrement would be reduced
- B. Public exposure to harmful biologic agents contained in pigeon excrement would be reduced
- C. DOTs could adopt successful strategies that match their management objectives based on demonstrated effectiveness

6) List the estimated funding needed.

\$50,000

7) List the estimated timeline for completing the research.

Oct 2007 - Select project manager
Oct 2007 - Define objectives
Nov 2007 - Survey current practices (2 months)
Jan 2008 - Identify four most promising technologies -
Feb 2008 - Paper evaluation of technologies for effectiveness, sustainability, environmental acceptance
Mar 2008 - Publish interim report of "State of the Practice"
Feb 2008 - Devise field test plan
Apr 2008 - Conduct field tests
May 2008- May 2010 - Monitor effectiveness over two-year cycle
May 2010 - Write Concluding report
Jul 2010 - Peer Review
Sep 2010 - Publish Concluding Report

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

Environmental Assessment Final: Bird Damage Management in the Tennessee Wildlife Services Program
United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Wildlife Services (WS), April 2002

<http://www.aphis.usda.gov/ws/nepa/TNbird.pdf>.

USDA/APHIS/WS is authorized by Congress to manage a program to reduce human/wildlife conflicts. WS's mission is to "provide leadership in wildlife damage control to protect America's agricultural, industrial and natural resources, and to safeguard public health and safety (USDA 1989)." This environmental assessment evaluates ways by which this responsibility can be carried out to resolve conflicts with bird species in Tennessee.

Scroll to Summary of Proposed Action (Page 10):

An Integrated Wildlife Damage Management approach would be implemented which would allow use of any legal technique or method, used singly or in combination, to meet requester needs for resolving conflicts with birds. Agricultural producers and others who request assistance would be provided with information regarding the use of effective nonlethal and lethal techniques. Lethal methods used by WS could include shooting, trapping, egg adding/destruction, nest destruction, DRC-1339, also called Starlicide (3-chloro-p-toluidine hydrochloride), Avitrol (4-aminopyridine), or euthanasia following live capture by trapping or use of the tranquilizer alpha-chloralose (A-C). Nonlethal methods used by WS could include porcupine wire deterrents, wire barriers and deterrents, netting, live capture and translocation using the tranquilizer A-C and/or traps, chemical repellents (e.g., methyl anthranilate, di-methyl anthranilate, or anthraquinone), and harassment with pyrotechnics, lasers, lights, vehicles, audio and visual distress. Bird damage management by WS would be conducted in the state, when requested, on private property sites or public facilities where a need has been documented, upon completion of an *Agreement for Control*. All management actions would comply with appropriate federal, state and local laws.

Evaluation of Passive Bird Deterrent Devices to Minimize Nesting on Bridges and Culverts

Research in progress – FHWA / Arkansas State Highway and Transportation Department

<http://rip.trb.org/browse/dproject.asp?n=11099>.

Abstract: The Arkansas State Highway and Transportation Department only has one approved method, Special Provision, "Conditions for Removal or Construction on Existing Bridge and Culvert Structures," for preventing migrating birds, primarily swallows, from nesting on bridges and culverts that need to be removed. This method allows the contractor to install netting before the nesting season and details the appropriate size of netting and installation procedure. The Environmental Division is proposing an alternative method, an ultrasonic bird deterrent, be installed at various test sites to prevent the birds from nesting as an option to netting. The department's current Special Provision requires netting to be installed with no more spacing than 1/2 inch. Frequently this installation requires lane closures during installation and maintenance. When installed and maintained correctly, the netting has proven to be very successful in deterring nesting birds. However, due to its size and required maintenance it is a labor-intensive installation that requires close monitoring.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com

Call 608-628-3806 or e-mail with questions.



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Linda Taylor, Mn/DOT – Office of Maintenance, Linda.taylor@dot.state.mn.us, (651) 282-2281

Title of proposed research project: Effective Anti-icing Strategies

1) Background:

Anti-icing operation is all over the board as to how it is being administered at truck stations and Districts. Some areas are only anti-icing bridge decks, while others have extensive program to anti-ice mainlines, ramps, shady areas, and bridges decks on a routine basis. Brine, hot brine, and/or liquid chemicals are commonly used for anti-icing operations. There is no consistency as to when, where, and what material or amount is being applied or the frequency of applications. The equipment used for anti-icing ranges from tanks on back of trucks to trailer mounted tank to tanker trucks. There are a lot of informal, pilot tests being conducted dealing with anti-icing. But uniform evaluation and testing has not been applied in most cases. The information and results are used locally and not shared with other areas or districts.

A formal evaluation of anti-icing is needed to help managers justify their investment and to quantify the benefits to operators. Based on a literature review and on-going studies, testing criteria will be developed.

Field testing of various anti-icing materials will be examined on various roadways, with a control section in one direction. Guidelines will be developed for anti-icing material for various weather and roadway conditions and classifications.

2) What is the specific problem or issue?

- There is no uniformity or constancy in how, where, when and what materials are being used to anti-ice.
- Anti-icing priorities need to be established to guide agencies to developing or enhancing their winter programs.
- Good test results are not available to cost justify anti-icing to operators and managers.

3) List the proposed research objectives and tasks.

Objective 1: Quantify the benefits and effectiveness of anti-icing for the different conditions (weather, roadway types and conditions, road classifications (level of service/ADT), material used and application rates).

Task 1: Literature review – publications, standards and specification related to the use and testing of anti-icing will be reviewed.

Task 2: Develop an evaluation plan which lays out the methodology used to field test anti-icing and quantity benefit and effectiveness. Determine the number of field test site required to effective evaluate anti-icing in both urban and rural settings. Other conditions to consider:

- five roadway classification/ADT (5 types – super commuter, urban commuter, primary and secondary);
- roadway type and condition
- topography of land
- roadway directionality (N-S or E-W orientation);
- anti-icing material used (brine, hot brine, and liquid chemical: MgCl or CaCl)

Task 3: Field performance – The field test sites will be determined with the participating states and the test procedures developed to consistently evaluate the anti-icing methods.

Task 4: Compare and analyze results – test results from the field sites will be compared and best field performance by various roadway classifications will be recommended.

Task 5: Cost Benefit Analysis – A cost benefit analysis will be developed comparing cost of various anti-icing procedures.

Task 6: Final Report – a comprehensive report will detail all the testing, results, analyses, cost benefit analysis, and field tests locations. It will include all guidelines and recommendations for anti-icing by roadway classification will be developed. Guidelines will be developed for best practices in effective anti-icing along with guidance on equipment (trucks, facilities, and storage).

4) What would be the product(s) of the research?

Summary of Literature Search

Field Test Results

Final Report

Powerpoint presentation of final result and conclusions.

5) How would the results benefit DOTs? How would they be used?

- Training tool can be developed that would quantify benefits to operators and managers so that program would be expanded or enhanced.
- Provide guidance to manager on how to most effectively use anti-icing methods to improve winter operation.
- Provide operators with a real world guide to anti-icing so that they can deliver the most effective program.

6) List the estimated funding needed.

\$100,000-150,000

7) List the estimated timeline for completing the research.

Field test for two winters; timeframe for project: 1-1/2 years

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

Mn/DOT's Anti-icing Guidelines

Ohio University study on snow & ice pretreatment techniques

Cornell University Study "Liquid Anti-icing study"

Anti-icing and Material Distribution Performance Measures for Achieving Level of Service Through Mobile Data Collection

Gregory Thompson, ThomTech Design Inc.

Transportation Research Circular E-C063: Snow Removal and Ice Control Technology, Page 503

<http://onlinepubs.trb.org/onlinepubs/circulars/ec063.pdf>.

Alaska Department of Transportation and Public Facilities determines the timing of application and application rate of deicing and anti-icing chemicals by subjective judgment in response to many dynamic variables. Increased road maintenance needs in conjunction with stable or declining maintenance budgets have emphasized the need to optimize the cost effectiveness of anti-icing and deicing activities. Alaska DOT/PF believes that using subjective judgment may not lead to the most cost effective use of anti-icing and deicing chemicals. The department along with ThomTech Design Inc. sought to determine the effectiveness of the material distribution methods employed during the snow and ice removal process in the Juneau area. Accomplishing this task required accurate data collection procedures, LOS estimation and analysis. The partners intended to develop particular performance measurements using a variety of in-vehicle sensors and post material distribution techniques that are subjective and objective in nature.

Evaluation of ODOT Roadway/Weather Sensor Systems for Snow & Ice Removal Operations

Research in progress – Ohio Department of Transportation

<http://rip.trb.org/browse/dproject.asp?n=10978>.

From Abstract: Phase 4: Optimization of Pretreatment or Anti-Icing Protocol for Snow/Ice

The overall objective of this phase is to prepare an effective snow/ice pretreatment strategy. Recommendations will be synthesized from the results of Phases III and IV, outcomes from the ODOT winter pretreatment practices, surveys of current practice by other agencies and information summarized from the literature. Specific tasks are to: (1) investigate the losses of sodium chloride mass on laboratory test specimens with respect to surface porosity and roughness; (2) validate the findings from Phase III; (3) correlate rate of depletion of salt with traffic, time and weather conditions; (4) during field tests collect and include available RWIS information for subsequent use in predictive modeling; (5) review and investigate weather forecasting models such as the MDSS for potential comparison to findings from the anti-icing tests; (6) incorporate real-time friction tests at pretreated and non-treated sections to determine anti-icing effectiveness with increased friction; (7) if ODOT's Road Friction Tester can be modified with digital friction readout, use the results to verify conclusions about the efficacy of treatment in the field; and 8) prepare an anti-icing Decision Tree or Expert System to aid in operational planning that includes current and predicted weather and traffic conditions.

Prediction of brine application for pretreatment/anti-icing

Gayle Mitchell, Christopher Hunt and Wallace Richardson: Ohio University

TRB 83rd Annual Meeting Compendium of Papers CD-ROM

Paper Submission: July 25, 2003 [No. TRB2004-000777.pdf].

From Abstract: Development of a sodium chloride brine anti-icing methodology was accomplished via an extensive study of brine residual decay on four pavement types. Brine residual was monitored for up to three days after initial application on five sections of four-lane divided highways in Ohio. Four evenly spaced test stations within each highway section were monitored for residual as time and traffic accumulated. An instrument that dissolves salt and measures conductivity was utilized to measure available salt residual. Efficacy of the brine to prevent ice/surface bonding was estimated utilizing freeze/thaw cycles of various brines. After freezing, the bonds were held vertically as temperature was raised. The appearance of liquid below the interface indicated release. Field and laboratory data were correlated to estimate freezing temperatures for various salt residuals as a function of brine dilution represented by precipitation in depth of rainfall. Results support estimation of brine application requirements for three specific pavements based on expected precipitation and the salt residual models developed in the study. A set of graphs is included to implement the algorithm.

Accurate Deicer and Anti-icer Calibration

Better Roads magazine, October 2006

[http://www.betterroads.com/content/Issue-Story.45.0.html?&no_cache=1&tx_magissue_pi1\[showUId\]=580](http://www.betterroads.com/content/Issue-Story.45.0.html?&no_cache=1&tx_magissue_pi1[showUId]=580).

By changing fixed-orifice to variable-orifice nozzles, deicer and anti-icer calibration accuracy can be controlled accurately. Calibration that provides the most accurate placement of anti-icer or deicer at a level that ensures economy is one of the key issues remaining in fighting snow and ice each winter. For managers who want to evaluate their own sprayers, the Web site www.mobilespraytesting.com has simple testing and evaluation methods that let the manager easily and quickly check the capability of the fleet. It also has useful specifications when considering buying new equipment.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com

Call 608-628-3806 or e-mail with questions.



2007 Research Proposal Form

Proposer's name, organization and e-mail address:

Gabriel Guevara / Mn/DOT / gabriel.guevara@dot.state.mn.us via Linda Taylor (Mn/DOT)

Title of proposed research project: Improved Winter Patching Products and Procedures

1) Background:

In recent years many products have come into the market that, if adopted as a Best Practice, could result in vast improvements over the results obtained using traditional winter patching materials and procedures.

2) What is the specific problem or issue?

In too many instances, winter Pothole-patching with traditional bituminous materials and techniques do not hold-up long enough in order to be considered an effective solution. At best, these traditional pothole patching procedures end up being a short term-temporary fix.

3) List the proposed research objectives and tasks.

- Identify the most effective materials suitable for winter patching operations
- Identify the most effective application products and procedures
- Identify qualitative and quantitative benefits of the improved materials and procedures

4) What would be the product(s) of the research?

- A summary report outlining materials and procedures investigated, detailing their performance characteristics and pros and cons from a wide variety of perspectives such as cost, environmental impacts, friendliness of application, etc...
- A winter pothole-patching handbook that describes materials and procedures to be used and correlates them to winter weather conditions and performance based criteria.
- Proposed implementation plan that includes procurement options and potential synergies between stakeholders (different districts within a DOT, DOT-county, DOT-City, etc...)

5) How would the results benefit DOTs? How would they be used?

- Improved cost-effectiveness of winter patching operations
 - Longer lasting repairs
 - Better utilization of material and human resources
- Improved safety
 - Traveling public
 - Patching applicators
- Improved customer satisfaction / positive PR

6) List the estimated funding needed.

\$100,000-\$150,000

7) List the estimated timeline for completing the research.

Six months to a year from notice to proceed

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

Development of Mix Design and Testing Procedures for Cold Patching Mixtures

Report No. FHWA/TX-05/0-4872-1, October 2005, Rev. January 2006

http://www.utexas.edu/research/ctr/pdf_reports/0_4872_1.pdf.

The objective of this study is to address the use and performance of homemade and containerized patching maintenance mixtures for repairs in cold and wet weather. Various failure mechanisms pertaining to the use of cold patch mixtures were identified and current mix design, materials, performance evaluation and field application procedures were assessed. Based on results from screening experiments, a preliminary mixture design procedure was developed.

Evaluation of Cold Mixes for Winter Pothole Repair

Transportation Research Record No. 1529, pages 76 to 85, 1996

<http://pubsindex.trb.org/document/view/default.asp?lbid=465190>.

The performances of 13 proprietary cold-mix patching materials, four of which are currently approved under Virginia DOT's Special Provision for High Quality Cold Patching Materials, were evaluated. Cold-mix patching materials are regularly submitted to the Materials Division for approval. The purpose of the evaluations was to determine which of the submitted materials were of the same caliber as the approved materials. The addition of materials of equal quality will promote competition in the competitive bid system. Three test sections were placed to evaluate the materials' performance. A standardized evaluation form and performance model were developed to rank the materials. The field performance results were compared with laboratory test results in an effort to develop a laboratory screening test. Design and quality control procedures were identified. These procedures were used to design a material that has performed well.

Patching Roads Better and Faster: product focus report/bid list

Better Roads magazine, August 2003

[http://www.betterroads.com/content/Issue-](http://www.betterroads.com/content/Issue-Story.45.0.html?&no_cache=1&tx_magissue_pi1[keyword]=winter%20patch&tx_magissue_pi1[pointer]=0&tx_magissue_pi1[mode]=1&tx_magissue_pi1[showUid]=565)

[Story.45.0.html?&no_cache=1&tx_magissue_pi1\[keyword\]=winter%20patch&tx_magissue_pi1\[pointer\]=0&tx_magissue_pi1\[mode\]=1&tx_magissue_pi1\[showUid\]=565](http://www.betterroads.com/content/Issue-Story.45.0.html?&no_cache=1&tx_magissue_pi1[keyword]=winter%20patch&tx_magissue_pi1[pointer]=0&tx_magissue_pi1[mode]=1&tx_magissue_pi1[showUid]=565).

Scroll to: Asphalt Dispatch -- new asphalt repair tactics for winter

Asphalt Dispatch, an operating division of Cleat America, has developed a winter asphalt-repair program incorporating permanent repair standards and procedures with asphalt supplied by an Astencook Super-043 portable asphalt mini-plant and recycler. The Super-043 generates asphalt to specification on site in the correct amount and temperature for pothole patching, according to the company. Asphalt Dispatch said 93 percent of 105 repairs completed in cold weather conditions in Ontario during the winter of 2001-2002 were still intact this spring. The company reports that nine of the 10 permanent repairs done in the City of Barrie were intact in the second year, while the 10th was eliminated from the trial in a street restoration. Benefits of the system included a 67 percent savings compared to traditional costs for temporary winter patching and spring replacement. A full report on the trial is available from Cleat America.

Dealing With Winter Potholes: injection patching picks up the pace of permanent winter patching

Better Roads magazine, November 2005

[http://www.betterroads.com/content/Issue-](http://www.betterroads.com/content/Issue-Story.45.0.html?&no_cache=1&tx_magissue_pi1[keyword]=winter%20patch&tx_magissue_pi1[pointer]=0&tx_magissue_pi1[mode]=1&tx_magissue_pi1[showUid]=261)

[Story.45.0.html?&no_cache=1&tx_magissue_pi1\[keyword\]=winter%20patch&tx_magissue_pi1\[pointer\]=0&tx_magissue_pi1\[mode\]=1&tx_magissue_pi1\[showUid\]=261](http://www.betterroads.com/content/Issue-Story.45.0.html?&no_cache=1&tx_magissue_pi1[keyword]=winter%20patch&tx_magissue_pi1[pointer]=0&tx_magissue_pi1[mode]=1&tx_magissue_pi1[showUid]=261).

Originally viewed as an expensive method, spray injection has been gaining favor because the patches are more likely to remain in place than some other methods, which can mean a lower-cost repair over the long haul. Spray injection is a good winter repair method because it is highly mechanized. When using a self-contained patcher, the repair machine operator completes the whole repair job in four steps, working from a heated cab.

LaPorte County Faces Winter Challenges: innovation and frugality help this snow-belt county meet its seasonal needs

Better Roads magazine, April 2006

[http://betterroads.gcnpublishing.com/content/Issue-](http://betterroads.gcnpublishing.com/content/Issue-Story.45.0.html?&no_cache=1&tx_magissue_pi1[pointer]=0&tx_magissue_pi1[mode]=1&tx_magissue_pi1[showUid]=185)

[Story.45.0.html?&no_cache=1&tx_magissue_pi1\[pointer\]=0&tx_magissue_pi1\[mode\]=1&tx_magissue_pi1\[showUid\]=185](http://betterroads.gcnpublishing.com/content/Issue-Story.45.0.html?&no_cache=1&tx_magissue_pi1[pointer]=0&tx_magissue_pi1[mode]=1&tx_magissue_pi1[showUid]=185).

Scroll to: Pothole problems

Potholes are one of the biggest winter challenges that LaPorte County, Indiana faces. They fight the holes using two patching machines. The product they produce is superior to rough patching, according to Robert Young, Supervisor of the LaPorte County Indiana Highway Department. They still do some rough patching, even though it won't hold, because the patching machines can only do a mile of road every day or so.



Winter pothole repair is more economical with use of oil storage tanks that keep the oil warm and agitated, ready for use.

The patching machines have worked so well, that the department demonstrated them for the city of LaPorte. The city department now has its own machine. The only caveat to having patching machines, Young says, is that you need to have your own tanks to store the oil, keep it warm and agitated. Otherwise, crews are forced to start patching once oil is delivered and weather conditions don't always allow that luxury. LaPorte County has two large storage tanks that allow them to store several thousand gallons of oil for future patching projects.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com

Call 608-628-3806 or e-mail with questions.



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Andrew Kubista/Steven Haider, Mn/DOT, Andrew.Kubista@dot.state.mn.us via Linda Taylor (Mn/DOT)

Title of proposed research project: Correct Recording of Material Usage for Snow & Ice operations

1) Background: There is a continually occurring problem in reconciling the amount of material an operator reports applying to a route(s), to what the truck controls are recording, to what is actually subtracted from our stockpiles. These amounts are continually being adjusted and modified to reconcile our stockpiles at the end of the year and the odd amounts are being added or subtracted equally over the various snow plow routes resulting in inaccurate information.

2) What is the specific problem or issue? Operators are unsure how much material they are really applying or they do not record the information until a different date and time and the information they remember is different than that actually utilized.

3) List the proposed research objectives and tasks.

- a. Develop an automated download type of program that will print for the operator some type of hard copy report of the material usage for their shift that lists the material used and the amount.
- b. Design and develop a small printer that can be mounted by the Dickey John controls in the truck that will print out a material usage ticket/report for the operator.

4) What would be the product(s) of the research?

- a. Small user friendly printer for amount usage tickets.
- b. User friendly program to automatically download the material usage into the printer.

5) How would the results benefit DOTs? How would they be used?

A. the information would help DOTs more accurately track material usage, application rates, and result in more accurate usage reports and less "adjusted material" occurrences.

6) List the estimated funding needed. \$100,000 to 150,000

7) List the estimated timeline for completing the research. 12 months

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

RCA programming is developing a function to automatically deduct the amount of material an operator enters for snow and ice operations from the stockpile of the location selected. The total amount of material located at each stockpile would be updated by a WMS Representative.

Syntheses of Best Practices- Road Salt Management: 7.0 Design and Operation of Road Maintenance Yards

Transportation Association of Canada, September 2003

<http://www.tac-atc.ca/English/pdf/design.PDF>.

This is one in a series of Syntheses of Best Practices related to the effective management of road salt use in winter maintenance operations.

Scroll to: Monitoring (Page 8)

Monitoring may include the following:

- The use of weigh-in-motion (WIM) sensors at the entrance and exit of the maintenance yard to confirm recorded amounts and track dispatches.
- WIM would work well in conjunction with a loader scale sensor so the operator is in control of the load and his good judgment can be confirmed.

McHenry County implements GIS technology to enhance snowplow application

American Public Works Association Reporter Online, October 2005

http://www.apwa.net/Publications/Reporter/ReporterOnline/index.asp?DISPLAY=ISSUE&ISSUE_DATE=102005&ARTICLE_NUMBER=1147.

McHenry County is one of the fastest growing counties in Illinois. The county developed a GIS Web site to manage the snowplow fleet and to analyze the application of salt along routes in an effort to maximize the use of limited resources. This article covers the implementation of wireless, GPS, laser and other latest technologies for data collection, n-tier distributed system architecture powered by ArcIMS and ArcSDE software, benefits achieved and lessons learned from the county's experience.

Scroll to:

- **Going wireless with the development of the Drive by Download system**
McHenry County Division of Transportation worked with a vendor to develop a system that would download the data using a wireless connection as the vehicles entered the maintenance shed. The result was the Drive by Download system, consisting of several components that allow the wireless transfer of data from one or many trucks to a central computer. Formatted data can be used to determine how much material (salt, brine, etc.) was used in snow removal and ice prevention, where the vehicles were located, what time, speed vehicle was traveling, and equipment fault codes, etc.
- **Component 2: Developing the Intranet Administrative Application**
After the data is uploaded to ArcSDE through the uploader it is automatically pulled by an ArcIMS Web site. An intranet application allows users within the county, with appropriate permissions, to access the snowplow trucks' information. Using ESRI ArcIMS technology, this intranet system is built with ArcIMS Java Connector, HTML and JavaScript. Functions of the intranet Web site include:
 2. User can use identify tool to get information such as spray mode, pavement temperature, speed, salt applied and etc.

Ground speed applicators ease winter maintenance

Technology News (Iowa LTAP), November / December 2000

http://www.ctre.iastate.edu/pubs/Tech_News/2000/novdec/groundspeed.pdf.

Ground speed applicators... record the amount of each material type used daily and even keep a year-to-date total.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com

Call 608-628-3806 or e-mail with questions.



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Dennis Burkheimer, Iowa Department of Transportation, dennis.burkheimer@dot.iowa.gov

Title of proposed research project:

Deicing Chemical, Additive or Mix Performance Standard

1) Background:

Every year manufacturers introduce a new deicing chemical, additive or mixture for use in snow and ice operations. Users do not currently have a method to measure the performance capabilities of these new products other than the corrosion work done by the PNS group.

2) What is the specific problem or issue?

There is a need to establish a set of performance tests that can be required of all deicing chemical, additives or mixture manufacturers to provide more performance information on their product.

3) List the proposed research objectives and tasks.

The objectives for this project are:

1. Literature search of existing laboratory performance tests for deicing chemicals, additives or mixtures
2. Identify the best tests to use to measure performance (ice melting, undercutting, freezing point, penetration, viscosity, specific gravity, BOD, etc.)
3. Develop lab testing protocols and procedures if suitable tests are not already available
4. Develop matrix of performance tests to make it easier for users to identify the best product for their operations
5. Work through AASHTO to establish the performance tests as a standard

4) What would be the product(s) of the research?

Establish laboratory tests that can be applied to all deicing chemicals, additives and mixtures to measure performance. Manufacturers would then be required to have the tests run at independent laboratories before they can be marketed or used by Clear Roads states. The laboratory tests could also be combined with the corrosion tests required by PNS states to provide a comprehensive testing requirement for deicing chemical or additive manufacturers.

5) How would the results benefit DOTs? How would they be used?

Developing a standard set of performance tests for deicing chemicals, additives and mixtures will allow users to be more informed on how the product may work in their operations. The test can allow users to better match a deicing chemical, additive or mixture to better suit their specific roadway environment based on performance.

6) List the estimated funding needed.

\$200,000.00

7) List the estimated timeline for completing the research.

12-24 months

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

SHRP H-332- Handbook of test methods for Deicing chemicals

Properties of Mixed Winter Roadway Chemicals

Research Problem Statement -- TRB Committee on Winter Maintenance (AHD65)

Developed February 2006

<http://www.trb.org/committees/rps2006/RPS-AHD65-2006-02.pdf>.

Research: Independent laboratory data on the performance of deicing chemicals and blends of chemicals will be collected. Existing data will be reviewed and verified. Additional testing will be conducted to establish performance data on blends of chemicals. A survey of chemicals and blends in common use will establish the final testing program. Likely materials will include sodium chloride, calcium chloride, magnesium chloride, CMA, potassium acetate and additives intended to reduce corrosion. Data collection will include the phase properties (primarily crystallization points under expected storage conditions) plus SHRP test procedure data for ice melting capacity.

Alternative Deicing Chemicals

Research in Progress – U.S. Department of Transportation

<http://rip.trb.org/browse/dproject.asp?n=10286>.

Abstract: The project covers the laboratory testing, in collaboration with BP Chemicals, to find an alternative deicing chemical to rock salt. The material developed will need to be cost effective and have minimal corrosiveness effects on steel reinforcement in concrete.

Ice Melting Performance for Ice-Control Chemicals

Wilfrid Nixon, Ju Qiu, Lin Qiu, George Kochumman and Jing Xiong: University of Iowa

TRB 84th Annual Meeting Compendium of Papers CD-ROM

Paper Submission: July 31, 2004 [No. 05-1731.pdf].

Abstract: A number of factors may impact the choice of ice control chemicals for a given agency or in a given circumstance, as noted by Nixon and Williams¹. These factors are in essence one way in which the performance of ice control chemicals can be quantified, and as such could be incorporated into specifications to ensure selection of the best chemical(s) for a given agency to use in its winter maintenance activities. The definition of best should be a function of the given agency's needs. Performance measures for ice control chemicals are important because they are the basis for a quality control program for the acceptance of those chemicals. This paper presents a series of performance measurement tests for chemicals, and discusses the role that they can play in such a quality control program. It extends some preliminary results on simple tests (viscosity and specific gravity) presented earlier (2). This paper examines the ice melting test, the freezing point test, and the ice penetration test as applied to seven different ice control products. The ice control chemicals tested were all as supplied by various agencies, rather than being supplied directly from manufacturers. The paper evaluates the suitability of the three tests as performance measurement tools for ice control chemicals, and also assesses the manner in which they might be used in a quality control program.

Effectiveness of Alternative Chemicals for Snow Removal on Highways

Liping Fu, University of Waterloo; Rudolph Sooklall, University of Waterloo; and Max. Perchanok, Ontario Ministry of Transportation

TRB 85th Annual Meeting Compendium of Papers CD-ROM

Paper No. 06-1691.

Abstract: This paper describes an empirical study aimed at quantifying and comparing the effectiveness of several alternative chemicals for snow and ice control under specific weather, site and traffic conditions. Data collected from a large scale field test are used in this analysis, involving measurements on snow cover, weather and pavement conditions, and treatment operations at 10-minute intervals over 16 snowstorms. The paper details a case-by-case comparison of several alternative chemical treatments including dry salt and salt pre-wetted with different agents. A set of statistical models are developed and used to explain the effects on snow melting trend of various weather and treatment factors.

Effectiveness of Alternative Chemicals for Snow Removal on Highways

From TRB Transportation Research Record: Journal of the Transportation Research Board No. 1948, 2006

<http://pubsindex.trb.org/document/view/multi.asp?pub=1&recordlist=788437>.

Transportation Research Record 1948 (Management and Delivery of Maintenance and Operations Services) contains 19 papers that explore winter maintenance, surface transportation weather and other topics. This paper details a case-by-case comparison of several alternative chemical treatments including dry salt and salt prewetted with different agents. Statistical models are developed and used to explain the effects on snow melting trend of various weather and treatment factors. To view the Abstract, scroll to "Components" and click on the paper title.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com. Call 608-628-3806 or e-mail with questions.



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Dennis Burkheimer, Iowa Department of Transportation, dennis.burkheimer@dot.iowa.gov

Title of proposed research project: Carbide blade wear and alarm system

1) Background:

Carbide inserts used in snow plow blades are often replaced too early or too late during snow removal operations resulting in a waste of material and money or possible damage to the moldboard. Wear on carbide blades is typically based on the type of roadway environment, contamination on the roadway, angle of attack and pressure. The angle of attack and pressure are often controlled by the equipment operator based on what they feel is needed to remove the snow and ice from the roadway. Equipment operators often estimate how long the carbide blade will last based on past and estimated wear. If replaced too early, there is a cost to the agency for wasted materials. If replaced too late the wear will move into the moldboard at a significant cost to the agency and down time for the plow.

2) What is the specific problem or issue?

Equipment operators do not know the optimal time for replacing carbide inserts. If replaced too early, there is a cost to the agency for wasted materials. If replaced too late the wear will move into the moldboard at a significant cost to the agency and down time for the plow.

3) List the proposed research objectives and tasks.

The objectives for this project are:

1. Complete a literature search of research conducted on devices used to measure wear in a related industry.
2. Develop and test a prototype in one Clear Roads state

Provide final design and specifications for the system

4) What would be the product(s) of the research?

Develop a method to provide snow plow operators with a measurement of wear on carbide inserts used in snowplow blades for snow removal operations. The system should provide users with a current wear rating (height of blade), expected life of the blade (based on historical miles and wear) and an audible and visible alarm when the carbide reaches a specific threshold.

5) How would the results benefit DOTs? How would they be used?

A state DOT may use several thousand carbide blades in a winter season. Additional wear life on carbide blades would result in savings to the agency for materials and labor and would also allow snowplows to operate longer periods without changing plows.

6) List the estimated funding needed.

\$100,000.00

7) List the estimated timeline for completing the research.

12 months

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

Snowplow Sensor

Research in progress – New Mexico State Highway and Transportation Department

<http://rip.trb.org/browse/dproject.asp?n=3345>.

Abstract: If snowplow blades are not replaced when worn, there is the potential for damage to the mould board. Damage results in cost to the department, as well as down time for repair when needed for snow removal. There is a need for a low-cost sensor to alert snowplow operators when it is time to replace the blade. The first sensors were installed in December 2000, a product report is forthcoming.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com. Call 608-628-3806 or e-mail with questions.



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Dennis Burkheimer, Iowa Department of Transportation, dennis.burkheimer@dot.iowa.gov

Title of proposed research project:

National Winter Driver Safety Media Campaign

1) Background:

Funding was provided by Clear Roads in 2006 to help develop a national winter driver safety message and accompanying material. Individual states were expected to develop their own media items from the slogans, messages and logos developed by Public Information Officers.

2) What is the specific problem or issue?

To get the message before more drivers will require a more concentrated media effort and additional funding to cover most of the nation.

3) List the proposed research objectives and tasks.

The objectives for this project are:

1. Determine with the assistance of the PIOs or other marketing group a multiple year strategy for the roll-out of the safety message in multiple states in the fall of 2007.
2. Identify key media products to convey the safety message
3. Develop and distribute media products

4) What would be the product(s) of the research?

Clear Roads is developing a national winter driver safety message and accompanying literature the assistance of several Public Information Officers at Departments of Transportation. Initial funding of \$10,000 was provided to initiate the effort and to get initial items purchased for the project. In order to make the roll-out of the message a success and get the attention of more motorists additional funding is needed to help purchase and distribute any products developed with this campaign. Getting the message before more motorists may help drive the message home and the additional funding will help get the materials to both member and non-member state DOTs.

5) How would the results benefit DOTs? How would they be used?

Thousands of people are killed each year in crashes during the winter. One of the leading causes of winter crashes is excessive speeds for the existing conditions. The safety message selected by the Public Information Officers and Clear Roads members is, "Ice and Snow, Take it slow" which addresses one of the leading causes of winter crashes. The payoff will be reduced crashes if the message can be delivered effectively.

6) List the estimated funding needed.

\$100,000.00

7) List the estimated timeline for completing the research.

12-24 months

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

Colorado DOT Winter Driving Public Service Announcements (PSAs)

<http://www.dot.state.co.us/TravellInfo/MediaRoom.htm>.

The CDOT Media Room provides links to four examples of winter driving PSAs – two audio and two video.

Television Commercial / PSA Rates Madison, WI
WKOW TV 27 (5727 Tokay Blvd., Madison)

Contact: Dave Kuehn- General Sales Manager, phone 608-661-2735, email dkuehn@wkowtv.com.

I usually advise my local clients that, unless you have a rich uncle who just died, you're going to get a lot more exposure concentrating on areas around prime time. For example, my cheapest prime time show is \$400 for a 30-

second spot, and I go all the way up to \$3,850 -- it's all based on audience. For that kind of money, you could buy an awful lot of spots during our newscasts and actually reach more people. The following would be examples of rates for 30-second spots this coming January and February: during our morning news (5 to 6 a.m.), \$35; Good Morning America (7 to 9 a.m.), \$75; our new local news which will begin January 8 (11 to 11:30 a.m.), \$50; the 5 p.m. news, \$125; 6 p.m. news, \$200; our new local newscast, which will also begin January 8 (6:30 p.m.), \$150; and the Monday through Friday 10 p.m. news, \$325. Fifteen-second spots would cost 65 percent of those figures while one-minute spots would be double. For public service messages that are cash buys, we usually match that total in no-charge spots. I will also mention that we can also do production of spots here, with rates running from \$750 to \$1,000.

WISC TV 3 (7025 Raymond Road, Madison)

Contact for questions concerning paid air time: Mark Friesch- Director of Sales, phone 608-277-5124, email mfriesch@wisctv.com.

Contact for questions concerning free PSAs: Craig Vursaw- Programming Department, phone 608-277-5147, email cvursaw@wisctc.com.

Paid air time (Friesch)

"Summing up our rates for spots during the news on a Monday to Friday basis, during the morning news between 6 and 7 a.m., you're looking at about \$150 for a 30-second spot. CBS Morning News between 7 and 9 a.m. is going to run about \$60. Between 5 and 6 p.m., you're looking at about \$75. For the 5 p.m. news in January, you're looking at about \$225 to \$250. We're kind of a supply and demand medium, so it kind of depends on how busy we are at that time, but it's probably better to figure a little high, like \$250 for a 5 to 5:30 p.m. Live at 5 position. You're going to be looking in the neighborhood of about \$375 for the 6 p.m. news, and about the same price for the 10 p.m. news. We have a noon news as well, which is going to run about \$90. Other day parts, it kind of depends on the demographic. If you're looking pretty much at adults 18+, that can really be any time of the day. If you're looking at, say, a Dr. Phil-Oprah from 3 to 5 p.m., you're probably going to be looking in the neighborhood of \$125. Late night, say 10:30 to 11:30 Letterman, you're also going to be in the neighborhood of \$125. Unless you're looking at soap operas, that's pretty much our day, excluding prime. Prime is kind of hard to give you, because it really is dependent on the show. Like some nights, Thursday for example, CBS is really strong, and you're going to be in the neighborhood of \$800 to \$1,000, and another night, such as Saturday, you're going to be as low as \$200 to \$250. So it really kind of depends on your budget. If you've got a heavy duty budget, and you really want high reach stuff and high visibility stuff, you're going to be looking at more the high visibility prime. But if your budget's limited, you're probably going to be looking at very little, if any, prime. Prime is kind of an as-needed commodity, and I probably wouldn't recommend it as sales manager unless, like I said, you've got pretty deep pockets. We have a state-of-the-art production facility. As a rule of thumb, our commercials generally start at about \$1,000 to \$1,500, and that's for an average spot. Ninety percent of the spots that we do here are \$1,500 or less."

Free PSAs (Vursaw)

"I'd say 99 percent of the PSAs we get in are totally unsolicited -- there are literally hundreds of them here waiting for us to look at. I do give considerably more preference to local PSAs -- the chance of them running are greater than a national PSA. Criteria for PSAs include nonprofit status, and we prefer that there is no corporate sponsorship in the spot. PSAs take a back seat, obviously, to commercials and to promotions for other shows that we air. There are times during the day when we might be able to plug in PSAs, but that's very unpredictable and you can't count on it. On Channel 3, PSAs are more likely to run in the 12 midnight to 5 a.m. time slot. On our cable channel (My Madison TV), PSAs are more likely to run in better time periods, though viewership is not quite as high."

WMTV 15 (615 Forward Drive, Madison)

Contact: Don Vesely- Local Sales Manager, phone 608-443-0212, email dvesely@nbc15.com.

"We have a handful of agencies here in town, and obviously around the state, that will do different campaigns with Wisconsin DOT. We do have campaigns on the air and we pretty much treat each of them the same regardless of where they're coming from: with the cash schedule we do the best job we can with fair rates -- average unit rates -- like we do with any client. One thing that we do differently with Wisconsin DOT is to run as many spots as possible in a PSA rotation. The typical cost per thousand would be, safest to say, \$10 for every 1,000 adults that you reach. So for an investment of \$10,000, you would reach one million adults over 18 years of age. Say that would take 200 commercials you would air, we would run you 200 additional commercials at no charge. We match the schedule and the amount of spots and run that, almost treating you as a not-for-profit organization. What's unique at this station is that we run the no-charge commercials as part of our sales inventory, so they're pretty much treated as contracted public service announcements and have a much better chance of running. We run probably 80 to 90 percent of those spots without any chance of getting bumped, and if they do get bumped by a cash spot, we make it good the next day. Bear in mind that new programming has altered many historical prime ratings. When your budget is determined, it might be in your best interest to allow me to help build a package for

you, as I have a pulse on viewership inventory and can help lower your cost per thousand. As an additional option, you might want to consider sending press releases to our news director at the station – Rob Crain – to try to get some news coverage along with your commercial spots.”

Related attachments:

- WMTV rate chart. This provides a listing of fees charged for a 30-second spot during the various WMTV programs, and includes the station’s quarterly projections (“Book”) for adults in the Madison area who will view the program (“000/P18+/000”), and their share of the viewing market (“000/P18+/Shr”), based on Nielsen Company data.
- WMTV coverage map.

Radio Commercial / PSA Rates Madison, WI

Entercom Madison [WOLX FM, WMMM FM and WCHY FM] (7601 Ganser Way, Madison)

Contact: Angela Drake- Account Executive, phone 608-826-1212, email adrake@entercom.com.

Related attachments:

- WOLX backgrounder.
- WMMM backgrounder.
- WCHY backgrounder.

These provide information on each of the stations including coverage maps and listener profiles.

- Angela Drake proposal

Provides commercial scheduling / pricing options and recommendation developed by Angela. Points of interest include:

No-charge matches for 30-second and 60-second paid commercials. (“Bonus commercials typically run 6 a.m. to 6 a.m.,” Angela says. “I was able to convince my superior that the DOT message should be able to run 6 a.m. to 12 midnight to avoid overnights. It is entirely possible that all of those commercials would run ‘prime time’ -- 5 a.m. to 8 p.m. -- as we place 6a-12mids in the best times available the weeks they run.”)

Longevity and multiple station discounts. Using any station for eight weeks or more in the first quarter merits a 5 percent discount. Using two or more Entercom stations merits a 5 percent discount.

Recommendation. Eight weeks of 30-second commercials on WOLX and WCHY: total number of commercials 768; total cost \$19,440 (factoring in discounts for longevity and multiple station); average cost per commercial \$25.

Commercial production. \$50 per commercial, any length and any number of audio elements.

WORT FM (118 S. Bedford, Madison)

Contact: Raechel Pundsack- Business and Foundation Development Director, phone 608-256-2001, email busdev@wort-fm.org.

“In addition to the support of listener sponsors (WORT was once again voted Madison’s Favorite Radio Station in the Isthmus Reader’s Poll), local businesses and organizations play a crucial part in the station’s overall vitality. We do quite a number of public service announcements, and we have a number of different venues. We have a radio kiosk announcement that runs five times a day from 6 a.m. to 8 p.m., and the different news and music programmers read public service announcements. We could certainly come up with an announcement that would get the word out about reducing driving speeds during winter. There’s also the option of doing some paid underwriting. Like all public radio and television stations, community radio is governed by the FCC, which says advertising is not permitted. But we are able to offer businesses the opportunity to underwrite 20-second message spots. These spots are available pretty much any time through drive time – 6 a.m. to 6 p.m. – and we can do an evening rotation as well. If you were to do some paid underwriting, we could augment that with the kiosk announcements, to help ensure that your message would run during the daytime.”

Related attachments:

- WORT underwriting rates.
- WORT underwriting FAQ.
- WORT program schedule.

Clear Channel Radio- Madison [WIBA AM, WIBA FM, WZEE FM, WTSO ESPN 1070 AM, WMAD FM, WXXM FM] (2651 S. Fish Hatchery Road, Madison)

Contact: Eric West- Group Sales Manager Clear Channel Radio Madison AM Division, phone 608-663-7300, email EricWest@clearchannel.com.

“Quite frankly, these days TV is not the greatest buy, because of time shifting and DVRs. I don’t know how you use TV or if you have a DVR, but I never see commercials because I time-shift everything. If there’s a program I want to watch, I’ll record it and watch it at my leisure, and when I watch the program, I speed through the

commercial breaks. If you want to talk to people about safe winter driving, it's probably more effective to talk to people while they're in their cars, over the radio, than when they're in their living room. Where you consume the message has a lot to do with how well it sinks in. Also, according to a recent Arbitron and Edison Media Research study, 94 percent of the public flips the TV channel when a commercial comes on, compared to 26 percent who change the channel when a radio commercial comes on. If you could provide me with some parameters, I think we could put together a winter driving campaign for you that would be educational -- and entertaining: it's all about the delivery of the message."

Related attachment:

- Clear Channel Rate Chart.

Abbreviations used in the rate chart headings include the following:

AVG RTG: Average Rating- average share of the listener market for that time period;

CUME RTG: Cumulative Rating- share of total listeners during a week;

FREQ: Frequency- average number of times a typical listener will hear a spot during a week;

NET REACH: Net Reach- number of listeners reached during a week;

EFF RCH: Effective Reach- share of total listeners who hear the spot, based on the Frequency;

GRP's: Gross Rating Points; and

CPP: Cost Per Point.

The "\$0" figure that appears under the RATE heading indicates no-charge commercials, or PSAs.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com. Call 608-628-3806 or e-mail with questions.



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Dennis Burkheimer, Iowa Department of Transportation, dennis.burkheimer@dot.iowa.gov

Title of proposed research project:

Double-paned windshield test and evaluation

1) Background:

Keeping windshields clear of winter precipitation on snowplow trucks is a perennial problem. Ice and snow can build-up on the cowl and around the windshield wipers making visibility difficult during a winter storm. The interior of the windshield can also become covered with frost or moisture that makes visibility on both sides of the windshield difficult. A Clear Roads research report identified the use of double paned windshields in South Dakota that appeared to be effective at reducing winter precipitation on windshields.

2) What is the specific problem or issue?

It is not known what all is involved in installing and maintaining these secondary windshields and how effective they are at maintaining good visibility for equipment operators.

3) List the proposed research objectives and tasks.

The objectives for this project are:

1. Literature search the use of double-paned windshields to reduce winter precipitation
2. Identify 1-2 Clear Roads States to test double paned windshields in a snowplow
3. Identify manufacturers that currently make or can make double-paned windshields for the 1-2 Clear Roads test states
4. Install and evaluate the windshields for one winter season

4) What would be the product(s) of the research?

Understand more about the effectiveness of double-paned windshields to help reduce winter precipitation through actual test and evaluation in the field.

5) How would the results benefit DOTs? How would they be used?

Keeping windshields clear of winter precipitation on snowplow trucks is a perennial problem. Eliminating or reducing this problem will provide improved visibility for equipment operators and improve their safety during winter storms.

6) List the estimated funding needed.

\$10,000.00

7) List the estimated timeline for completing the research.

12 months

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

Synthesis of Best Practices for Eliminating Fogging and Icing on Winter Maintenance Vehicles, Clear Roads, CTC & Associates LLC, September 2006

Bon Homme County, South Dakota

Contact: Ray Haenfler, Equipment Technician- South Dakota DOT, phone 605-668-2929, email

Ray.Haenfler@state.sd.us.

(A brief, related article appears on the National LTAP / TTAP Web site at

<http://www.ltapt2.org/tips/showtip.php?id=2.>)

Ray told us that he was working for the Bon Homme County Highway Department when he got the idea for the double-pane windshields.

“There was a company that was making a plastic stick-on for the inside of windshields that was designed to insulate like a second piece of glass,” Ray said. “But during summer, too much sunlight made the stick-ons brittle, and they’d break, get scratched up and that kind of thing, so they were only good for about one winter. So what we started doing was to take the old rope rubber seal for windshields and glue another pane of glass to the inside of the windshield. We would stick the rope seal to the new glass, and then stick it right up against the existing glass. What that does is keep your outside glass cold enough that nothing will stick to it, and your inside glass warm enough so that it won’t frost up. The only place we’d ever have ice buildup was where our rope seal would set along the outside edge.

“We did it in motor graders mostly, 11 of them I think, because that’s where we didn’t have enough heat to keep the windows clean. We also had it in about five or six trucks. For some of the setups we would build little brackets, so if the second pane of glass came loose (which it never did), we’d have something to catch it with. About the only cost involved was the second pane of glass, and rope rubber seal that we were gluing them in with. It worked very well for us and we had such good luck with it. The guys just loved it because it took away their visibility problem. Before, they were just looking through little holes that they were scratching out with ice scrapers because they were frosting up so bad.

“I tried to find a company that would make me the rubber seal to go in where I could mount two windshields, one on the inside and one on the outside, but never came up with anybody. They didn’t seem to want to get into it. It’s a little surprising to me that the motor grader companies don’t come up with an option to double-pane windshields right away.”

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com. Call 608-628-3806 or e-mail with questions.



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Dennis Burkheimer, Iowa Department of Transportation, dennis.burkheimer@dot.iowa.gov

Title of proposed research project: Combination snowfence

1) Background:

On many roadways maintenance forces attach lath or plastic snowfence to existing right of way fences to help control blowing and drifting snow. The practice is a very effective method to control blowing and drifting problems if the right of way area is of sufficient size to store the blown snow. The addition of the lath or plastic fence is not very attractive and is also duplication of effort with the installation of two fences.

2) What is the specific problem or issue?

The addition of the lath or plastic fence is not very attractive and is also duplication of effort with the installation of two fences.

3) List the proposed research objectives and tasks.

The objectives for this project are:

1. Literature search of snowfences to control blowing and drifting snow in areas with limited storage and requirements of existing right-of-way fences
2. Design a dual purpose fence that can reduce blowing and drifting problems while also meeting the needs for livestock control
3. Contract with a manufacturer to create a test fence
4. Test the combination fence in all Clear Roads members states

4) What would be the product(s) of the research?

Develop one fence that can be used to control blowing and drifting snow and livestock along existing right-of-way lines.

5) How would the results benefit DOTs? How would they be used?

Blowing and drifting snow are a common problem in many states. The development of a combination fence to handle both blowing snow and livestock would eliminate the practice of adding snowfence to existing right-of-way fences.

6) List the estimated funding needed.

\$100,000.00

7) List the estimated timeline for completing the research.

12-24 months

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

SHRP H-381

Controlling Blowing and Drifting Snow with Snow Fences and Road Design

Ronald Tabler, prepared for NCHRP August 2003

<http://www.sicop.net/Tabler.pdf>

Scroll to: Chapter 6.3.6.1- Wyoming Snow Fence (Page 148)

The designs presented here are able to withstand wind gusts in excess of 100 mph, snow settlement pressures associated with complete burial, and forces imposed by livestock.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com. Call 608-628-3806 or e-mail with questions.



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Dennis Burkheimer, Iowa Department of Transportation, dennis.burkheimer@dot.iowa.gov

Title of proposed research project:

Synthesis of methods to prevent frost/ice/snow formations on bridge decks or roadways using alternate energy sources

1) Background:

There have been a number of research projects conducted over the last decade where alternative energy sources have been used to reduce or eliminate the formation of ice, snow or frost from bridge decks and roadways. Geothermal energy has been used to heat bridge decks and some experimentation has also been done to test various additives to concrete or asphalt pavements that can then be used to carry electrical power to keep the surface free of winter precipitation.

2) What is the specific problem or issue?

The alternative energy options have not been compiled into one place, which would help states make comparisons and informed decisions.

3) List the proposed research objectives and tasks.

Identify and compile research project results that have been conducted over the last decade (1995-present) on the use of alternative energy sources to help eliminate or reduce the formation of winter precipitation from roadways or bridge decks.

4) What would be the product(s) of the research?

Synthesis of the latest information on alternative energy methods for reducing winter precipitation from roads and bridges.

5) How would the results benefit DOTs? How would they be used?

This synthesis will provide the latest information on alternative energy methods tested in the past to help reduce or eliminate winter precipitation from roadways and bridges. The payoff to the snow and ice community would be a report on the successes and failures of research into the use of alternative energy methods to reduce or eliminate winter precipitation on roadways and bridges.

6) List the estimated funding needed.

\$25,000.00

7) List the estimated timeline for completing the research.

12 months

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

Pavement Snow Melting

John Lund, Geo-Heat Center

http://www.geothermie.de/egec-geothernet/ci_prof/america/usa/pavement_snow_melting.htm.

Abstract: The design of pavement snow melting systems is presented based on criteria established by American Society of Heating, Refrigerating and Air-Conditioning Engineers. The heating requirements depends on rate of snow fall, air temperature, relative humidity and wind velocity. Piping materials are either metal or plastic, however, due to corrosion problems, cross-linked polyethylene pipe is now generally used instead of iron. Geothermal energy is supplied to systems through the use of heat pipes, directly from circulating pipes, through a heat exchanger or by allowing water to flow directly over the pavement. Examples of geothermal and other systems in New Jersey, Wyoming, Virginia, Japan, Argentina, Canada, Switzerland and Oregon are presented.

Development of Highway Snow Melting Technology Using Natural Energy

Hiroshi, T; Nobuhiro, T; and Nobuo, K; Xth PIARC International Winter Road Congress

<http://ntlsearch.bts.gov/tris/search.do?b1=1&f1=0&t1=ctid%3A2585&r=1&d=tr&p=39&z=1&s=&o=>

Abstract: The principal method used to deal with snow on Japanese roads is snow removal, but in recent years, the prohibition on spike tires has increased the importance of measures to prevent freezing of road surfaces, and in an effort to reduce the amount of energy consumed by snow removal and snow melting equipment, highway snow melters are being introduced. Conventional snow melting technology which involves the use of heating wires and the spraying of water is plagued by problems: obtaining water, ground subsidence, etc., and high maintenance costs. In recent years, efforts have been made to replace this method by developing roadway snow melting technology that uses various kinds of natural energy. The following methods are being explored: underground water sources or steam; storing heat underground and circulating it under pavements; and using electricity generated by wind power.

Solar Culvert Deicer

Transportation Research Board, Research in Progress database

<http://rip.trb.org/browse/dproject.asp?n=12557>.

From Abstract: Water freezes in many culverts in winter, sometimes causing icing, washouts and flooding of major roadways. This study will select several culverts around the state of Maine that are likely candidates for water freeze and devise a solar deicer system to maintain flow.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com. Call 608-628-3806 or e-mail with questions.



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Dennis Belter, Indiana Department of Transportation (INDOT), dbelter@indot.in.gov

Title of proposed research project: Development of Snow and Ice Removal Performance Standard

1) Background:

INDOT is developing performance standards and measurements for various activities. A measurable performance standard for snow and ice removal is difficult to identify and as a result no standard has been developed.

2) What is the specific problem or issue?

A performance standard for snow and ice removal activities is needed. A performance standard may be developed by comparing road conditions to traffic count data. The research would explore the possibility of placing pavement sensors at existing traffic count stations. Issues to be addressed include; type of sensors to use, communications, data transmission, how to compare the data, development of a performance standard, presentation of the data and incorporation of existing equipment.

3) List the proposed research objectives and tasks.

The primary objective is to develop a performance measure for snow and ice removal by comparing pavement conditions and traffic count data. Weather data could also be used to verify accuracy of traffic counters. Traffic counters are currently installed statewide. Development of an inexpensive alternative to Road Weather Information Systems (RWIS) could provide a method to drastically increase the amount of pavement condition data. This could result in improved pavement forecasts.

Purdue University (Dr. McCullough) has the expertise and resources to perform this research project.

4) What would be the product(s) of the research?

The research would provide an automated method to develop a snow and ice removal performance standard, potentially a method to verify traffic count data, potentially an inexpensive alternative to RWIS sites and more accurate pavement forecasts.

5) How would the results benefit DOTs? How would they be used?

Performance standards are used nation wide. Most methods require a manual collection of data. The results of this research could provide an automated collection and calculation of a snow and ice removal performance standard. The performance standard can assist DOTs determine the success of their snow and ice removal activities.

6) List the estimated funding needed.

\$150,000.00

7) List the estimated timeline for completing the research.

It is estimated that 12 to 18 months would be required to perform the research. This would include preparation, one winter season followed by evaluation and reporting.

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

The Iowa State University Center for Transportation Research (CTRE) performed a research project sponsored by Aurora that evaluated winter weather effects on traffic speed.

A Pilot Study to Measure the Potential of Using Speed Recovery Duration as a Winter Maintenance Performance Measure

Chanyoung Lee and Bin Ran, University of Wisconsin at Madison

TRB 83rd Annual Meeting Compendium of Papers CD-ROM

Paper Submission Nov. 15, 2003 [No. TRB2004-002348.pdf].

From Abstract: To improve the effectiveness and the efficiency of winter maintenance activities the performance of the approach taken must be measured. The objective of this research was to develop winter maintenance performance measures using speed data from automatic traffic recorders (ATRs) and winter storm report data. An

attempt was made to combine the ATR speed data and the storm report data to determine the average vehicle speed reduction during a snow event relative to normal vehicle speeds at a location, and the duration of time needed from the minimum value to regain normal or average vehicles speeds. A determination was made related to whether this “speed recovery duration” might be an appropriate performance measure for winter maintenance.

Performance Measures for Snow and Ice Control in the Province of Alberta

Lynne Cowe Falls, University of Calgary; and Roy Jurgens and Jack Chan, Alberta Infrastructure and Transportation

TRB 85th Annual Meeting Compendium of Papers CD-ROM

Paper No. 06-0548.

From Abstract: This paper presents the results of a project to develop winter performance measures that address both the planning and operations of a large rural highway network. Preliminary results indicate that traffic volumes and speed data can be used to identify major storm events and as such may hold promise as repeatable, robust, relevant and responsive performance measures.

Simple Map-Matching Algorithm Applied to Intelligent Winter Maintenance Vehicle Data

Carola Blazquez, Ph.D. candidate, University of Wisconsin at Madison; and Alan Vonderohe, University of Wisconsin at Madison

TRB 84th Annual Meeting Compendium of Papers CD-ROM

Paper Submission July 31, 2004 [No. 05-1866.pdf].

Abstract: Intelligent winter maintenance vehicles are equipped with Automatic Vehicle Location technology, including Differential Global Positioning System (DGPS) receivers and various additional sensors that collect equipment status and material usage data. DGPS data points are associated with the nearest roadway centerline by calculating minimum perpendicular distances between each roadway centerline representation and the DGPS data points. Highly accurate roadway centerline maps and DGPS measurements are not always available. Thus, spatial mismatches may occur at converging and diverging roadways, divided highways and intersections. Decisionmakers use winter maintenance performance measures to evaluate achievement of goals and objectives, and to improve winter maintenance operations within public agencies. These performance measures are sensitive to spatial mismatches, which need to be resolved before calculating them. This paper presents a simple map-matching algorithm that resolves spatial ambiguities by determining the correct roadway centerline on which the vehicle is traveling.

Performance Measures for Snow and Ice Control Operations

NCHRP Project 06-17

<http://www.trb.org/trbnet/projectdisplay.asp?projectid=884>.

The objective of this research is to recommend methods and measures for assessing agency and contractor performance in snow and ice control operations. The research shall cover all road classifications.

Accomplishment of this objective will require tasks including:

Phase I: (1) Collect and review information relative to the use of performance measures in snow and ice control operations. This information should be obtained from domestic and foreign literature, contacts with highway agencies and industry organizations, and other sources. Identify relevant performance measures (e.g., pavement condition, friction, travel speed, resource allocation, time to achieve level of service, cost and extent of customer satisfaction). Describe how these measures vary for different roadway classes and storm characteristics. Through this review, also identify available approaches for evaluating the effectiveness and usefulness of these performance measures.

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com. Call 608-628-3806 or e-mail with questions.



2007 Research Proposal Form

Proposer name, organization and e-mail address:

Shane Larson, Illinois DOT, shane.larson@illinois.gov

Title of proposed research project:

The effectiveness of blending agricultural byproducts with more traditional liquid chemicals.

1) Background: ?

2) What is the specific problem or issue? Manufacturers of liquid agricultural byproducts claim effectiveness of their products at low temperatures, ease of use, easy application, decreased corrosiveness, increased residual value and effective lower cost. However, liquid agricultural byproducts are considerably more expensive.

3) List the proposed research objectives and tasks. The objective is to determine if agricultural byproducts can lower the effective temperature, increase the residual value and/or decrease the corrosiveness when blended with more traditional liquid chemicals. If it is proven that they can accomplish the above listed items, determine an optimum blending ratio to maximize efficiency.

4) What would be the product(s) of the research? Documented data showing the lower effective temperature, increased residual value, decreased corrosiveness and optimum blending rates versus traditional liquid chemicals.

5) How would the results benefit DOTs? How would they be used? DOT's could use the documented data to make cost effective decisions when purchasing liquid chemicals. If the agricultural byproducts can be proven to be effective, their use will make DOT's more efficient.

6) List the estimated funding needed. ???

7) List the estimated timeline for completing the research. 12 months

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

See this 2006 Clear Roads proposal below.

Hold the salt: ice fighting moves forward with new ideas and mixes

Government Buyer, May/June 2006

<http://www.eco-solutions.net/pdfdocs/GB-p16.pdf>.

Scroll to: "Supermix" blends products

Mark DeVries [of the Illinois DOT] said McHenry County had been using liquid mixtures mostly for prewetting of solids, but wanted to move to a liquid application in some uses. So, working with West Des Moines, Iowa, they looked at creating a mix of chemicals that would work well for them. The "Supermix" they came up with is 85 percent salt brine, 5 percent calcium chloride and 10 percent Geomelt, an agricultural byproduct from Grain Processing Corporation. "We manufacture our salt brine on site -- it's a good product and very inexpensive," DeVries said. "Calcium chloride is also very inexpensive... we looked at alternate chemicals, and there are many out there. The De-Ice 55 (Geomelt) is a sugar beet byproduct. The calcium chloride had a good response immediately, but would re-freeze later, and the De-Ice 55 had a great residual effect that we

liked.” The extended benefits of the mix -- residual effects have been seen up to a week after application -- are accompanied by a reduction on the bottom line as well, DeVries said.

(More information concerning Supermix preparation is discussed in: Blending Liquid Deicing Chemicals Precisely,

http://www.apwa.net/Publications/Reporter/ReporterOnline/index.asp?DISPLAY=ISSUE&ISSUE_DATE=102005&ARTICLE_NUMBER=1143)

Synthesis of Information on Anti-icing and Pre-wetting for Winter Highway Maintenance Practices in North America

O’Keefe, K. and Shi, X.: Western Transportation Institute College of Engineering, August 2005

http://www.coe.montana.edu/wti/wti/pdf/4W0169_Final_Report.pdf.

This report, prepared for the Pacific Northwest Snowfighters Association in collaboration with Washington State DOT, synthesized information obtained from a literature review and telephone interviews with maintenance personnel at 15 state departments and provincial ministries of transportation regarding the advantages and disadvantages of anti-icing and pre-wetting for winter highway maintenance. Concerns discussed include driver safety, human health, environmental stewardship, corrosion and costs.

Scroll to: interview question 9 (Page 60)- What kind of chemicals does your agency use and what is the cost?

- Colorado -- majority of liquids are $MgCl_2$, also use $MgCl_2$ with agricultural enhancement additives – corn based. $MgCl_2$ (\$0.34/gallon), for $MgCl_2$ with agricultural additives (\$0.60/gallon). $MgCl_2$ comes from Utah, $MgCl_2$ with agricultural additives comes from Minnesota. Also use IceSlicer for deicing which also comes from Utah. Use $MgCl_2$ for all three practices. (Respondent: Wayne Lupton, CDOT Director of Maintenance and Operations, phone 303-273-1840, email wayne.lupton@dot.state.co.us.)

Clear Roads Problem Statement
Pooled Fund #TPF-5(092)
Federal Fiscal Year 2007

I. PROBLEM TITLE

Agricultural Products vs. Salt Brine, Magnesium Chloride, and Calcium Chloride for Anti-Icing and De-Icing

II. RESEARCH PROBLEM STATEMENT

Manufacturers of liquid agricultural products claim effectiveness of their products at low temperatures, ease of use, easy applications, decreased corrosiveness, and effective lower cost. However, liquid agricultural products are considerably more expensive. Are the liquid agricultural manufacturer claims correct? Does the use of agricultural liquids provide a way to lower costs vs. salt brine, magnesium chloride, and calcium chloride?

III. OBJECTIVE

The objective is to see if the liquid agricultural products are a better alternative to salt brine, magnesium chloride and/or calcium chloride for anti-icing and de-icing.

IV. RESEARCH PROPOSED

Use the agricultural products in anti-icing and de-icing applications, alongside the salt brine, magnesium chloride and calcium chloride. Compare effectiveness, ease of use, corrosiveness, problems with application, and costs at different temperatures.

V. ESTIMATE OF THE PROBLEM FUNDING AND RESEARCH PERIOD

Recommended Funding: ???

Research Period: Two winters

VI. URGENCY AND PAYOFF POTENTIAL

The use of salt and other chlorides is a concern for the environment. If cost-effective, safer products are available, all transportation departments would benefit.

VIII. RELATED RESEARCH

University of Iowa

Evaluation of an Ice Ban Product as a Prewetting Agent for Snow Removal and Ice Control Operations, January 2000

http://www.virginiadot.org/vtrc/main/online_reports/pdf/00-r12%20.pdf

Introduction and Page 2

The purpose of this project was to determine if VDOT should use Ice Ban M50 for snow and ice control. Ice Ban is the registered trade name of a group of agricultural by-products patented for use as roadway deicing/anti-icing agents. Ice Ban is more expensive than traditional anti-icing and deicing chemicals. In 1997, the price for Ice Ban in Virginia was \$0.33/L (\$1.25/gal). The prices for more traditional anti-icing chemicals, converted to liquid measure, were \$0.015/L (\$0.06/gal) for NaCl, \$0.17/L (\$0.65/gal) for MgCl₂, and \$0.13/L (\$0.50/gal) for calcium chloride (CaCl₂). Based only on cost, it appears that Ice Ban cannot compete with the more traditional chemicals. However, if Ice Ban products can reduce corrosion of equipment, infrastructure damage, and the adverse environmental effects of traditional chemicals while maintaining the level of service provided by current anti-icing techniques, its use may be cost-effective.

Agricultural byproduct deicers are here to stay, January 2001

<http://www.betterroads.com/articles/brjul01a.htm>

Proof of the viability of the market is the creation of a new company formed by Minnesota Corn Processors and METSS Corporation. METSS is the developer of the new class of anti-icing materials that include First Down, effective to -34 degrees F, and All Clear, effective to -65 degrees F. Both contain no chloride salts at all, being made entirely of all-natural, organic materials. The corrosion characteristic is less than distilled water. All Clear has another advantage in boasting an indefinite shelf life. America West currently distributes both products.

Road Solutions, Inc. began distributing X-Ice this year after successful trial marketing by parent company Correlated Products, Inc. It's being used successfully in many Midwest state and local highway departments, and is made from the residue of grain and other agricultural products. It blends with magnesium chloride (called X-Ice M50) for an effective temperature to -20 degrees F, or with salt brine (X-Ice S50) down to -33 degrees F for liquid applications.

Cargill Salt makes a product called ClearLane with a molasses base. The liquid is used for spraying on rock salt as it's applied to roads and for prewetting to boost brine generation on the roads. It's a mixture of molasses and liquid magnesium chloride. ClearLane Treated Salt adds rock salt to the mix for a ready-to-go road deicer. Both products provide corrosion protection to user equipment.

FOCUS on anti-icing and deicing materials, August 2000

<http://www.betterroads.com/articles/prod800.htm>

Scroll to: Agricultural Mix

An environmentally safe product used for anti-icing, de-icing, and freeze proofing is M-50 Road Deicer from Mountain Products & Equipment. The patented agricultural by-product derived from processed grain or other sugar-content crops is mixed with liquid magnesium chloride to create the non-toxic, bio-degradable material. Applications for M-50 include anti-icing, deicing, stockpile treatment, prewetting, and freeze proofing. It has a freezing point of -40 degrees F and is less corrosive than distilled water. It re-activates in precipitation until diluted and prevents black ice and clear-weather frost.

IX. DATE AND SUBMITTED BY

Proposer: Mike Rivers, INDOT

Contact person:

Dennis Belter

Program Support Manager

Indiana Department of Transportation

IGCN Rm. N925

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Indianapolis, IN 46202

Telephone: 317-232-5424

Fax: 317-232-5551

dbelter@indot.state.in.us

January 24, 2005



2007 Research Proposal Form

Proposer's name, organization and e-mail address:

Kim Linsenmayer, CTC & Associates LLC, kim.linsenmayer@ctcandassociates.com

Title of proposed research project: Transportation Synthesis Reports on Winter Maintenance Issues

1) Background:

Winter maintenance professionals at DOTs around the country need to make numerous decisions related to policies, materials use, and budgets. Since many states face the same challenges, it makes sense to see how other states are addressing similar problems to take advantage of existing work or experience.

CTC & Associates LLC has produced nearly 150 quick turnaround Transportation Synthesis Reports for the Wisconsin Department of Transportation and the University of Wisconsin-Madison on a wide range of topics. TSRs are brief summaries of currently available information on topics of interest to agency technical staff. Online and print sources for TSRs include NCHRP and other TRB programs, AASHTO, the research and practices of other transportation agencies, and related academic and industry research.

2) What is the specific problem or issue?

DOT managers do not have the time to investigate how other states are handling similar issues. They need to make decisions quickly and can't afford to wait months or years for information that will help them do their jobs.

3) List the proposed research objectives and tasks.

CTC & Associates LLC would interview the Clear Roads representative(s) requesting the report to understand the goals and desired outcomes in the information gathering effort. CTC would then gather pertinent information related to the topic by means of Internet research, phone interviews and sometimes multi-state e-mail surveys. A completed report would be returned to Clear Roads for review within two to three weeks.

4) What would be the product(s) of the research?

A 3-10 page summary of current research, U.S. DOT guidance, Internet resources, journal abstracts, best practices and contact information related to the topic requested.

5) How would the results benefit DOTs? How would they be used?

Winter maintenance professionals around the country would benefit from the information gathered in the TSRs. Although the reports do not make specific recommendations for action, they help manager make decisions based on current national best practices. The reports would be posted on the Clear Roads Web site and announced via the Snow and Ice Listserv. This would increase the visibility of Clear Roads as a go-to resource for information related to winter maintenance and could encourage membership from additional states.

6) List the estimated funding needed.

\$5,000 for 5 TSRs.

7) List the estimated timeline for completing the research.

2 to 3 weeks for each TSR is requested

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

CTC has completed nearly 150 TSRs on a wide range of topics. For a sampling, see <http://www.dot.wisconsin.gov/library/research/reports/tsr.htm>

Submit proposal to:

Kim Linsenmayer at kim.linsenmayer@ctcandassociates.com
Call 608-628-3806 or e-mail with questions.