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**Highway Deicing™**

for the WINTER MAINTENANCE PROFESSIONAL

WRITTEN SNOW AND ICE CONTROL PLAN AND POLICY DOCUMENTS ARE ABSOLUTELY ESSENTIAL FOR WINTER MAINTENANCE AGENCIES

PART III OPERATIONS AND MATERIALS MANAGEMENT

BY

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The preceding two articles on this topic have dealt with the process for creating a written snow and ice control plan and policy, and some of the administrative and planning items that should be considered for inclusion. This article will deal with the nuts and bolts of the plan in terms of operations and materials management.



OPERATIONS

GENERAL APPROACH TO SNOW AND ICE CONTROL OPERATIONS

This section should review the strategies and tactics employed by the agency, their background, rational and specific areas and times they will be utilized. This should be fairly specific and detailed, as it will be a basis for training agency personnel. Here, a clear definition of fundamental snow and ice control terms

should be provided, or reference provided for items such as:

- Anti-icing
- Deicing
- Temporary Friction Improvement
- Prewetting
- Pre-Treating
- Material spread pattern
- Material Discharge Rate
- Material Application Rate
- Ice Control Chemicals
- Chemical Form
- Gradation or Grain Size Distribution

- Solution
- Chemical Concentration
- Chemical Dilution
- Eutectic Temperature
- Eutectic Concentration
- Endothermic
- Exothermic
- Hygroscopic
- Abrasives
- Mixed Abrasives
- One Way Plow
- Reversible Plow
- Wing Plow
- "V" Plow

- Underbody Plow
- Plow Angle of Attack
- Plow Rake Angle
- Minimum Depth of Snow that can be Plowed
- Snow Plowing
- Tandem Plowing
- Close Echelon Plowing
- Benching or Shelving
- Windrow of Plowed Snow
- Snow Removal
- Other Locally Defined Terms and Procedures

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A more complete list (glossary) and associated definitions for most of the terms that appear in this article that is suitable for placing in the body of the plan and policy document or in an appendix can be found at: www.saltinstitute.org/snowfighting/glossary.html

SPECIFIC TREATMENT GUIDELINES

This section provides the specific guidance for all snow and ice control operations. Before getting into designing individual treatments, a set of definitions for common terms that relate to pavement and weather conditions should be provided. Pavement condition terms may include:

- Dry
- Damp
- Wet
- Slush
- Loose Snow
- Packed Snow
- Frost
- Thin Ice
- Thick Ice

Weather (Precipitation) Condition terms may include:

- None
- Light Rain
- Moderate Rain
- Heavy Rain
- Freezing Rain
- Sleet (Ice Pellets)
- Light Sleet
- Moderate Sleet
- Heavy Sleet
- Light Snow
- Moderate Snow
- Heavy Snow
- Blowing Snow

TREATMENT DECISION (DESIGN) PROCESS

This section should define the weather and other information resources utilized by the agency when making treatment decisions. It should also provide definition, significance and impact of the presence

and magnitude of the treatment design factors including:

- Ice – Pavement Bond
- Pavement Temperature and Trend
- Solar Radiation or Sunshine
- Clear Night Sky Radiation
- Geo-Thermal Effects
- Air Temperature and Wind
- Residual Snow or Ice on the Pavement
- Type, Intensity and Trend of Precipitation Event
- Treatment Cycle Time
- Traffic Volume, Speed and Timing
- Chemical Type
- Chemical Form

The analysis of items immediately above should be summarized into an application type and rate table for the various pavement, weather, traffic and operating conditions.

SNOW PLOWING GUIDELINES

This section should include specific procedures and requirements for:

- Plowing Speed
- Snow Cast
- Tandem and Echelon Plowing
- Plow Angles for Various Conditions
- Managing Windrows
- Various Lane Configurations (Passing, Turning, Deceleration/ Acceleration)
- Intersections and Ramps
- Crossovers
- Cul-de-sacs, Dead Ends and Alleys
- Safety Appurtenances
- Railroad Grade Crossings
- Shoulders
- Benching and Shelving

MATERIALS SPREADING PROCEDURES

This section should include specific requirements for placing the material on the highway. Typical items include:

- Spreading Speed
- Spread Pattern for Various Conditions
- Banked Curves
- Hills, Curves and Intersections

- Banked Curves and Bridges
- Placement of Material in Lane(s)
- Parking Areas and Walkways
- Bridges and other Potentially Cold Spots
- Blizzard Treatment
- Thick Ice (Heavy Freezing Rain) Treatment
- Thin Ice (Frost and Black Ice) Treatment
- Snow Pack Treatment
- Railroad Grade Crossings

PASSIVE SNOW CONTROL

This section should contain the locations and type of passive snow control features employed and their maintenance requirements. It should also contain recommendations for design and reconstruction design options that minimize drifting and blow-overs.

PERSONNEL OR PERSONNEL MANAGEMENT

This section should contain detail on all the personnel rules and policies that relate to snow and ice control operations. Items that typically would be included in this category include:

- Training Requirements and Certifications
- Call-In Procedures and Requirements
- Overtime, Shifts and Scheduling
- Hours of Continuous Duty Limitations
- Temporary and Reassigned Personnel
- Fitness for Duty – Requirements and Cites
- Relevant Portions of Union Agreement
- Interaction with the Public
- Family Readiness
- Procedures for Managing Hired, Reassigned, and Cooperative Personnel

EQUIPMENT MANAGEMENT

This section should contain the “nuts and bolts” (no pun intended) of managing the snow and ice control equipment fleet. This may be further broken down into the agency equipment and other equipment.

AGENCY EQUIPMENT

This should contain the relevant policies and procedures associated with equipment owned or leased by the agency. These may include:

- Inventory requirements (parts, required numbers of each type of equipment and any “spare” equipment allowances)
- Routine Inspection Procedures
- Safe Operating Criteria for Each Type of Equipment (Operational)
- Criteria for “Downing” or Determining a Piece of Equipment is not Roadworthy or Safe to Operate
- Maintenance Schedule for Each Type of Equipment
- Calibration Procedures for the Various Materials Distribution Systems
- Fueling Procedures
- Personnel authority to perform various types of maintenance/repairs
- Procedures and warrants for outsourced repairs/maintenance

OUTSOURCED, COOPERATIVE OR “BORROWED” EQUIPMENT

Everything necessary to acquire and manage other than agency equipment should appear here. Items may include:

- Who has What, and How Many
- Activation Procedure
- Contract Requirements
- Determination of Priorities
- Work Management Procedures (if Operator comes with Equipment)
- Accounting and Required Paperwork

POST STORM CLEANUP AND SAFETY RESTORATION PROCEDURES

This section should contain, with specific location detail, the items of work and when they are to be performed. Items that may be included:

- Shoulder Plowing
- Islands and Pedestrian Areas
- Railroad Grade Crossings
- Warrants for Hauling Snow
- Procedures for Loading, Hauling and Disposing Snow
- Achieving and Maintaining Satisfactory Pavement Surface Conditions
- Clearing Sight Distance Problems
- Pushing Back
- Maintaining “Problematic” Areas
- Drainage Restoration
- Clearing Bridges Safety Appurtenances as Necessary
- Clearing Drifted Areas
- Clearing Sidewalks
- Clearing Hydrants
- Clearing Crosswalks
- Clearing Signs and Signals

EMERGENCY OPERATIONS MANUAL

If the agency has a separate emergency operations manual, relevant portions may be included here or simply reference the plan. If not, an emergency operations plan should be included here. Critical information to be provided includes:

- Contact Information for Key Functions in Local, State and Federal Government, Utilities and Emergency Aid Providers
- Road and Bridge Closure Plans
- Detours and Emergency Evacuation Routes/Plans for Every Possible Scenario
- Potential Sources of Help and What They can Provide
- Maps Showing Water Level at Various Flood Stages
- Sources of Weather Information
- Shelter Information
- Sources of Emergency Provisions

- Alert and Public Information Systems
- Reporting Procedures
- Emergency Fuel Procurement

MATERIALS MANAGEMENT PLAN

It is crucial to include a comprehensive materials management plan, within the framework of the agency snow and ice control plan. This will clearly demonstrate that the agency is doing a credible job of planning and executing operations in a way that will have the least possible environmental impact. One of the best sources of information on this topic is found on the Transportation Association of Canada’s web page: <http://www.tac-atc.ca/english/information/services/readingroom.cfm#syntheses>

POLICY STATEMENT

The first order of business is to clearly state, in a policy statement, the agency’s policy, objectives and commitment to minimizing environmental impacts and taking reasonable actions to actually reduce environmental loadings. The statement should emphasize that highway safety is the first priority in the agency’s snow and ice control operations.

SITUATIONAL ANALYSIS

Here, the agency identifies the potential sources of negative environmental impact associated with snow and ice control operations and defines the locations of areas that known or may be environmentally sensitive to aspects of winter maintenance operations.

Material

- Sand
- Solid Ice Control Chemicals
- Liquid Ice Control Chemicals

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Material Storage and Work

Locations

- Stockpiles
- Drainage
- Housekeeping
- Loading
- Wash Water
- Equipment Fluids

Potentially Sensitive Areas Associated with On-Road Usage

- Groundwater Recharge Areas
- Vulnerable Water Tables
- Drinking Water Supplies
- Sensitive Vegetation
- Sensitive Water Bodies
- Sensitive Agriculture Areas
- Sensitive Non-Plant Species
- Other - Locally Defined

Disposal Sites

- Snow
- Abrasives

PLANNED APPROACH

In this section, the proposed control measures for dealing with each of the items in the situational analysis should be described. Some not-so-obvious measures may include:

- Equipment Calibration
- Prewetting to make Solid Chemicals More Effective
- Ground Speed Control of all Materials Dispensed
- Designing Individual Material Treatments in Response to Weather and Road Conditions of the Moment and Near Future
- Spread Pattern Control

TRAINING ACTIVITIES

The various training requirements/activities in support of the agency materials management program, for agency and hired forces, should be described here.

MONITORING, RECORD KEEPING, REPORTING, ANALYSIS AND AGENCY ACTION

Here, the systematic process for assuring the materials management program is working, as intended, should be described in detail.

SUMMARY STATEMENT

The list of possible topics for inclusion in municipal snow and ice control plans provided in this series of articles is large, and probably incomplete. Realistically, it is not expected that every snow and ice control plan will contain all of the material listed. However, it is a good idea for an agency to at least consider all of the topics.

DEICING CHEMICALS AND PAVEMENT CONCRETE DETERIORATION

Highway maintenance operators are continually barraged with advertising claims on the benefits of various deicing compounds. The number of conflicting claims out in the marketplace make it difficult to arrive at a decision one can comfortably live with. One of the areas of greatest contention is the effect of various deicing chemicals on pavement concrete. A recent and comprehensive paper, *Effects of Various Deicing Chemicals on Pavement Concrete Deterioration*, (<http://ntl.bts.gov/lib/9000/9500/9557/Lee.pdf>) authored by H. Lee, R. D. Cody, A. M. Cody, and P. G. Spry of Iowa State University's Department of Geological and Atmospheric Sciences, described their comprehensive investigations into the effects of different deicers on con-

crete deterioration. The materials they used were sodium chloride, calcium chloride, magnesium chloride, calcium magnesium acetate (CMA) with 5 different Ca/Mg ratios, Ca-acetate, and Mg-acetate. Each deicer



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A BETTER WAY OF TRAINING

By John A. Anderson

Imagine you're a winter maintenance trainer and you just received 500 slides and numerous videos. Now imagine you need to create a one-day program for next week, a quick one-hour presentation tomorrow addressing key equipment issues, a safety review program for field personnel, a presentation on deicing chemicals for engineers and another for administrators, a half-day program on plowing techniques, and then your boss sends you off to another part of the state that uses different equipment and materials.

Wow, you've got a lot of work ahead of you and tomorrow's the first session! Not only that, you probably have other things to do than prepare for training. Even with all the materials in digital format, you will probably have to make a few modifications, select the right materials for the audience, stay within time constraints, arrange some logical presentation order, determine which slides go with what videos, and decide on how much detail you should address. The challenges are daunting, yet this is exactly what many trainers do, and re-do, time after time.

Wouldn't it be nice if you could magically duplicate, select, and organize all your slides into unique presentations within just a couple of minutes? Well, that's exactly what Salt Institute (SI) is creating for you. We've already developed hundreds of slides and video clips. We've grouped them into small learning modules, and we're creating a database type tool that allows you to quickly generate your own customized training programs complete with learning maps, instructor

notes, a safety review module, and helpful statistics such as the number of slides selected, number of video clips, video viewing times, and estimated times for conducting the training. Best of all, the trainer retains the ability to easily modify the slides, add new slides, add videos, adjust estimated times, present extra information on the fly, step down through related topics or technical



detail, and navigate by simply clicking on buttons.

To good to be true? Not at all. The prototype exists. Along with its partners, SI realizes the many challenges facing technical trainers. Most trainers are practitioners who find themselves limited to using PowerPoint. At the same time, training developers and instructional designers, although adept at using the latest developer toolboxes and learning theories, frequently don't have the substantive or practical knowledge to build meaningful in-depth training applications. Putting developers and practitioners together is often expensive and challenging. They think differently,

and speak differently, and have different interpretations of what successful training looks like.

Keeping abreast of advancing technology, ever changing audiences, needs for different levels of knowledge, ongoing pressures to hold down costs, and continually expanding services all present an overwhelming challenge. No wonder trainers have little time, energy, and funds to advance material development skills and no wonder training developers have trouble creating affordable, meaningful, and lasting training programs.

SI's current training project edges toward a solution. It gives trainers a well defined learning framework along with increased flexibility to better meet the ever growing needs of their unique audiences. So, stay tuned to <http://www.saltinstitute.org/snowfighting> and expect this valuable new tool to become available later this year.

Reminders:

The deadline for the 2007 **Excellence in Storage Award** is closer than you think. Read about the program and download an application form at <http://www.saltinstitute.org/40.html>

Salt Institute has a blog for highway maintainers. You can subscribe to any or all of our RSS feeds at <http://www.saltinstitute.org/rss/subscribe-rss.html> or just visit "Salt & Winter Roadway Safety: For Roadway Maintainers (Snowfighters)" at http://www.saltinstitute.org/rss/roadway_safety-snowfighters/

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You just enjoyed another electronic **Salt and Highway Deicing** Newsletter! It helps you make better decisions in your winter maintenance responsibilities and gives even more information by active links to www.saltinstitute.org <<http://www.saltinstitute.org>> with specific pages to further snowfighter information. Feel free to forward this newsletter to other interested persons so they can also enjoy this informative free quarterly. Be aware Salt Institute never sells or distributes any of your contact information to any outside source. Please sign up at: <http://www.saltinstitute.org/subscribe/index.html>



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