ANTIS TOWNSHIP'S
SNOW AND ICE CONTROL PLAN

GENERAL INFORMATION

GUIDELINES AND

OPERATIONAL PROCEDURES FOR THE

PUBLIC WORKS OPERATIONS

MATERIALS MANAGEMENT PLAN

TOWNSHIP OF ANTIS, PENNSYLVANIA

November 2011

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NOTE: Polices highlighted in "**Red**" is not currently utilized by Antis Township.

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INTRODUCTION

I.A. General

It is **ANTIS'S** goal to provide a transportation system that is passable and reasonably safe as much of the time as possible within the limitations imposed by the natural environment and the availability of equipment, material and personnel resources. As a result of those limitations, it is recognized that there will be occasions when the pavement and bridge surfaces will be slippery and/or snow and ice covered. During these periods customers (drivers) must recognize the conditions and operate their vehicles in an appropriately safe manner.

This manual provides information and guidance to assist **ANTIS** Public Works Department in conducting snow and ice control operations. It will serve as a basis for training **ANTIS** personnel.

The manual contains information on pre-winter operations and readiness, total storm management and decision making using **ANTIS** information resources, pre-storm preparedness, treatment options, post storm and post season activities. The provisions were developed to provide a reasonable balance among safety, cost, and environmental responsibility. The manual also contains related operational procedures and personnel procedures. The contents of this manual supersede all applicable prior manuals, directives and guidance relating to snow and ice control.

The contents of this manual reflect best practices as determined from a review of the relevant national and international literature and from information obtained from **ANTIS** maintenance personnel through surveys and interviews. It is intended to be a living document that is responsive to new technology and techniques developed within **ANTIS** and elsewhere. Suggestions for change may be submitted at any time to the Road Foreman.

The words shall, must, should, recommended and may, used in Section II of this manual have the following meanings:

shall and must - a required course of action
should and recommended - a recommended course of action
may - an optional course of action

I.B. Specific Information for Residents and Property Owners

I.B.1. How Residents and Property Owners Can Help Assure the Safety and Efficiency of ANTIS'S Snow and Ice Control Operations

a. Do not park on township streets, especially during snow or ice events.
b. Keep basketball devices at least 10 feet from the edge of pavement
c. Do not park cars in driveways within 10 feet of edge of pavement
d. Do not allow children to build and occupy A snow forts@ and similar creations within 10 feet of the edge of pavement

e. Do not relocate snow from driveways and sidewalks into the paved street. This is in violation of Pennsylvania law and will cause a hazardous condition on the street (PA C.S., Chapter 55)
f. Fences should not be within 10 feet of the edge of pavement
g. Remove all non-permanent seasonal items from within 10 feet of edge of pavement
h. Trim trees so that branches do not extend beyond the back of the curb
i. Pile most of the snow from the driveway throat on the traffic downstream side. This will minimize visibility problems

I.B.2. Roads within Antis Township that are NOT maintained by the Township of Antis

Following is a list of roads/plans that are **NOT** maintained by the Township (they are either maintained by the state or receive private maintenance). If the road you live on is **not** on the following list, then you receive winter maintenance from the Township.

Table 1: Roads NOT maintained by ANTIS TOWNSHIP

State Maintained Roads	Privately Maintained Roads
1. **SR. 1008 Skelp Road**	1.
2. **SR. 4015 Grandview Road**	2.
3. **SR. 4018 Sabbath Rest Road**	3.
4. **SR. 4018 Lower Riggles Gap Road**	4.
5. **SR. 4019 Old Sixth Ave. Road**	5.
6. **SR. 4020 Reightown Road**	6.
7. **SR. 4021 Bell Tip Road**	7.
8. **SR. 4023 Tipton Road**	8.
9. **SR. 4025 Grazierville Road**	9.
10. **SR. 865**	10.

I.B.3. Private Driveways

Township snow removal crews do not clear private driveways or driveway entrances of accumulated snow.

I.B.4. Protection of Driveways

Prior to snow removal season apply a driveway protectant. This will help eliminate the possibility of damage from snow removal materials. The Municipality is not responsible for damage to private driveways, etc. due to snow removal materials.

I.B.5. Plow Trucks with Plows Raised

A truck with a raised plow does not always mean the driver has completed your area. They may be:

a. Returning for fuel or vehicle service
b. Returning to the maintenance yard for additional treatment material
c. Responding to a call to assist Emergency Services, i.e.:

    i. Police Department
    ii. Fire Department
    iii. Volunteer Ambulance
    iv. School District Transportation Department

I.B.6. Mailboxes and Mailbox Posts

You can help reduce the possibility of a damaged/broken mailbox or mailbox post. Plow operators are urged to take precautions to avoid hitting mailbox posts. Experience has shown that reduced visibility during a storm makes it difficult for a driver to see a post in time to avoid striking it or pushing it over with plowed snow.

Any installation within the right of way - including a mailbox/post - is placed there at the owner's risk. Owners are encouraged to install mailboxes at the maximum usable distance from the edge of the pavement. Posts should also be checked for deterioration to reduce the possibility that the weight of the plowed snow may simply break or push the post over. The Township shall not repair or replace mailboxes or posts damaged by the force or placement of plowed snow.

I.B.7. Contacting the Township during a Snow or Ice Event

Avoid calling municipal offices during a storm except in an emergency. Personnel are extremely busy dealing with storm conditions.

Please keep telephone lines clear for emergencies

Emergency calls during snow removal season should be placed to the Antis Township, (814) 742-7361, Monday thru Friday 8:00 am to 4:30 pm.

Weekends and evenings, please call 911.

I.B.8. Priority of Treatment

Treatment priorities are found in Section II.B of this document

II. OPERATIONAL GUIDELINES

II.A. Goal of Snow and Ice Control Operations

ANTIS will conduct snow and ice control activities that afford customers a reasonably safe and passable (not necessarily bare) road surface as much of the time as possible. To accomplish that, snow and ice accumulations will be removed as soon as possible, consistent with stated priorities and resources. To the extent possible, the bond of snow and ice to the

pavement will be prevented by the timely application of ice control chemicals (anti-icing strategy). Abrasives may be used as necessary to provide temporary friction improvement.

Certain conditions such as blizzards, whiteouts, other locally severe snow or ice events, thin ice formation in the absence of or during very light and spotty precipitation, and other conditions unknown to or beyond the control of **ANTIS** maintenance forces may temporarily preclude achieving this goal.

II.B. Operational Priorities and Personnel Policies

II.B.1. Operating Priorities

ANTIS has established a traffic volume and route type classification system for determining the priority of snow and ice control operations. Generally a lowered level of service will be provided between the hours of 9 PM and 5 AM.

II.B.2. Personnel Policies

II.B.2.a. Hours of Continuous Duty

A driver may be on duty a maximum of 16 hours. After that, the driver must be off duty for a minimum of eight (8) continuous hours before returning to work. Our most experienced drivers will be utilized first unless a state of emergency is declared.

II.B.2.b. Call-In Procedures

Drivers are required to report for duty within 45 minutes of notification

II.B.2.c. Fitness for Duty

i. Drug and alcohol policy as outlined by the Pennsylvania CDL requirements and Antis Policy, spectrum
ii. Other factors

II.B.3. Operational Resource and Responsibilities

Equipment Type and Location:

Type	Attachment(s)	Location
Back hoe (Cat) Ditching Bucket	Vib Plate, Jackhammer, 12", 24", and 36" buckets	PW Garage
Loaders (Cat)	Front bucket, Broom	PW Garage
Front end wheel loader		
Excavator (Cat Grader)		PW Garage
Tractor	5 foot mower deck	PW Garage
Light Truck		
• 2011-Ford Ranger 4X4		
• 1997 GMC Pick-up 4X4	Salt Spreader	PW Garage
Heavy Truck		
39,000 GVW Dump Truck	Plow and Spreader	PW Garage
39,000 GVW Dump Truck	Plow and Spreader	PW Garage
37,300 GVW Dump Truck	Plow and Spreader	PW Garage
26,000 GVW Dump Truck	Plow and Spreader	PW Garage
26,000 GVW Dump Truck	Plow and Spreader	PW Garage
17,950 GVW Dump Truck	Plow and Spreader	PW Garage
12,000 GVW Dump Truck	Plow and Spreader	PW Garage

Personnel Available:

Public Works Department: **Road Foreman: Steve Schiffler**

NAME OF OPERATOR	TYPE OF LICENSE
Terry Beck	**CDL**
Arthur Walters	**CDL**
Donald Carnell	**CDL**
Seasonal Employee	**CDL**

Budget Trends:

Public Works Expenditures 01-43?-???	2008 Actual	2009 Actual	2010 Actual	2011 Estimate	2012 Budget
Personal Services					
2-100-Snow Removal Wages	$ 12,846	$ 16,417	$ 20,131	$ 16,000	$ 16,659
Total Personal Services	$ 12,846	$ 16,417	$ 20,131	$ 16,000	$ 16,659
Commodities					
2-245-Snow Removal Supplies	$ 39,575	$ 48,666	$ 26,718	$ 25,000	$ 32,476
Total Commodities	$ 39,575	$ 48,666	$ 26,718	$ 25,000	$ 32,476
Total Snow and Ice Removal Expenditures	**$ 52,421**	**$ 65,083**	**$ 46,848**	**$ 41,000**	**$ 49,135**

Salt Storage: Salt barn capable of storing 350 tons of material

Miles of Roads: Approximately 124 miles (center line)

Number of Cal-de-sacs: 15

II.B.4 Operators Direct Communication with the Public

Operators are to report all stranded or stuck vehicles to the Road Foreman. Operators may stop to check to see if the vehicles passengers are safe.

If an Operator is being flagged down to stop by a resident, the Operator may stop; however, the Operator should offer that all disputes or concerns be directed to the Road Foreman or office staff to be relayed to the Road Foreman.

EMERGENCIES WILL BE REPORTED TO 911

II.C Pre-Winter Activities

II.C.1 Review and revise this manual as necessary

As this is a living document, appropriate changes should be incorporated as soon as possible. Areas that may change include: highway responsibility, technology, procedures, equipment, personnel, staffing, materials and level of service. Sources of changes may include: our customers, individual or work group suggestions, personnel meetings, post-season reviews and **ANTIS** management.

Levels of service goals should be reviewed for their impact on plow routes and required resources (personnel, equipment, materials, facility, etc.). Those resources should be assigned as necessary.

II.C.2 Emergency and Severe Weather Response Procedures

ANTIS TOWNSHIP will initiate emergency operating procedures under two (2) conditions; if the Township, County or State declares a state of emergency, or if winter storm predictions are expected to exceed 8 inches of snow in a 24 hour period. Under these conditions all Public Works employees are called to service.

II.C.3 Equipment Readiness

All of **ANTIS**'**s** snow and ice control related equipment should be inspected; test runs completed, repaired as necessary, and receive scheduled maintenance prior to the snow and ice season.

II.C.3.a Truck Readiness

The prescribed seasonal and use based maintenance service should be completed prior to the winter season. All trucks should be checked with full winter gear (plows and spreaders) well in advance of the first anticipated snow or ice event.

II.C.3.b Material Spreader Readiness

The materials spreaders should receive required maintenance and be lubricated, repaired, test run and calibrated.

II.C.3.c Liquid Materials Dispensing Systems

ANTIS does **NOT** currently use liquid dispensing systems during snow and ice control operations. However, if ever utilized these systems should be inspected, test runs completed, calibrated, lubricated and repaired as necessary. Associated bulk storage tanks should be inspected per manufacturer's recommendations. Large storage tanks should be tied down and

have secondary containment systems. Appropriate safety gear (goggles, rubber gloves, etc.) and MSDS sheets should be conveniently available. Any time a liquid is added to a tank be sure it is compatible with the liquid that is in the tank.

II.C.3.d Plow Equipment

Plow equipment should be inventoried, test mounted, and inspected for proper function, missing parts, structural damage, proper adjustment, and sufficient remaining wear depth on items like shoes and cutting edges. Necessary repairs and replacement should be made. Plows should be stored in a position for easy hookup and have easy-to-read identification to match them to the proper truck.

II.C.3.e Spare Parts

The maximum allowable stock of commonly used spare parts should be acquired prior to the snow and ice season. These include: cutting edges, plow shoes, shear pins, nuts and bolts, filters, bulbs, spreader controller parts, springs. Windshield wipers should be new or near new at the start of the winter maintenance season.

II.C.3.f Individual Tools and Safety Gear

Trucks should be checked for the required compliment of tools and safety gear. These include, for example: shovels, bars, hand tools, tire chains, flashlights, flags, flares, warning devices, gloves, hard hats, tow chains, ice scrapers, and snow brushes/brooms. Proper stowage for these and other in-cab loose items must be provided.

II.C.4 Personnel Readiness

II.C.4.a Acquisition and Assignment

Sufficient personnel (permanent, reassigned and interdepartmental) should be acquired and trained for snow and ice operations prior to the winter season. Any internal Department of Public Works reassignments and provisions for emergency reassignment from non-highway units should be accomplished before the first anticipated snow or ice event. Specific route assignments should also be made prior to the snow and ice season and added to this document. However, there should be provisions to accommodate the lack of specific people.

II.C.4.b Callout and Family Readiness

Callout procedures, impacts of winter maintenance on family life and family responsibilities should be reviewed and discussed with applicable **ANTIS** personnel before the snow and ice season.

II.C.4.c Training

Snow and ice control training should be accomplished prior to the snow and ice control season. Training topics include at a minimum: Intra-**ANTIS** communication, cooperation and responsibilities; weather conditions, road conditions, road and weather information systems; safety issues; public relations/information issues; operational issues and procedures; level of service (local and system-wide); equipment readiness; materials management; new technology, new initiatives and procedures; and emergency response issues.

II.C.5 Materials Readiness

II.C.5.a Contracts

ANTIS acquires most snow and ice control materials through the contract process. Given the time required to establish a contract, these requirements and contracts and purchase requisitions should be done early. Typical materials purchased include sodium chloride (salt or rock salt), calcium chloride (liquid and flake), abrasives (sand), liquid magnesium chloride with corrosion inhibitor, etc. Individual responsibilities in the contract administration process should be defined. Quality assurance procedures should be established for each material.

II.C.5.b Materials Storage Structure

Most **ANTIS** snow and ice control chemicals are stored in a structure. This structure and associated run-off containment features, lighting systems, and ventilation systems should be inspected and repaired as necessary. It should be filled to working capacity prior to the snow and ice season.

II.C.6 Emergency Readiness

Staff likely to be involved should review relevant portions of this document. Cooperative agreements within and outside **ANTIS** should be reviewed and reaffirmed with the cooperating groups.

II.C.7 Highway System Readiness

Various elements of **ANTIS**'**S** highway system should be checked and given necessary attention as required. These include: crack and joint sealing, permanent pothole repair, striping, drainage clearing and marking, winter signage, obstacle markers and delineators

II.C.8 Maintenance Facility Readiness

Certain features of **ANTIS**'**S** maintenance facilities should be inspected and repaired as necessary prior to the snow and ice season. These include: buildings, yard traffic areas, fuel delivery systems, yard and garage lighting, emergency generators, and run-off control features.

II.C.9 Road and Weather Information System Readiness

ANTIS has acquired a variety of systems and measuring devices to help in defining road and weather conditions. These include hand-held pavement temperature measuring devices, NOAA weather band radios, satellite delivered weather information systems (DTN), and internet weather forecast providers. These systems should be checked for function prior to the snow and ice season. All measurement devices and sensors should be calibrated and maintained per the manufacturer's recommendations. All computers, software and communication systems should also be checked and repaired as necessary.

II.C.10 Public and Customer Readiness

The traveling public and **ANTIS** customers should receive information to assist them in transitioning and adjusting to winter driving. **ANTIS** has a number of opportunities to deliver valuable information including: media clips, media press releases, public service announcements, public access TV (for local distribution), outreach speakers and web sites. Antis employees are to be as courteous and helpful to public inquiries as possible.

II.C.11. Communication Systems

Antis has a variety of communications systems including: radio, cell phone, and land-line phone and fax. These systems should be checked prior to winter and any necessary training/retraining provided.

II.D. Decision Making for Snow and Ice Control Operations

As **ANTIS** acquires more information resources, it will be moving toward routine information-based decision making for determining appropriate snow and ice control treatments. That process involves the following:

1. Gathering all available relevant information about recent past, present and near term future conditions.
2. Selecting a treatment option that best addresses those conditions.
3. Systematically gathering and evaluating data on treatment effectiveness, actual road conditions, and actual weather conditions from operators and other sources.

II.D.1 Elements of Snow and Ice Control Decision Making

II.D.1.a Status of Assets

Assets for snow and ice control operations include personnel, equipment, information systems, and materials inventories. Deficiencies in any of these areas will impact treatment decisions. Loss of truck availability due to mechanical failures or accidents will have an impact on response time and general snow removal operations. Every effort will be made to cover the route(s) by alternative methods.

II.D.1.b Weather Information

II.D.1.b.1 Weather Forecasts

There are a variety of weather forecast products available to **ANTIS's** maintenance forces. Decision-makers should be simultaneously evaluating short-term, mid-term, and long-term forecasts. Information on precipitation should include onset, cessation, type and intensity. Other relevant factors include air temperature, dew point, wind speed, wind direction, and cloud cover.

II.D.1.b.2 Current Weather Data and Observations

Current weather data and observations may be obtained from maintenance patrols, operators, and media outlets.

II.D.1.b.3 Other Weather Information

Other weather data sources include radar and satellite imagery (from DTN, Internet and local TV), NOAA radio, the Weather Channel; computer acquired current condition data from upstream storm locations, local TV and radio, etc.

II.D.1.c Highway and Pavement Information

II.D.1.c.i Pavement Temperature

Pavement temperature is one of the most important factors when deciding on a snow and ice control treatment. Data on recent past, current and predicted pavement temperature is very useful. This data may be obtained from in-pavement systems, truck mounted and hand-held sensors, surrogate locations (other systems, facility parking areas, etc.). Predictions and estimates can be made based on forecast knowledge of air temperature, ground temperature, cloud cover, precipitation, wind, and time of day.

II.D.1.c.ii Accumulations of Snow and Ice on the Pavement

Knowledge of the character and depth of any snow or ice accumulation on the pavement surface prior to treatment is important in the treatment decision process. Relative slipperiness and whether or not the snow or ice is bonded to the pavement are even more important.

II.D.1.c.iii Traffic Characteristics

Traffic data are important to the decision-maker. Relevant characteristics include volume, speed, timing of peak flow, status of any closures and any reduction in available lanes.

II.D.1.c.iv Status of Critical Locations

Traffic flow and pavement condition information for Acritical @ locations are important in prioritizing snow and ice control operations. Critical areas include hills, intersections, bridges, cold locations (low, shaded and elevated) locations having mist or fog generation tendencies, traffic generators, high snow and ice accident locations, school bus routes and access to the Municipal Center, Fire Stations (Tipton and Pinecroft), and Ambulance Service.

II.D.1.d Assessments of Effectiveness and Efficiency

Systematic after-action assessments of effectiveness and efficiency are important in the decision-making process as they provide a knowledge base for future decisions. Results achieved in response to treatment can be obtained from the reports of operators. Other factors to evaluate include cycle times achieved, materials used, equipment performance, and cooperative procedures.

II.E Snow Control

II.E.1 General

For the purpose of this manual snow and ice control operations are separated into two categories 'snow control' and 'ice control'. Snow control is the mechanical removal of accumulations of loose snow from the paved and stabilized portions of the system. This is accomplished primarily with truck-mounted plows. In certain circumstances like cleanup and drift removal, front-end loaders are sometimes used. It may also involve the use of passive measures like snow fence and plantings.

Ice control is all treatment operations directed toward preventing snow or ice from bonding to the pavement and the chemical and or mechanical removal of bonded snow or ice from the pavement. It also includes providing temporary friction improvement by spreading abrasives and abrasives/chemical mixtures and using no-treatment when appropriate.

Snow control is one of the most difficult and important tasks assigned to **ANTIS** maintenance personnel. Having uniform snow control methods is important for the safety of our customers and our maintenance personnel.

There are some definitions relating to snow control that will help clarify subsequent sections of this manual:

Snow plowing - the relatively rapid displacement of snow from paved surfaces with Vehicle-mounted plows and wing plows.

Snow removal - physically relocating areas of accumulated snow. This is usually a slow operation that may be accomplished with plows, loaders or snow blowers.

Berm or windrow - an accumulation of snow cast by plow or other equipment.

Tandem plowing - snow plows working together to clear wider areas.

There are some general guidelines for keeping snowplowing operations reasonably uniform on **ANTIS** system:

a. To the extent possible, traffic should not have to pass through a berm of plowed snow.
b. All plowing shall be done with trucks moving in the direction of traffic, except in an emergency situations where the work area is closed to traffic or, backing in the direction of traffic is required to spread material on very slippery surfaces where normal directional travel will not provide sufficient traction for the truck to move and as necessary in the culde-sacs.
c. To the extent possible, plow snow beyond the point where it could melt and run back across the highway. Snow may be cast toward the center of the cul-de-sacs even though it may be higher than the outside.
d. Plowed snow shall not be cast into traffic.
e. Cast snow downwind to the extent possible.
f. In the cul-de-sacs, cast snow away from the driveways to the extent possible. This is less demanding on the property owners and facilitates more efficient general route plowing.
g. Within the normal sequences of operations, any time there is enough snow on the road to plow, it should be plowed.
h. In events where snow is likely to change to freezing rain before ending, consideration should be given to leaving enough unplowed snow on the road to absorb the freezing rain. Plow and treat the road again after the event has ended.
i. At the end of the storm, push snow back as much as possible to make room for the next snow storm.

Occasionally snowfall intensity is so severe that operator visibility is reduced to a few feet. With supervisor approval, operators may drive their trucks to a safe haven that is stable and well off the highway, shut their lights off and wait until visibility improves before continuing.

When low visibility is anticipated, extra caution in operations should be exercised. Vehicles and other obstacles may be anywhere. Supervisors should be prepared to suspend operations and recommend road closure if conditions warrant, or recommend temporary road closure so that plowing can be completed.

II.E.2 Safety Restoration and Cleanup Operations (Snow Removal)

After the entire **ANTIS** maintained highway system is in satisfactory condition, safety restoration and cleanup operations shall begin and continue until complete or operations are directed to higher priority snow and ice control or emergency work. This work will generally be performed on a regular time basis. Coordination of this work with interfacing agencies and other **ANTIS** units is recommended. Cleanup operations that may impact traffic flow or larger numbers of customers should be performed in lower volume time periods if possible and utilize traffic protection where appropriate.

The following is a listing in priority order of the areas where snow should be removed:

a. Locations that could melt and run onto traveled areas, for example: banked curves and sloped bridge decks.
b. Snow stored on bridge decks. (Do not throw snow over the side of the bridges B transport it beyond the back wall and off the shoulder.)
c. Areas having reduced sight distances for customers and plow operators, such as sharp curves and intersections.
d. Buried or obscured regulatory and warning signs, delineators, and accumulated snow around work zone delineation.
e. Any area where accumulated snow is causing traffic to use other-than-intended pavement areas.
f. Any narrow raised features between the outside edges of pavement that may be storing snow.
g. The travel lane around cul-de-sacs will be plowed, the center will remain snow. The snow will be removed from the center of the cul-de-sac when snow exceeds six inches.

II.E.3 Drainage Restoration

After safety restoration and cleanup operations are complete, drainage facilities should be inspected and cleared as necessary

II.F Ice Control

Ice control is all treatment operations directed toward preventing snow and ice from bonding to the pavement and the chemical and/or mechanical removal of bonded snow or ice from the pavement. It also includes providing temporary friction improvement by spreading abrasives (sand) and abrasives/chemical mixtures, and using delayed or no-treatment options when appropriate.

II.F.1 Ice Control Strategies

There are four basic ice control strategies used by **ANTIS;** anti-icing, de-icing, temporary friction improvement, and delay of, or no treatment. When conditions are favorable for success and resources permit, anti-icing shall be the strategy of choice.

II.F.1.a Anti-icing

Anti-icing is a modern strategy that takes an information-based systematic approach to preventing snow/ice pavement bond. This results in higher levels of service for longer periods of time. The key to effective anti-icing is to get an appropriate quantity of ice control chemical on the pavement surface before or very soon after precipitation or ice formation begins.

II.F.1.b De-Icing

De-icing is a traditional strategy for dealing with snow or ice that has already bonded to the pavement surface. It is used when anti-icing treatments have failed, as they occasionally will, or as a series of treatments at the end or after a storm. De-icing is most effectively accomplished by spreading a coarse-graded solid or pre-wet solid ice control chemical on the surface of the bonded snow or ice during favorable road, weather and traffic conditions. The coarse particles will melt through the snow and ice and break the bond as created chemical solution flows across the pavement surface.

II.F.1.c Temporary Friction Improvement

Temporary friction improvement is an immediate short-term improvement in surface friction that is achieved by spreading abrasives (sand) or abrasives/chemical mixtures on the snow or ice surface. There will be times when this is an appropriate strategy usually in very cold conditions. A major disadvantage of this strategy is that its effectiveness degrades very quickly with traffic. If sufficient ice control chemical is spread with abrasives, it can be part of anti-icing and de-icing strategies.

II.F.1.d Delayed or Non-Treatment

Delaying or not applying ice control materials is a tactic that may be used in support of the anti-icing strategy. Conditions where this tactic should be considered include light precipitation events, where pavement temperature is likely to remain above freezing and dry snow and blowing snow events where pavement surface temperature is below about 10˚ F and there is no residual ice control chemical on the pavement.

II.F.2 Terms Relating to Precipitation, Road Conditions, Ice Control Chemicals, and Operational Procedures

II.F.2.a Precipitation Terms

Light Rain - Small liquid droplets falling at a rate such that individual drops are easily detectable splashing from a wet surface. Include drizzle in this category.

Moderate Rain - Liquid drops falling are not clearly identifiable and spray from the falling drops is observable just above pavement or other hard surfaces.

Heavy Rain - Rain seemingly falls in sheets; individual drops are not identifiable; heavy spray from falling rain can be observed several inches over hard surfaces.

Freezing Rain - When rain freezes upon impact and forms a glaze on the pavement or other exposed surfaces.

Sleet - Precipitation of transparent or translucent pellets of ice, that are round or
(Ice Pellets) irregular in shape.

Light Sleet - Scattered pellets that do not completely cover an exposed surface regardless of duration. Visibility is not affected.

Moderate Sleet- Slow accumulation on ground. Visibility is reduced by ice pellets to less than 7 miles.

Heavy Sleet - Rapid accumulation on ground. Visibility is reduced by ice pellets to less than 3 miles.

Light Snow - Snow alone is falling and the visibility is greater than 2 mile.

Moderate Snow - Snow alone is falling and the visibility is greater than 3 mile but less than or equal to 2 mile.

Heavy Snow - Snow alone is falling and the visibility is less than or equal to 3 mile.

Blowing Snow - When fallen snow is raised by the wind to a height of 6 feet or more and is transported across a road.

None - No precipitation or blowing snow.

II.F.2.b Road Condition Terms

Dry - No wetting on the pavement surface

Damp - Light coating of moisture on the pavement resulting in slight darkening of surface, but with no visible water drops.

Wet - Road surface saturated with water from rain or melt-water, whether or not resulting in puddling or run-off.

Slush - Accumulation of snow on the pavement that is saturated with water. It will not support any weight when stepped or driven on but will Asquish@ until the base support is reached.

Loose Snow - Unconsolidated snow that can be blown by the wind into drifts or off of a surface, or blown by traffic into non-traffic areas or off of a surface.

Packed Snow - Snow-pack or pack that result from compaction of wet snow by traffic or by alternate surface melting and re-freezing of the water.

Frost - Also called hoarfrost. Ice crystals in the form of white scales, needles, feathers, or fans deposited on pavement and other surfaces cooled by radiation or by other processes.

Thin Ice - A very thin coating of clear, bubble-free, homogeneous ice which forms on a pavement; sometimes called black ice.

Thick Ice - A coating of ice thicker than black ice or frost that is formed from freezing rain, or from freezing of ponded water or poorly drained melt-water. It may be clear or milky in appearance, and generally is smooth though it sometimes may be somewhat rough.

II.F.2.C Ice Control Chemical Terms

Form - The physical state of the chemical usually solid or liquid

Gradation - The distribution of particle sizes for solid chemicals and abrasives; (a characterization) fine, coarse, percent passing various sieve sizes, etc.

Concentration - The percent (by weight) of the ice control chemical in the liquid or solid product.

Solution - A liquid containing chemicals and water.

Eutectic Temperature - The lowest temperature a concentrated (near saturated) solution begins to freeze or the lowest temperature it will melt ice.

Eutectic Concentration - The solution concentration that produces the eutectic temperature

Dilution - Reducing solution concentration by adding water.

Endothermic - Becomes colder when going into solution.

Exothermic - Becomes warmer when going into solution.

Hygroscopic - Having the ability to draw water vapor from the air

II.F.2.d Operational Procedure Terms

Pre-treating - Applying an ice control chemical (liquid or solid) to the road before a snow or ice event begins

Pre-wetting - Adding liquid ice control chemical or water to solid ice control chemicals or abrasives prior to distribution on the road

Application Rate - The amount (weight or volume) of ice control chemical applied per mile or lane mile of highway. In the case of pre-wetting liquids, it is the number of gallons of liquid applied to a ton of solid ice control chemical, or abrasives.

II.F.3 Ice Control Chemicals

ANTIS uses a number of ice control chemicals in both the liquid and solid form. Most of them and their properties appear in Table 2. Other chemicals are often added to sodium chloride, magnesium chloride and calcium chloride to reduce their corrosion potential and aggressiveness toward other materials. The resulting products go by a variety of trade names. **Antis Township's primary ice control chemicals are Sodium Chloride (salt) and Magnesium Chloride with rust inhibitor.**

The important properties of ice control chemicals include the lowest (eutectic) temperature it will melt ice, how much ice will be melted at various temperatures, and the relationship between solution concentration and freezing point. The lowest (eutectic) ice melting temperatures appear in Table 2. How much ice melted per unit of common chloride chemicals at various temperatures, appears in Table 3.

The temperatures above are pavement surface temperatures. Other chemicals have similar relationships where their effectiveness decreases with decreasing pavement temperature. The importance of pavement temperature in ice control operations should be obvious.

The relationship (phase diagram) between solution concentration and freezing point is found in Figure I for sodium chloride, magnesium chloride, and calcium chloride. The low point on each diagram is the lowest temperature at which the chemical will melt ice (eutectic temperature). Any value falling below any point on the curves will be frozen. This includes solution concentrations greater that those producing the eutectic or lowest melting temperature on the diagrams.

The hygroscopic properties of the common solid ice control chemicals are:

Sodium Chloride - slight
Magnesium Chloride - moderate
Calcium Chloride - high

Table 2. Ice Control Chemical Comparison

CHEMICAL		TEMPATURE, F		CORROSION POTENTIAL		CONCRETE DAMAGE POTENTIAL	HANDLING CONCERNS	ENVIROMENTAL CONCERNS
Formula Name	**Form**	**Effective to***	**Eutectic**	**Vehicles**	**Structure**			
NaCI (Sodium Chloride)	Solid	15	-6	Yes	Yes	Some**	Dust	Water, Plants
NaCI (Sodium Chloride)	Liquid	23	-6	Yes	Yes	Some**	Dust	Water, Plants
MgC12 (Magnesium Chloride)	Solid	0	-28	Low	Possible	Very Little	Dust	Water
MgC12 (Magnesium Chloride)	Liquid	10	-28	Low	Possible	Very Little	Dust	Water
CaC12 (Calcium Chloride)	Solid	-20	-60	Yes	Yes	Yes**	Generates Heat; Dries Skin and Leather	Water
CaC12 (Calcium Chloride)	Liquid	0	-60	Yes	Yes	Yes**	Generates Heat; Dries Skin and Leather	Water
Organic Chemicals	Liquid			No	No	No	None	BOD in Water
Magic	Liquid			No	No	No	None	BOD in Water

***Pavement Surface Temperature**
****If concrete is non-air entrained or has utilized poor materials or procedures**

Table 3. MELTING ABILITY AND TEMPERATURE FOR CHLORIDE CHEMICALS

Temperature		Units of Ice Melted Per Unit of Chemical		
F	C	Calcium	Magnesium	Sodium
30	-1.1	31.1	48.8	46.3
25	-3.9	10.4	15.4	14.4
20	-6.7	6.8	10.0	8.6
15	-9.4	5.5	7.9	6.3
10	-12.2	4.8	6.8	4.9
5	-15.0	4.4	6.1	4.1
0	-17.8	4.0	5.5	3.7
-6	-21.1	3.7	5.0	3.2

This means that solid calcium chloride and solid magnesium chloride should be protected with airtight coverings during storage.

The temperature increase or decrease when water is added to common solid ice control chemicals is:

Sodium Chloride - slight decrease (endothermic)
Magnesium Chloride - slight increase (exothermic)
Calcium Chloride - large increase (exothermic)

Caution must be exercised when adding water to solid calcium chloride.

II.F.4 Pre-Wetting Ice Control Materials

Pre-wetting is the addition of a liquid to a solid ice control chemical or abrasives prior to distribution on the highway. The liquid application rate typically ranges from 8 to 12 gallons of liquid per ton of solid ice control chemical, depending on the efficiency of the pre-wetting technique and the gradation of the solid chemical. The benefits of this procedure include:

a. Improving the retention of the materials on the road or ice surface.
b. Accelerating the melting action of the solid ice control chemical
c. Allowing the solid ice control to work better on lower pavement temperatures

Improved effectiveness should yield an overall reduction in solid ice control chemical use.

Any liquid as long as it is mostly water and will not freeze during operations is suitable for prewetting.

The use of pre-wetting is most effective in storms having pavement surface temperatures above about 12˚F and when necessary to spread material on packed, icy or dry pavement. Using pre-wet solid ice control chemicals on pavements having sufficient available moisture (loose snow, slush, water) and warmer temperatures (above 23˚F) will not significantly improve the effectiveness of the solid ice control chemical.

II.F.5 Factors that Impact the Choice of Ice Control Treatments and the Application Rates of Snow and Ice Control Materials

II.F.5.a Pavement Surface Temperature

Pavement temperature is one of the most important factors that impacts treatment decisions. A number of factors influence this temperature and understanding them will aid in making treatment decisions.

SOLAR RADIATION OR SUNSHINE

Solar radiation can warm surface temperatures significantly above air temperature. The darker the surface, the more pronounced this effect will be. It is not uncommon to have surface temperatures 30 to 40 Fahrenheit degrees above the air temperature early in the afternoon. As the angle of the sun above the horizon increases, solar warming increases. The lowest sun angles occur at the winter solstice and at sunrise and sunset of each day.

CLEAR NIGHT SKY RADIATION

Just as the sun warms surfaces through radiation, clear night skies, with little or no wind, cool surfaces. This can result in pavement surface temperature being colder than the adjacent air temperature. This condition often allows black ice or frost to form on the pavement surface. This cooling is also related to the subsurface temperatures and the time of the year.

GEO-THERMAL EFFECTS

Subsurface temperature influences pavement surface temperature primarily through thermal conduction. In the fall, when the earth is still warm and short-term air temperature drops below freezing, absent radiational effects will probably not cause the pavement surface to fall below freezing. During the spring, at the end of the season, pavement surface temperatures will remain cold although the air temperature is warmer (absent radiational effects). Bridge decks may freeze quicker than adjacent road surfaces in the fall due to the lack of thermal conduction provided by the earth. However, in the spring bridge decks can warm more quickly than surrounding surfaces for the same reason.

AIR TEMPERATURE AND WIND

Absent radiational and geo-thermal effects, the pavement surface temperature will always be moving toward the adjacent air temperature. The rate of temperature change is usually slower than changes caused by radiational or geo-thermal effects. However, with increasing wind speed, the rate of pavement temperature change due to air temperature will increase.

TRAFFIC

Traffic can slightly increase pavement surface temperature as a result of tire-road friction and the radiant effects of engine and exhaust systems.

II.F.5.b Dilution of Ice Control Chemical

There are several factors that influence how quickly an ice control chemical reaches Acritical dilution or the freezing point.

WATER OR SNOW AND ICE ON THE PAVEMENT AT THE TIME OF TREATMENT

This is largely due to the effectiveness of the plowing operation or accumulation on the road if there is no plowing prior to the chemical treatment. The more water or snow/ice on the pavement at the time of treatment, the more quickly it will dilute the ice control chemical.

ICE CONTROL CHEMICAL FORM

Liquid ice control chemicals are quite dilute (23% - 32%) to begin with. With dilution, they will reach the freezing point more quickly than solid chemicals that are nearly 100% chemical.

ICE CONTROL CHEMICAL TYPE AND GRADATION

Some solid chemicals go into solution more quickly than others. Their potential for critical dilution is greater. Finer graded solid chemicals also go into solution more quickly. Different chemicals also have different ice melting rate characteristics.

ICE OR WATER CONTENT OF THE EVENT

The ice content of snow and ice events varies dramatically. Light, fluffy dry snow has an ice or water content in the range of 5%. Wetter heavier snow may be as high as 80% ice or water. Rain, freezing rain, and sleet all have nearly 100% water or ice. Higher ice content events will dilute ice control chemicals more rapidly.

EVENT INTENSITY

The more intense the precipitation rate, the quicker it will dilute an ice control chemical.

CYCLE TIME OF CHEMICAL TREATMENTS

The longer the time between treatment cycles, the greater the opportunity for dilution, however, cycle times should be long enough to allow the chemicals to work.

CLEARING ABILITY OF PLOWS

The more snow and ice mechanical equipment removes, the less dilution will occur in the following chemical treatment.

ICE-PAVEMENT BOND AT THE TIME OF TREATMENT

This may be the single most important factor effecting chemical dilution. If there is ice-pavement bond, more ice control chemical will usually be required in order to be effective. The

thickness of the bonded ice is also important. Very thin ice will require little or no additional ice control chemical while thick ice and snow pack will require significantly more. The following are indications that there is ice pavement bond:

i. A spray of water will be produced by moving vehicle tires.
ii. On loose snow or slush-covered roads, the track created by moving tires will appear bare.
iii. There will be many bare spots on freshly plowed pavement.
iv. Scraping the snow or ice on a pavement with a plow (or shovel) will easily expose the pavement surface.
v. The plow will make a louder noise if there is no bond

TRAFFIC

Traffic can have positive and negative effects on ice control efforts. Mechanical agitation helps break up snow and ice that have been weakened by the ice control chemicals, aids in allowing chemicals to go into solution quicker and keeps some potentially frozen brine solutions from actually solidifying. Traffic can also remove ice control chemicals from surface and consolidated snow to form pack. Vehicle generated wind and natural wind can displace solid chemicals and cause tire spray to leave the pavement environment.

II.F.5.c Ice-Pavement Bond at the Time of Treatment

If there is ice-pavement bond at the time of treatment, more ice control chemical will be required to penetrate the ice, break the bond and remain above critical dilution until the next treatment. Very thin ice would be an exception to this.

II.F.6 Deciding on an Ice Control Treatment

Every time a snow or ice treatment is being designed, as much of the following information as possible should be on hand or estimated:

a. The level of service prescribed by **ANTIS** policy
b. Present pavement temperature
c. Trend of the pavement temperature
d. Is the remaining snow or ice before treatment bonded to the surface?
e. Traffic volume and timing

Once some determination of the items above and other operational considerations has been made, a decision on treatment can be made. It is likely that every treatment will be different as the critical factors are always changing.

Table 4 (Recommended Ice Control Treatment) summarizes the most recent available guidance for ice control. Here the factors that relate to pavement surface temperature and ice-pavement bond are displayed in a fairly simple matrix. The ice -pavement bond characteristic determination can be made by operators or supervisors in the field using the guidance in II.F.5.b.

Pavement Temperature (E)	**Ice Pavement Bond**	**Salt/Anti-Skid%**	**Application Rate, lb/lm**
			Solid & Pre Wet Solid products
Over 32	No	100% Salt	150
	Yes	100% Salt	200
30 to 32	No	100% Salt	200
	Yes	100% Salt	275
25 to 30	No	100% Salt	250
	Yes	100% Salt	350
20 to 25	No	Mix 70% Salt 30% Anti-Skid	300
	Yes	Mix 70% Salt 30% Anti-Skid	450
15 to 20	No	Mix 70% Salt 30% Anti-Skid	350
	Yes	Mix 70% Salt 30% Anti-Skid	700 or 400
Below 15		Mix 70% Salt 30% Anti-Skid	700* Or 400*

NOTE : Pre Wetting should be used when the pavement temperature is below 25 degrees. It also should be used when there is little moisture on the road to hold the salt and when treating snow pack and ice of any thickness.

* In order to achieve these rates, use salt spreading settings for 500 pounds per lane mile and 300 pounds per lane mile respectively.

II.F.7 Application of Ice Control Chemicals and Abrasives

II.F.7.a Application Techniques for Solid Ice Control Chemicals

After the ice control treatment for prevailing conditions has been decided, the final step is to get the designed treatment in the right location at the right time. There are a number of techniques for spreading solid chemicals that can optimize treatment effectiveness:

TRAVEL LANES

Try to place solid ice control chemicals in a fairly narrow band near the high edge of each lane on two land highways. On multi-lane highways, a more general distribution may be used in spreading on more than one lane.

BRIDGES AND OTHER ELEVATED STRUCTURES NOT RESTING ON EARTH

In the fall and at other times when there is a rapid, severe, decrease in air temperature, elevated structures are likely to be colder than adjacent pavement on earth. The application rate made be increased by up to 20 percent on these structures so chemical solution freezing will not occur or will occur at about the same time as the surrounding pavement. Toward spring, when air temperatures are warming, structure temperatures are likely to be warmer than the surrounding pavement. Higher application rates are not necessary in this situation.

STRONG CROSS WINDS AND BLOWING AND DRIFTING SNOW

When spreading in strong cross winds, try to keep the spreader upwind of the intended spread location. If the wind is too strong, and the pavement temperature is low, spreading may not be appropriate.

BANKED OR ELEVATED CURVES

Try to keep the spread pattern on the high side of elevated curves. As the chemical works, chemical brine will migrate over the remainder of the pavement.

PARKING AREAS AND WALKWAYS

Spreading ice control chemicals as evenly as possible over the entire paved area is recommended for parking areas and walkways. These areas present an opportunity for pre-event anti-icing with solid chemicals as traffic will not displace them very readily from the surface.

THE WORST CASE SCENERIOS

The worst cases usually occur when the chemical treatment is quickly overwhelmed (diluted) by excessive amounts of water or ice. Blizzard conditions (intense snowfall, wind, very cold temperatures) quickly dilute ice control chemicals and render them virtually useless. If the pavement temperature going into and coming out of a blizzard is expected to be low, then plowing only is probably the best strategy. After the blizzard if it is still very cold, use abrasives as necessary until warmer temperatures will allow chemical de-icing to work. If the pavement temperature throughout and after the blizzard is likely to be fairly warm, a treatment with an ice control chemical before or early in the storm followed by plowing only throughout the storm, will make de-icing at the end of the storm much quicker.

Rapidly accumulating freezing rain is a major maintenance concern. The best strategy here is to apply solid ice control chemicals, at a high rate, in very narrow bands in the high side wheel path of each lane. Usually, this will provide a location in each lane that will have enough friction to allow vehicles to stop and steer.

GETTING THE APPLICATION RATE RIGHT

Application rates for ice control chemicals are usually specified in pounds per lane mile. Spreaders are usually calibrated to deliver pounds per mile (the discharge rate). It is important to

understand that relationship in order to be sure the proper application rate is being used. The application rate is the number of pounds dispensed per mile (the discharge rate), divided by the number of lanes being treated.

II.F.7.b Applying Abrasives (Anti-Skid) and Abrasives (Anti-Skid) /Chemical Mixtures

i. The application rate (when necessary) shall be 700 pounds per lane mile on higher traffic volume roads and 400 pounds per lane mile on lower traffic volume roads.
ii. Abrasives and mixes should be spread reasonably uniformly across the travel lanes, within the confines of the plowed path.

11.F.8 Materials Spreading Equipment

Materials spreading equipment is most efficient and effective when associated with plow trucks. Independent plowing and spreading operations require almost impossible coordination. By spreading chemicals on freshly plowed surfaces, the chemicals will dilute less and last longer. Most chemicals need time to work. Uncoordinated plowing that removes chemicals from the surface too soon is wasteful.

There are a variety of solid material spreader types used by **ANTIS**. These include V-Box (slide-in or frame mount), and under- tailgate.

II.F.8.a Calibration

Whatever materials distribution system is used, it must be calibrated. This will assure that the proper amount of material is being applied. Over-application is wasteful and under-application will not achieve the desired results. Solid material spreaders are usually calibrated by capturing and weighing material dispensed at various speeds, control settings and gate openings. A back-up or manual calibration for automatic control systems should be developed for each spreader. A calibration procedure for solid chemicals appears below.

Calibration procedures for liquid spreaders are similar except that the liquid is captured in a container and the time of discharge is recorded. This will yield a rate of discharge (volume or weight) that can be related to vehicle speed and area of coverage for calculating application rate.

Prewetting systems also require calibration. Here, the pre-wetting liquid is captured and related to the amount of solid ice control chemical dispensed in the same time period. Adjustment is primarily a function of changing nozzle size.

For smaller and hand operated solid material spreaders, a band of material can be run across a plastic tarp. The area of that band on the tarp is measured and the amount of material on the tarp is weighed. The weight of material on the tarp divided by the area of material on the tarp is the application rate for these spreader conditions.

II.F.8.b Spread Pattern Control

Most commercial materials spreaders have the capacity of adjusting the spread pattern they deliver. The most common device for spreading solid materials is a vaned spinner plate. The distance material is cast is controlled by the speed of the spinner plate. The faster the spinner plate rotates the farther it will cast material.

The direction of cast from spinner plate is controlled by the direction of rotation of the spinner and the location of the point where the material drops onto the spinner plate. Material dropped on one side of the spinner plate is generally discharged on the opposite side. Deflectors or skirts that divert the cast material downward provide additional control.

The proper spread pattern adjustments should be determined on the floor of the chemical storage facility. By pushing the discharged material into a windrow that runs parallel to the back of the spreader, a good indication of spread pattern can be obtained. Spread patterns determined by this method should be field verified by observing the distribution under actual operating conditions and making adjustments as necessary. The spread pattern for liquid distribution systems is usually accomplished by adjusting the direction and spacing of the nozzles. Observing the pattern is the best method to determine if it provides the desired distribution.

II.F.8.c Spreading Speed

The potential for solid ice control chemicals to bounce and scatter increases with increasing truck speed. Spreading speed should be as slow as possible, consistent with maintaining a safe speed in traffic.

II.G Post-Storm Activities

II.G.1 Post-Storm Evaluations

Post-storm evaluations should be conducted at the crew level. The following should be discussed and significant findings/results should be committed to record:

a. Personnel issues
b. Materials and materials management issues
c. Equipment issues
d. Safety issues
e. Weather and information system accuracy
f. Observed storm conditions
g. Treatment effectiveness and pavement conditions
h. Motorist response issues
i. Coordination and cooperation issues
j. Effectiveness and efficiency of safety restoration activities:

    i. Melt water control
    ii. Snow containment features, and potential problems on bridges

iii. Safety appurtenances attenuators, median and safety barrier, guard rail, etc.
iv. Traffic restriction areas
v. Narrow raised features
vi. Signs and delineators
vii. Sight distance restorations
viii. Drainage features
ix. Raised obstructions

II.G.2 Post-Storm Operational Tasks

The following is a partial list of post-storm operational tasks that should be accomplished:

a. Asset inventory (number and operational status)
   Personnel
   Materials
   Equipment
   Information system
b. Treat Persistent Snow and Ice Conditions
   Blow-over areas
   Freeze-back areas
   Areas with snow pack or ice
c. Road Maintenance Activities
   Pothole patching
   Appurtenance repair
   Brush and tree work
   Sign and delineator work
d. Abrasives clean-up in critical areas
e. Equipment repair, cleaning, maintenance and re-calibration
f. Maintenance and inventory of ice control materials
g. Yard and facility clean up
h. Repair of damaged safety appurtenances, signs, etc.
i. Parts and fuel inventories

II.H Post Season Activities

II.H.1 Evaluation of All Elements of Snow and Ice Control Operations During the Past Season

The following is a partial list of topics that should be discussed, evaluated and committed to writing at the crew, and **ANTIS**-wide levels following the winter season:

a. Personnel
b. Materials B availability, management, problems, etc.
c. Equipment

d. Maintenance of equipment
e. Safety
f. Treatment effectiveness
g. Weather and other information systems
h. Routing and response
i. Level of service
j. Highway and bridge design issues that may have impacted snow and ice control
k. Cooperative agreements and inter-agency cooperation
l. Contracts
m. Emergency response/management
n. Media and public information

II.H.2 Post Season Equipment Maintenance

The following equipment should be repaired, given use or time-based maintenance, and prepared for storage as required:

a. Material spreaders
b. Pre-wetting systems
c. Storage tanks and pumps
d. Plow equipment
e. Trucks, loaders, etc.

II.H.3 Materials, Equipment and Parts Inventory and Acquisition Activities

With the long lead-time required to acquire commodities, the inventory and purchase activities for next season should begin for:

a. Abrasives
b. All ice control chemicals
c. Plow equipment
d. Safety equipment
e. Spare parts

II.H.4 Continuous Improvement Activities

ANTIS is committed to continuous improvement of all of its operations. Snow and ice control is no exception. Forums available at all levels of **ANTIS** include:

a. Direct communication with the office of the Road Foreman
b. Task specific employee meetings;
c. Suggestion program;
d. Customer interaction;
e. Transfer of best practices or successful innovations (internal and/or external to **ANTIS**); and

f. Training.

III. MATERIALS (ROAD SALT) MANAGEMENT PLAN

III.A. Background

Road salt (sodium chloride) can have adverse environmental, infrastructure and vehicle effects. Potential environmental effects have been identified in the areas of:

1. Surface water
2. Ground water
3. Soils
4. Vegetation
5. Wildlife

However, these effects have been only observed in situations where:

1. Highway salting was excessive
2. Uncovered stockpiles of salt and sand/salt mixtures were allowed to remain exposed to the elements
3. Unique wind patterns and earth geology permitted a rapid departure of salt from the highway or stockpile environment

Vehicle and infrastructure effects are well known and are generally accommodated in the design of these elements.

Salt is the most common and least expensive ice control chemical and is likely to be the material of choice well into the future.

With the above in mind, it is **ANTIS'S** policy to create a reasonable balance among cost, safety (**ANTIS** plow operators and the traveling public) and environmental responsibility with its snow and ice control operations.

III.B. Situational Analysis

ANTIS is not aware of any locations within the zone of influence of highway salting where road salt is creating severe negative environmental effects.

III.C. Salt Management Plan

ANTIS will utilize best practices as the primary tool in salt management.

III.C.1. Highway Use

ANTIS will do the following in support of this salt management plan:

a. Use only the amount of salt necessary to provide a satisfactory level of service for individual combinations of weather and road conditions
b. Calibrate all materials spreading equipment to allow the proper application rates of salt
c. Upgrade equipment over time to include ground speed materials application rate control
d. Acquire technology to assist in better defining weather and road conditions
e. Conduct operations in an efficient and effective manor
f. Use pre-wetting of salt when operationally necessary
g. Train Antis employees in the use of appropriate snow and ice control procedures and the importance of salt management
h. Use the principles of **CONTINUOUS IMPROVEMENT**

III.C.2. Non-Highway Considerations

a. **ANTIS** stores all its salt under structural cover
b. Loading salt on to trucks will be done within the salt storage structure to the extent possible
c. Trucks will be loaded only to a point below where spillage is likely to occur
d. All trucks and spreaders will be washed in the wash bay where appropriate waste water controls are in place
e. All salt spillage in the yard will be cleaned up ASAP or after every snow event.
f. The salt storage shall be light during all night time operations
g. The salt storage shall be kept clear of all stored equipment and materials so as to not interfere or cause a hazard during loading and unloading of slat and magnesium chloride.

VEHICLES AND EQUIPMENT AVAILABLE


GMC
9


9

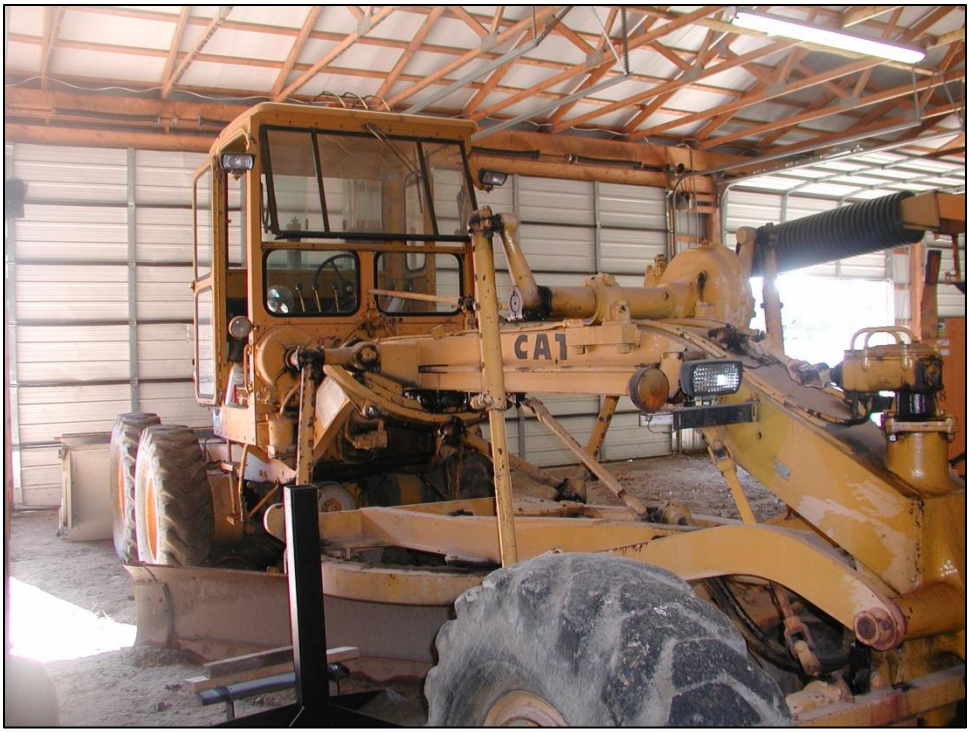

10


MACK
Mack


BARRIER


924G
CAT


CATERPILLAR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