Highway Factors Attachment – New York State Thruway Authority Winter Maintenance Manual

Mount Pleasant, PA

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WINTER MAINTENANCE MANUAL

NEW YORK STATE THRUWAY AUTHORITY

REVISED OCTOBER 2019

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BUREAU OF MANAGEMENT ANALYSIS AND PROJECTS

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INTRODUCTION

The purpose of the Winter Maintenance Manual (Manual) is to provide information and guidance to assist the maintenance forces of the Thruway Authority (Authority) in conducting snow and ice control operations as well as to serve as a basis for training Authority personnel. It reflects best practices as determined from a review of the relevant national and international literature and the collective knowledge of an Authority multi-discipline focus group with representation from all Divisions and Administrative Headquarters in Albany.

The requirements set forth in the Manual were developed to achieve a reasonable balance of safety, cost, and environmental needs. The requirements are separated into the following six areas:

PRIORITIES AND GENERAL GUIDELINES establish program goals and service priority levels and addresses snow and ice control operations for pre-winter, post-storm, and post-winter activities.

ROLES AND RESPONSIBILITIES describe program activities and assignments for personnel engaged in winter maintenance operations.

SNOW CONTROL GUIDELINES provide definitions, techniques and best practices for operators actively engaged in snow plowing and snow removal operations. Snow control by means of passive measures is also discussed.

ICE CONTROL GUIDELINES provide strategies, definitions, techniques and best practices for ice control treatment. Properties of ice control materials are also discussed. Ice control treatment operations are directed toward preventing snow and ice from bonding to the pavement, as well as chemically or mechanically removing snow or ice that has bonded to the pavement.

OPERATIONAL PROCEDURES prescribe techniques and establish standardized reporting methods to be utilized in snow and ice control operations. These Procedures ensure that the program goals are achieved in both an effective and efficient manner and that timely and accurate communications occur all without compromising safety.

ORGANIZATIONAL POLICIES AND PROCEDURES set forth provisions and standardized methods applicable to personnel engaged in snow and ice control. These policies and procedures ensure that personnel, the most important resource of the Snow and Ice Control Program, are utilized in both an effective and efficient manner in achieving program goals without compromising personal safety.

It is intended that this Manual be a "living document" that is updated on an ongoing basis as new technologies and techniques are developed within the Authority and elsewhere. Suggestions for changes may be submitted at any time to the Director of Highway Management at Administrative Headquarters in Albany.

The contents of this Manual shall supersede all applicable prior manuals, directives and guidance relating to snow and ice control. In the event of a conflict between the provisions of this Manual and the current Unit I and Unit II labor agreements, the provisions of the applicable labor agreements will prevail and those provisions shall be brought to the attention of the Director of Highway Management so that updates to this Manual may be made if necessary.

I. PRIORITIES AND GENERAL GUIDELINES

The Authority will conduct snow and ice control activities to provide customers a roadway which is safely drivable at a reasonable speed under the weather conditions presented, with the ultimate goal of returning to bare pavement as quickly as possible.

Snow and ice accumulations will be removed as soon as possible consistent with priorities stated herein. Prevention of the bond of snow and ice to the pavement will be attempted through the timely application of ice control chemicals. However, blizzards, whiteouts, locally severe snow or ice events or other conditions beyond the control of Authority maintenance forces may temporarily present more difficult operating conditions for motorists.

The words "shall", "must", "should", "recommended", and "may" as used in this Manual have the following meanings:

Shall and Must	-	A required course of action. Extenuating circumstances may arise and cause a departure from the documented practices. The Supervisor is empowered to make this determination.
Should and Recommended	-	A recommended course of action.
May	-	An optional course of action.

A. Elements of Snow and Ice Control for Supervisor Decision Making

1. Equipment

During (and just prior to) the winter maintenance schedule, Motor Equipment Managers 1 (MEMs 1) shall provide to the Division Maintenance Engineer (DME) or designee, a weekly report of the status of all snow fighting equipment, including loaders, plow trucks, spreader trucks, and patrol trucks. The DME will be able to use this report to: 1) detect a severe equipment deficiency at a specific work location with enough pre-storm lead-time to work with the MEMs 1 to accomplish critical equipment repairs; and, 2) work within Highway Management to either move equipment resources to an area where needed or extend the responsibilities of a neighboring work unit.

2. Weather Information

a. Weather Forecasts

There are a variety of weather forecast products available to the Supervisor to plan effectively and to operate an efficient storm response. Supervisors should be simultaneously evaluating short-term, mid-term, and long-range forecasts. Information on precipitation should include forecast (beginning and end) type and intensity. Other relevant factors include air temperature, humidity, dew point temperature, wind speed, wind direction, and cloud cover.

b. Current Weather Data and Observations

Current weather data and observations may be obtained from maintenance patrols, operators, State Police, toll facilities, and Thruway Seasonal Weather Information System (SWIS) sites.

c. Other Weather Information

Other weather data sources include the National Weather Service, Internet, the Weather Channel, upstream spotters, local TV and radio, Micronet and IBM personal weather stations, etc. This information is available on the Authority's "Winter Dashboard" available at http://ird/ with permission from the Director of Maintenance and Operations, Superintendent of Thruway Maintenance, Director of Operations or Director of Emergency Management.

3. Highway and Pavement Information

a. Status of Critical Locations

Traffic flow and pavement condition information for critical locations is important in prioritizing snow and ice control operations. Critical locations include toll plazas, hills, interchanges, bridges, cold locations (low, shaded and elevated), locations having mist or fog generation tendencies, areas historically identified as high accident locations, and areas prone to drifting snow.

b. Pavement Temperature

Pavement temperature is one of the most important factors when deciding on a snow and ice control treatment. Data on pavement temperature trends may be obtained from in-pavement systems, SWIS, vehicle mounted and hand-held sensors, and surrogate locations (other systems, i.e. facility parking areas, etc.). Predictions and estimates can be made based on knowledge of current air temperature and trends, ground temperature, subsurface temperature, cloud cover and time of day.

c. Accumulations of Snow and Ice on the Pavement

Knowledge of the character and depth of any snow or ice accumulation on the pavement surface is important in the treatment decision process, including whether or not the snow or ice is bonded to the pavement.

d. Traffic Characteristics

Traffic data, including volume, speed, timing of peak flow, status of any closures and any reduction in available lanes, is critical in decision making.

4. Assessments of Effectiveness and Efficiency (Best Practices)

Post-storm assessments of effectiveness and efficiency are important for improving the decision making process. Supervisors, in conjunction with their maintenance staff, shall conduct Post-storm assessments at the Section level. For major events as determined by the Division Director or Director of Highway Management, the DME, working with Supervisors, shall conduct Post-storm assessments at the Division level. In the case of major events, the results of the Division assessments shall be shared with the Director of Highway Management.

Feedback on the Post-storm assessments should be shared with the right parties at the right level with the goal of enhancing winter maintenance operations.

Storm response information for discussion can be obtained from the verbal reports of operators and patrolling Supervisors, as well as in written

material: Storm Activity Reports, Truck Operator Activity Logs, Maintenance Patrol Logs, Compu-Spread controller trip data, AT&T Webtech reports and environmental sensor station (ESS) data.

Factors to consider for discussion include personnel and vehicle(s) deployed, timing of start-end cycle times achieved, materials used and their performance, equipment performance, shift transition efficiency, and cooperative procedures.

B. Operational Priorities

During a snow and ice event, the following service level priorities are established:

Priority 1

Mainline pavement, toll barriers, interchanges (including ramps and toll areas), service area ramps (car and truck) and associated crossovers (U-Turns).

In the case of a heavy snow storm, the minimum objective shall be to maintain traffic flow in the driving lane.

Priority 1A

Service area parking lots and sidewalks. Accident assistance, as directed by the Supervisor, in coordination with other Authority functional units (i.e. Operations, State Police, Duty Officer, etc.).

Priority 2

Shoulders (including shoulders on mainline bridges), toll facility parking lots, rest area parking lots and access roads, tandem trailer areas, State Police facilities and access gates.

Priority 3

Other facilities and parking lots.

Priority 4

Safety restoration and clean-up operations. See Section III. D. for further information.

C. Pre-Winter Activities

Annually, a Maintenance Directive shall be issued by the Superintendent of Thruway Maintenance to establish time frames for the winter maintenance schedule and activities.

Annually, once the pre-winter activities have been completed, the Thruway Maintenance Supervisor 2 (TMS 2) shall complete and forward the ANNUAL PRE-WINTER MAINTENANCE CHECKLIST (TA-N41204) to their DME for review/verification. The DME shall forward the ANNUAL PRE-WINTER MAINTENANCE CHECKLIST to their Deputy Division Director, the Director of Highway Management and the Superintendent of Thruway Maintenance by COB the first Monday in November.

1. Review and Recommend Revisions to Manual

This document should be selectively reviewed by the affected parties that take part in the various elements of the winter maintenance program as a part of pre-winter activities. However, changes should be recommended throughout the year as soon as the need for a change becomes evident. Changes may be the result of individual or work group suggestions, snow and ice control focus groups, Supervisors meetings, post-season reviews, or instruction from Authority management. (See Exhibit 1, memo format for submitting changes. Memo can be obtained by contacting the Director of Highway Management.)

2. Operational Plan Readiness

a. Review Loops

In an effort to improve plowing efficiency, Supervisors shall conduct an annual review and make modifications and adjustments to plow loops on an as-needed basis. As improvements to loops are identified, changes should be coordinated with the DME and reported in writing to the Director of Highway Management. Each Section maintenance unit shall keep updated records (preferably maps) indicating the plow loop for each truck within their Section at the following levels of operation:

i. normal operation (no fleet trucks down)
ii. operations with one truck down
iii. operations with two trucks down
iv. operations with enhanced resources (numbers will vary by Section)

b. Identify Deployed Resources

Supervisors shall, at all times, keep up-to-date records of all deployed resources, including but not limited to: plow and other equipment operators, mechanics, snow and ice fighting equipment, and any active patrols.

3. Review Emergency and Severe Weather Response Procedures

Supervisors should annually review the procedures outlined in Appendix C of this Manual.

4. Equipment Readiness

All of the Authority's snow and ice related equipment should be inspected, receive scheduled maintenance, test run and repaired as necessary prior to the winter maintenance season. (See Maintenance Directive entitled MAINTENANCE AND OPERATION OF MOTORIZED EQUIPMENT.)

a. Truck Readiness

The prescribed annual truck inspections and use (hours/miles) maintenance should be up-to-date prior to the winter season. Trucks should be checked by their operators prior to each use as per CDL requirements.

b. Material Spreader Readiness

The material spreaders should be inspected, repaired, lubricated, calibrated and test run. Calibration procedures vary for the several types of ground speed controllers used by the Authority. All material spreaders should have a backup or manual calibration if the automatic system fails. (See Equipment and Inventory Management Intranet page for speed control calibration procedures.)

Mounting material spreaders on trucks should begin in early October as directed by the DME. All material spreaders should be mounted and ready for use by the time the normal winter storm season begins.

c. Liquid Material Dispensing/Storage Systems

The Authority uses a variety of liquid dispensing and storage systems during snow and ice control operations:

- on-board pre-wetting systems
- anti-icing systems
- bulk storage systems
- brine makers

These systems should be inspected, repaired, lubricated, calibrated and test run. All tanks and systems should be inspected per manufacturer's recommendations. Bulk storage tanks shall be labeled and tied down. Any time a liquid is added to a tank, steps shall be taken to make sure it is compatible with the liquid that is already in the tank.

d. Plow Equipment

Plow equipment should be inventoried, mounted, and inspected for proper function. Equipment having missing parts, structural damage, improper adjustment and inadequate paint protection shall be repaired. Shoes and cutting edges shall have sufficient wear depth or be replaced.

Necessary repairs and/or replacement should be made.

Plows and wings should be stored in a position for easy hookup and have easy-to-read identification to match them to the proper truck.

e. Snow Blowers

Snow blowers should be inspected and test run. Preventative and use-based maintenance should be performed as required.

f. Safety Gear

Appropriate safety gear, such as hard hat, safety vest, winter parkas and boots, goggles, rubber gloves, etc., and Safety Data Sheets (SDSs) for safety gear and the various chemicals used in winter maintenance should be conveniently available in each of the Maintenance Sections.

g. Motor Graders

Motor graders can perform a variety of snow and ice removal tasks. Like the equipment above, they should be in a similar state of readiness prior to the winter maintenance season. Preventative and use-based maintenance should be up-to-date and cutting edges should have sufficient depth.

h. Spare Parts

The maximum allowable stock of commonly used spare parts should be acquired prior to the winter maintenance season. These include: cutting edges, plow shoes, plow guards, shear pins, nuts and bolts, filters, bulbs, spreader controller parts, push arms, springs, etc.

i. Individual Tools

Trucks should be checked for the required complement of tools and safety gear. These include: shovels, bars, tire chains (where appropriate), flags, warning devices, tow chains, ice scrapers, snow brushes/brooms, etc.

5. Personnel Readiness

a. Assignment

Annually, the Superintendent of Thruway Maintenance issues a Maintenance Directive announcing the start and end dates of the winter maintenance schedule and outlining the minimum, desired shift-staffing levels. Personnel shall be trained and/or assigned for snow and ice operations prior to the winter maintenance season as defined in this annual Maintenance Directive.

Reassignment of all applicable staff shall be accomplished before the start of the winter schedule. By October 1st, the DME shall initiate a canvass of all other staff with CDLs (e.g., Trades Generalist, Service & Repair Mechanic [Motor Equipment], etc.) and implement required training prior to the start of the winter schedule.

Availability of Section staff should be factored into staff assignments, especially for storms that occur on the day shift.

Reassignments shall be coordinated with all Program Managers and Supervisors who have staff being reassigned. Shift and work location assignments may require lead-time per union agreements.

The DME is to ensure that each Section can respond to a storm and/or mount a work crew on each shift; therefore, balancing the Section staff on all shifts is encouraged. At all times during the winter maintenance schedule, when not engaged in snow and ice control, and necessary preparation, Supervisors shall use staff for seasonally appropriate maintenance work on all shifts. Section VI. Organizational Policies and Procedures should be reviewed for more detailed direction.

Postings for voluntary assignment during emergency conditions should also be reviewed prior to the winter maintenance season.

b. Callout and Family Readiness

Supervisors should review and discuss, with employees, callout procedures, impacts of winter maintenance on family life, and family responsibilities. Supervisors should remind employees that overtime response is an integral part of their job as maintenance employees.

c. Training

Program managers at the Division and Administrative Headquarters levels should accomplish group-specific snow and ice control training in the fall, prior to the winter maintenance season. Winter Storm Meetings are conducted in accordance with the INCIDENT RESPONSE PLAN (600-0-03). Training topics include: intra-Authority communication, cooperation and responsibilities; describing weather and road conditions, and

utilizing the environmental sensor station (ESS) systems; safety issues; public relations/information issues; operational issues and procedures; level of service issues - local and system-wide; equipment operation and readiness; new technology; new initiatives; new procedures; emergency response issues, etc.

6. Materials Readiness

a. Contracts

The Authority acquires most snow and ice control materials through the contract process. Given the time required to establish a contract, these requirements, contracts and purchase requisitions should be done early. This is a joint effort between the DME or designee, the Bureau of Purchasing, and the Bureau of Highway Management. Typical materials purchased include sodium chloride (salt or rock salt), abrasives (sand), liquid magnesium chloride and liquid magnesium chloride blends. Quality Assurance/Quality Control procedures have been established for each material.

b. Materials Storage Structures

Most Authority snow and ice control materials are stored in structures. These structures, and any associated run-off containment features, lighting systems, pigeon netting, and ventilation systems shall be inspected and repaired as necessary. Salt sheds shall be filled in accordance with individual shed capacity limits prior to the winter maintenance season and fill lines shall be clearly marked.

c. Stockpiles (Non-Structurally Covered)

The Authority stores some abrasives and salt outdoors. Such a stockpile shall be built, maintained and covered. It shall be placed on an impermeable base and drained properly. Conditions of the stockpiles, covers, and area drainage characteristics shall be routinely inspected.

7. Highway System Readiness

The Authority's highway system should be checked and given necessary attention throughout the year in accordance with Thruway Maintenance Management System (TMMS) Activities. Key TMMS data relative to salt inventories, equipment and staff resources should be reviewed to ensure that the information is correct. Supervisors shall conduct their maintenance activities to ensure that all pavement, bridges, culverts, signage and lighting are functional for the coming winter season. Activities include crack and joint sealing, “permanent” pothole repair, striping, drainage clearing and marking, winter signage, obstacle markers, delineators, guide rail, bridge rail, median barrier, gore (point) and guide rail and end treatments, snow fence, living snow fence, snow containment fence on bridges, permanent snow fence on bridge rail, etc.

8. Maintenance Facility Readiness

Facility heating systems, yard traffic areas, fuel delivery systems, electrical outlets for engine block heaters, yard and garage lighting, emergency generators, run-off control features, etc. shall be inspected and repaired as necessary prior to the winter season.

9. Road and Weather Information System Readiness

The Authority has acquired a variety of systems and measuring devices to help in defining road and weather conditions. These include: fixed location pavement and atmospheric sensors, vehicle mounted and hand-held pavement temperature measuring devices, satellite delivered weather information systems, weather forecast providers, etc. These systems shall be checked for function prior to the winter maintenance season. All measurement devices shall be calibrated and maintained per the manufacturer's recommendations.

10. Customer Information and Feedback

Authority customers are provided information to assist in transitioning and adjusting to winter driving.

- Thruway Road Conditions are available by calling **1-800-THRUWAY** (1-800-847-8929). The recording is updated as conditions change.
- Toll Booth "Emergency Report Boards"

- Highway Advisory Radio (HAR)
- Variable Message Signs (VMS)
- Winter Driving and Storm Press Releases
- Website traveler information: http://www.thruway.ny.gov/
  - Winter Driving Safety Tips
  - Weather Forecasts from the NWS
  - Closed Circuit Television (CCTV) Cameras

Customers can provide feedback by contacting the Authority in several ways:

- Telephone
- Postal mail
- Email to the Media Relations office: publicinfo@thruway.ny.gov
- Website form: http://www.thruway.ny.gov/about/contact/index.html
- Thruway mobile app

D. Post-Storm Activities

1. Post-Storm Evaluations

Post-storm evaluations should be conducted at the Crew and Division levels. The following are suggested topics for discussion:

- Coordination and cooperation issues
- Effectiveness and efficiency of safety restoration activities
- Equipment issues
- Materials and materials management issues
- Melt water control
- Motorist response issues
- Narrow medians
- Observed storm conditions
- Personnel issues
- Safety appurtenances - attenuators, median and safety barrier, guide rail, etc.
- Safety issues
- Signs and delineators
- Snow containment features and potential problems on bridges
- Traffic restriction areas
- Treatment effectiveness and pavement conditions
- Weather and information system accuracy

2. Post-Storm Operational Tasks

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

- Clean up yard and facility.
- Inventory ice control materials and re-order if necessary.
- Re-calibrate spreader controls, if necessary.
- Repair, clean, and perform maintenance on equipment.
- Repair damaged safety appurtenances, signs, etc.
- Assess deicing application rates.

E. Post-Winter Activities

1. Post-Winter Clean-Up

Post-winter clean-up activities are intended to provide a safe and well-maintained highway system for the Authority's customers. The activities outlined below establish a Thruway-wide standard and shall be completed by May 1, unless otherwise indicated.

While local expertise will determine the best and most effective way to complete the work, clean-up efforts by Highway, Bridge and Facilities crews shall be coordinated to increase efficiency, and seasonal and other resources shall be fully utilized whenever possible.

a. General

Major clean-up activities shall be completed before significant spring growth of grass and underbrush occurs. This will allow access to areas that may become inaccessible later in the growing season:

- Remove litter and debris from the center mall areas and from the right side right-of-way (ROW) from the edge of the roadway to the fence line or to the beginning of the tree and underbrush line. Litter and debris caught in undergrowth and tree limbs adjacent to the grass line should also be removed;

- Identify for immediate action or follow-up, as appropriate, any (1) dead trees or trees with the imminent potential to fall and reach the pavement; and (2) areas of turf or slope damage; and

- Clean bridge slopes and areas adjacent to overhead bridges up to the top of the embankments and to the full extent of the Authority's ROW responsibility.

  Note: All in-house bridge washing shall be completed by the end of June in accordance with Activity 1102 Bridge Cleaning standards.

b. Mainline

- Permanently patch potholes as soon as hot asphalt becomes available;

- Repair guiderail and attenuator damage from winter operations; and

- Straighten and replace delineators, smaller roadside signs or fencing impacted by winter operations and remove temporary snow fencing including temporary fencing added to bridge rails.

c. Toll Plazas

Clean-up activities at toll plazas shall include pavement areas, toll islands and bullnoses, toll booths, building exteriors and lawn/ROW area. The following efforts shall be completed by June 1:

- Clear toll lanes, islands and bullnoses of any debris. Toll booths, buildings and bullnoses shall be cleaned and/or painted where appropriate (painting shall be coordinated with the Division Facilities Engineer). The standard color scheme for the toll utility building exterior should be an earth tone shade similar to Sherwin Williams Biscuit or equivalent matching color. The trim color should be an earth tone shade similar to Sherwin Williams Walnut Brown or equivalent matching color. Each plaza should be painted on an as-needed basis; and

- Maintain landscaping in a manner appropriate for the planting or feature.

General debris and litter removal shall be guided by Section a. above and completed by May 1.

d. Service Areas and Parking Areas

- Clean service area and parking area locations to the edges of the Authority's area of responsibility;

- Pick up litter and debris that has blown into adjacent areas if it can be done with minimal impact on the adjacent property; and

- Clear the ROW immediately adjacent to the service area and parking area of brush and other litter/debris that may have accumulated over the fall and winter.

A clean roadside environment is important, but it does not preclude the need to maintain other features of the roadway. Post-winter clean-up and regular ROW activities required throughout the year need to be balanced with the need to perform other maintenance functions.

2. Post-Winter Evaluations

The following is a partial list of topics that should be discussed and evaluated at the Crew, Division and Authority-wide levels:

- Contracts
- Cooperative agreements
- Emergency response/management
- Equipment
- Highway and bridge design parameters and conditions
- Level of service
- Materials - availability, management, problems, etc.
- Media and public information
- Operator maintenance of equipment
- Personnel
- Refinements to this Manual
- Routing and response

- Safety
- Treatment effectiveness and efficiency
- Weather and other information systems

3. Equipment Maintenance

Proper maintenance and storage of plows, wings and spreaders is essential for equipment longevity. At the end of the winter season, each plow, wing and spreader shall be inspected, washed, lubricated, painted if necessary, and stored properly.

a. Inspection

When plows, wings and spreaders are removed from host vehicles, each component shall be inspected. Any potential problem that may require repair prior to the next winter season shall be recorded on a DRIVER'S VEHICLE CONDITION REPORT (TA-4260) (VCR) and given to the work unit Supervisor. Using the VCR, the work unit Supervisor shall inspect the mechanical condition and painted surfaces of all plows, wings and spreaders and coordinate remedial action. Repairs shall be scheduled through the summer months and be completed prior to October.

b. Washing

The guidelines described in the Maintenance Directives entitled CARE AND CLEANING OF AUTHORITY MAINTENANCE VEHICLES AND MOTORIZED EQUIPMENT and OPERATION, MAINTENANCE AND INSPECTION OF OIL WATER SEPARATORS AT MAINTENANCE FACILITIES shall be followed when washing plows, wings and spreaders.

As part of the washing process, the equipment shall be treated with a salt neutralizer and/or rust inhibitor. (Note: these products cannot be used at those facilities that are not connected to a municipal waste water system.) Currently, the Authority stocks "Carwell" (part numbers 61043508, 5 gallon pail, and 61043509, 55 gallon drum, rust preventative for vehicle undercoating) and "Neutro-Wash" (part number 31080005, 55 gallon drum, salt and chloride neutralizer).

Once dry, treat components such as spreader chains and hydraulic couplers with the corrosion inhibitor "Fluid Film". It can be either sprayed (part number 58010131, spray can, 12-oz penetrant, corrosion preventative) or applied with a brush (part number 58010132, gallon can, 1-gal penetrant, corrosion preventative).

c. Lubrication

After washing, lubricate bearings and pivot points to disperse moisture, salt, debris and other corrosive materials. When safe and practical, lubricate spreader bearings while they are rotating.

d. Painting

Maintaining paint in good condition provides several benefits:

- Maximizes visibility of the plow;
- Protects plow from further corrosion; and
- Maintains the professional appearance of our fleet.

Painting is required on an as-needed basis. While there is no specified repainting interval, the expectation is that plows and wings will have the appearance of being new from a distance of approximately 100 yards.

Most mainline plows and wings will require touch-up or spot painting annually and potentially complete repainting every few years. Plows and wings can be refreshed or touched up by using one of the following methods:

- Minimal wear and/or paint damage can be touched up with a brush and those with larger surfaces may require spray application; or
- Heavy rust and corrosion may require sandblasting and a total repaint.

Only approved Thruway fleet yellow paint (DuPont LF224 or equivalent) is to be used. The only exception is the use of a flat

black paint on the backside of the mold board. This is done to help reduce glare from the headlights and is a local option for the work unit. During the painting process, all cylinder rams, hose couplings and ground areas are to be protected from paint intrusion. All paints and coatings are to be lead free.

e. Storage

Proper storage of plows, wings and spreaders is important due to the extended period of time they sit inactive. All equipment shall be stored on a dry, flat, hard surface free of vegetation. Concrete is the preferred surface for storage; however, asphalt or hard gravel surfaces are acceptable as long as the necessary precautions are taken to prevent the equipment from sinking and/or tipping. Specific storage requirement are described below:

Plows

Plows shall be stored on wooden blocks or steel beams to keep the cutting edge from contacting the ground. This prevents the wicking of moisture into joints and seams that can lead to additional corrosion during storage.

- The hitch end of the plow shall be blocked and elevated.
- Hydraulic rams with cylinders exposed shall have the rods greased to protect the chromed surface from rust and pitting.
- Hydraulic hoses shall be coupled, greased, wrapped to prevent corrosion, folded over the plow frame and stored off the ground.
- Plows shall be organized to allow individual access and stored in an orderly manner to minimize space requirements.

Wings

- Wings shall be stored upright horizontally off the ground. Upright storage minimizes the chances of water pockets which can lead to additional rust and corrosion. Wings shall be stored on:

- Fabricated racks; or
- Modified old truck wheels that allow the wing to be securely stored horizontally.

- All storage racks and devices shall stabilize the wing to prevent accidental tipping or falling.

Spreaders

- Spreaders shall be stored off the ground with a slight slope front to back to allow drainage.
- No liquid or deicing materials are to be left in or on the spreader during storage.
- Spreaders can be stored using one of the following methods:
  - Transversely across two rows of concrete barriers;
  - On specially built box rails that perform the same function; or
  - On wagon type running gear provided they are stable and secure.
- Spinner assemblies must be off the ground. This may require removal or folding the chute up out of the way to prevent damage.
- Spreaders equipped with ELP frame rails are to be stored on a flat level surface. If stored on any surface other than concrete, the legs or contact points must be stabilized to prevent the spreader from sinking into the asphalt/hard gravel.
- All hydraulic hose connections shall be stored off the ground, greased and wrapped to prevent corrosion.
- Electrical connections shall also be protected with dielectric grease (part number 58030138, 100 gram tube), wrapped and stored off the ground.

Note: In addition to the steps detailed above, pre-wetting systems, storage tanks and pumps, and anti-icing slide-in units should be repaired, given use or time-based maintenance and prepared for storage as required.

4. 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 immediately following the winter season for abrasives, all ice control chemicals, plow equipment, safety equipment, and spare parts.

5. Continuous Improvement Activities

   The Authority is committed to continuous improvement of all of its operations. Forums available at all levels of the Authority include:

   a. Fall Highway Management Supervisors Meeting
   b. Annual Winter Storm Meeting per INCIDENT RESPONSE PLAN (600-0-03)
   c. Customer feedback
   d. Division Snow and Ice Meetings
   e. Intranet e-mail
   f. Thruway Maintenance Worker Training Program
   g. Training Seminars

II. ROLES AND RESPONSIBILITIES

A. Thruway Maintenance Supervisors 2 and 1

1. The TMS 2, under the general supervision of the DME, is responsible for all winter maintenance activities within the Section.

2. The Thruway Maintenance Supervisor 1 (TMS 1) assists the TMS 2 in all aspects of the Section's winter maintenance activities. The TMS 1, on assignment, may take over the duties of the TMS 2 when necessary.

3. TMSs 1 and 2 are responsible for responding to all snow and ice control conditions within the limits of that Section, including but not limited to, communication with Headquarters and adjoining Sections (requests for support) as well as coordination with the Duty Officer Command structure and Traffic Operations. The judgment of the Supervisor, based on the analysis of data at hand, must be the controlling factor in deciding how to deal with each storm.

4. Before the start of the winter maintenance schedule each year, the TMS 1 or 2 shall analyze all of the plow routes within the Section taking into account areas of traffic growth, traffic pattern changes, priorities and changes in physical features. Plow routes shall then be updated as necessary.

5. TMSs 1 and 2 have the primary responsibility for snow and ice removal at service areas within the Section. Before the start of the winter maintenance schedule each year, TMSs 1 and 2 should meet with the managers of the restaurants and gas stations in their Section to ensure that responsibilities and operating procedures are fully understood.

6. The shift Supervisor for each shift of a storm should complete STORM ACTIVITY REPORT (TA-E41130). The Report is a post-storm evaluation tool used to measure performance and monitor resources expended and is benchmarked against various types of storms encountered. It should be reviewed, dated and signed by the TMS 2 and sent to the DME for review and signature. It should be filed in the Division for a period of 5 years unless otherwise extended by the Division Director. Definitions of precipitation may be found in Appendix D.

The materials reported as expended on form TA-E41130 should reflect the sum of the materials shown on the TRUCK OPERATOR ACTIVITY LOG (TA-41188), prepared for each vehicle for each shift of the storm.

The Authority's TMMS is an integral part of scheduling, event tracking and inventory management, and every effort must be made to ensure that all relevant Sections of the system are kept current with the correct entries.

7. TMSs 1 or 2 may be scheduled for overtime duty on Saturdays, Sundays, and holidays during the winter maintenance season.

8. Supervisor shift activities include:

   a. Review of activities and work accomplished by previous shift.

   b. Review, by field inspection, the condition of Section roadways.

   c. Evaluate and adjust, where necessary, pre-planned activities of shifts.

   d. Coordinate shift assignments. Extend shift assignments and/or mobilize more personnel. This may include moving in personnel from other work locations. The receiving Supervisor must brief new personnel on the specific local characteristics unique to the reassigned location.

   e. Evaluate equipment assignments and repair needs.

   f. Review and revise a necessary Section call-out roster based on unavailable responses from Section employees.

   g. When appropriate, provide assignments, guidance and direction to the Supervisor of the next shift. One example of such action would be to prepare for “shifting on the fly”. When a weather forecast predicts the arrival of a winter storm close to the time for shift change, the shift Supervisor on duty should take action to ensure a timely response to road conditions during the shift change.

      The shift Supervisor should ensure that current shift operators be held over and advise the next shift Supervisor to have the next shift operators directly relieve current shift operations by reporting to

their on-station assigned spreader truck locations. Material spreaders should be stationed at the beginning of their routes and not at central locations such as salt sheds.

h. Supervise and conduct necessary Section communication activities.

i. Complete Section records.

B. Crew Leader

The Crew Leader is in charge of the shift activities and reacts as required to commence snow and ice control activities. The Crew Leader may contact any of the Supervisors or the Division Duty Officer.

In the absence of a scheduled Supervisor on a shift, an employee is designated as a Crew Leader. The Crew Leader will be a Construction Equipment Operator Heavy (CEOH), a Trades Specialist (Bridge) or either a Construction Equipment Operator Light (CEOL) or a Thruway Maintenance Worker (TMW) on an out-of-title basis acting as a CEOH in accordance with the terms of the Unit I Collective Bargaining Agreement.

C. Equipment Operator

1. Equipment Operators shall operate all equipment in a safe manner and in accordance with the policies and procedures covered in this Manual. If a situation arises in which an operator is unsure of what to do, he or she should seek the guidance of their Crew Leader/Supervisor.

2. Equipment Operators should avoid climbing on top of a hopper. If it is necessary to climb on top of the hopper, call for assistance or return to the yard. Hopper access on the road via the hopper ladder shall only occur when another individual is present and has visual contact with the person on top of the hopper. Before climbing on top of the hopper, all wings must be raised and secured with safety chains. Also, the area must be well lit.

3. Equipment Operators shall record all plowing and spreading activity on TRUCK OPERATOR ACTIVITY LOG (TA-41188).

4. Equipment Operators perform operator maintenance tasks as specified in item 4 of the Maintenance Directive entitled MAINTENANCE AND OPERATION OF MOTORIZED EQUIPMENT.

D. Communications Center

Radio Dispatchers shall conduct roll calls of each Maintenance Section when and if specified by the current Winter Maintenance Schedule Maintenance Directive. This is usually done when only one employee is on duty in each Maintenance Section.

E. Division Traffic Supervisor

1. Division Traffic Supervisors monitor traffic flow in the Sections during a snowstorm and communicate their observations directly to the Supervisors. The role of Division Traffic Supervisors during snow emergencies is covered in more detail in the INCIDENT RESPONSE PLAN (600-0-03).

2. Division Traffic Supervisor ensures that there are sufficient tow trucks with operators to service and/or remove disabled vehicles.

3. Division Traffic Supervisor may reassign tow trucks to adjoining Sections if the need arises.

4. Division Traffic Supervisor, with concurrence of the HQ Duty Officer, may put Thruway Authorized tow trucks on an hourly rate paid by the Authority. Division Traffic Supervisor must supervise and direct tow trucks that are on hourly-rate.

5. Division Traffic Supervisor shall coordinate and determine the proper type of maintenance and protection of traffic to be utilized for recovery operations of vehicles being conducted by towing services. Division Traffic Supervisor shall coordinate operations requiring State Police, Maintenance, and towing services for removal of vehicles in storm condition situations.

F. State Police

1. State Police Troop T will maintain regular patrols during storm situations and will report any unusual conditions to the Dispatcher who in turn will contact the appropriate Maintenance Sections.

2. State Police patrols are also available to assist Maintenance personnel with traffic problems involving stalled vehicles, etc. to facilitate snow removal operations.

3. Whenever possible and necessary, the State Police patrol shall establish roadblocks in conjunction with Maintenance personnel when the road is closed during storm periods.

G. Maintenance Patrol

1. The primary function of this patrol during the winter season is to report on highway conditions. The secondary function is to provide emergency service to customers in accordance with the PROCEDURE FOR PROVIDING EMERGENCY ROADSIDE SERVICE FOR THRUWAY PATRONS (600-0-02). If a conflict in duties should arise, the primary function takes precedence.

2. The Radio Dispatcher must be advised of the start and end times of each patrol.

3. The operator of the patrol must keep a MAINTENANCE PATROL LOG (TA-N4159) during those shifts that require patrolling, namely, the first and third shifts Monday through Friday and all shifts Saturday, Sunday and Holidays.

4. When emergency conditions prevail and the patrol is suspended, the Radio Dispatcher must be notified, and an entry made in the MAINTENANCE PATROL LOG, indicating the time and reason for suspension. Similarly, when the patrol is resumed, the Radio Dispatcher must be notified and an entry made in the MAINTENANCE PATROL LOG. The operator of the patrol should register pavement and air temperature at locations designated by the TMS 2.

5. A radio equipped pick-up truck will normally be used in all Maintenance Sections for patrols.

6. One maintenance patrol is required per shift at a time set by the DME unless emergency conditions dictate otherwise, or the DME suspends patrols due to warm temperatures. The shift Supervisor may schedule additional patrols as conditions warrant.

7. Each patrol shall cover the entire Section including interchanges. Whenever possible, the patrol shall use the same route as established by the Supervisor.

8. The operator of the maintenance patrol shall:

   a. Inspect the gates at the rear of the service areas. Each service gate has a minimum of three (3) locks and some as many as six (6). If the gates are found open or unlocked, the operator must lock them and note the finding on the MAINTENANCE PATROL LOG. The notation must include either the location of the lock (i.e. "2nd from left"), or if the hasp or lock is painted, must indicate the color of the lock or hasp. In addition to recording information in the MAINTENANCE PATROL LOG, the operator must also give the information to the Radio Dispatcher for transmittal to Division Traffic.

   b. Inspect guide rail, delineators, fences, shoulders, and pavement to see that they are in proper condition and free of any trash or debris. Any unusual circumstances shall be entered on the MAINTENANCE PATROL LOG and reported to the Supervisor.

   c. Check for bridge/embankment potential or actual flooding conditions especially during winter thaws. The operator shall immediately report such conditions to the Supervisor and shall note the conditions on the MAINTENANCE PATROL LOG. The Supervisor shall be responsible for taking appropriate action as warranted by the circumstances in accordance with established guidelines and procedures. Observe the general condition of Bridge Maintenance winter work sites for obvious damage or unusual conditions, note on the MAINTENANCE PATROL LOG and report such conditions to the Supervisor.

9. The patrol may be suspended during emergency situations and/or at the discretion of the DME. Suspension of a patrol will <u>not</u> be extended after a storm for the purpose of rinsing out material spreaders, repairing plow and wing cutting edges, replacing plow shoes, cleaning buildings, or other routine duties. Every effort should be made to minimize periods when a patrol is out of service.

10. If only one employee is assigned to a shift, the patrol will ordinarily be suspended and the employee will not leave the Section Maintenance area. The MAINTENANCE PATROL LOG will note suspension. If the employee volunteers to patrol and the Supervisor concurs, the patrol may be conducted with one employee.

III. SNOW CONTROL GUIDELINES

Snow control is defined as the mechanical removal of accumulations of snow from the pavement. Removal is accomplished primarily with truck mounted plows. In circumstances such as cleanup and drift removal, snow blowers, front-end loaders, and motor graders with plows are sometimes used. Snow control may also involve the use of passive measures such as snow fencing, plantings, or other highway design features to contain blowing and drifting snow.

A. Definitions

benching or shelving	using a wing plow to displace the top portion of snow berms adjacent to the pavement or shoulder.
berm or windrow	a linear accumulation of snow cast by a plow, other equipment, or wind.
close echelon	snowplows in adjacent lanes working in a tight plowing group that do not permit traffic to pass between them.
plow attack angle	the angle (less than 90º) formed in plain view where the plow blade face deviates from a 0º set position which is parallel to the front grill of the plow truck.
plowable snow	a snow depth to start plowing when traffic and chemical action no longer keep lanes clear - 1/2" to 1".
snow plowing	the displacement of snow from paved surfaces with 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.
tandem plowing	snowplows working in groups having sufficient space (a minimum of 500 feet or about the distance between tenth mile markers) between them for traffic to pass.
tow plow	a steerable trailer-mounted plow (towable snow plow) that allows truck operators to simultaneously clear snow from two lanes of travel.

B. Snow Plowing Guidelines

1. To the extent possible, every attempt should be made to avoid forcing traffic to pass through a windrow of plowed snow.

2. All plowing shall be done with trucks moving in the direction of traffic, except in an emergency situation where the road is closed to traffic.

3. Where there is inadequate space in the center mall to store snow, it will be removed in a manner approved by the DME.

4. To the extent possible, snow shall be plowed beyond the point where it could melt and run back across the highway.

5. Plowed snow shall not be cast into oncoming traffic.

6. Snow and ice shall not be plowed over the sides of bridges and overpasses onto roadways or railroad tracks. To the extent possible, at time of initial plowing, snow on bridge shoulders should be plowed off bridges and beyond the point where it can fall onto roadways or railroad tracks below.

7. Within the normal sequences of operations, any time there is plowable snow on the road it should be plowed.

8. During heavy snow conditions:

   - Supervisors should consider using tandem or close echelon plowing and adding wing persons.

   - During severe blizzard or white out conditions when reduced visibility impairs the operator from safe operation of the vehicle, the Supervisor on duty may suspend operations and provide the proper safety guidance to the driver. The Supervisor shall immediately inform Thruway Statewide Operations Center (TSOC) of this suspension along with the estimated subsequent resumption timeframe.

   - Operators should be mindful that vehicles or other obstacles might be anywhere.

C. Snow Plowing Techniques

Supervisors shall plan plowing schedules in accordance with the priorities set forth in Section I.B.

1. Mainline Plowing

The following factors shall be considered when plowing the mainline: the number of lanes in the Section, traffic volume, equipment availability, weather conditions, snow storage options and other physical features of the roadway Section. Combinations of tandem, tow plows and close echelon plowing may be used. The minimum distance for tandem plowing may be shortened when operationally necessary for transitioning ramps and crossovers.

2. Ramp Plowing

Ramp plowing should be integrated with mainline plowing to avoid traffic back-ups on the mainline and vehicles getting stuck in snow berms created by mainline plowing. Where resources permit, smaller plow trucks may be dedicated to ramps and tollbooth areas.

3. Toll Areas/Plazas

Plowing toll areas will depend on size and complexity and should be coordinated with mainline plowing and toll personnel. Any necessary plowing across the lanes should be limited to the downstream toll lanes during the storm. Care must be exercised at all times especially when plowing across lanes and in the vicinity of E-ZPass lanes. Where resources permit, smaller plow trucks may be dedicated to ramps and tollbooth areas.

4. Plowing Shoulders

Shoulder plowing should be done periodically during a storm if mainline conditions permit. Operators should be aware of variable shoulder width, disabled vehicles, presence of guiderail, and other obstacles that may be on the shoulder.

It is recommended that shoulders be plowed once every two to three mainline passes if resources and conditions permit.

5. Benching or Shelving

   The Supervisor should consider benching if physical features permit to provide additional snow storage for snow falling during an ongoing storm or future storms.

   As weather, traffic, and other conditions may dictate, a wing person should be considered for use with a right-handed wing.

6. Plowing Crossovers (U-turns)

   Plowing crossovers must be done with caution. When slowing for crossover and deceleration lane plowing, traffic behind the plow truck must be observed and assessed.

7. Bridge Plowing

   Reduced speeds and added caution are necessary on bridges for several reasons: discontinuities in the riding surface at joints, curbs and other raised features; narrowing of the road section; and, to minimize plowed snow from being cast off the bridge.

   Accumulations on short bridges can be reduced by having the plow attack angle closer to 0°, carrying the snow downstream and casting it to the side after the end of the bridge. Also, the plow attack angle should be set so that it does not match the angle of the bridge joint.

   Most plows currently in service can reverse attack angles 35° each way (left and right) with two other settings between 0° and 35°. The attack angle of the cutting edge to the road surface is also adjustable, and most are between 10° and 25°.

8. Parking Areas (service, rest, State Police, toll employee, commuter and tandem)

   Plowing procedures for these areas are individual in nature depending on proximity to other features, available snow storage and traffic patterns (people and vehicles). Coordination with the managers of these facilities is recommended to minimize inconvenience to customers and staff.

D. Safety Restoration and Cleanup Operations

After operational priority areas one through three are in satisfactory condition, safety restoration and cleanup operations shall begin and continue until completed or until resources are directed to higher priority snow and ice control or emergency work. Coordination with interfacing agencies and other Authority units is recommended.

Safety restorations and cleanup operations that may impact traffic flow or larger numbers of customers shall be performed during off-peak time periods. Where needed, the appropriate maintenance and protection of traffic shall be utilized. The following is a list of the areas where snow should be removed:

1. Locations where snow and ice could melt and run onto traveled areas (i.e. banked curves, super-elevated ramps, sloped bridge decks, etc.).

2. Bridge decks

   Removal of snow from bridge decks depends on the feature crossed. Where the feature crossed is a highway, road, railroad, travel way or environmentally sensitive area, snow must be transported beyond the back wall and off the shoulder. This may be accomplished with snowplows, front-end loaders, snow blowers or other appropriate machinery. Where the feature crossed is a large stream, river or other water body where there is no other practicable alternative, and there is no possibility of danger or damage to any person, property or the environment, it is permissible to cast snow over the bridge rail. Where a bridge crosses multiple features such as a river and highway, Section and Division Maintenance management staff will determine the most appropriate method for snow removal.

3. Areas having reduced sight distances for customers and plow operators (i.e. downstream point on interchanges, ramp curves, crossovers, “T” intersections with other systems).

4. Various safety appurtenances such as median and safety shaped concrete barriers within 10 feet of travel lanes. Extra care shall be used around guide rail end treatments to avoid damage.

   Remove as much snow as possible in front of guide rails and/or retaining walls (if applicable) with trucks with wings, if possible. Any further removal of snow and ice from around guide rail shall be performed after higher priority snow removal operations are completed.

5. Any area where accumulated snow is causing traffic to use other than intended pavement areas.

6. Drainage structures, drop inlets, and bridge scuppers where cleaning is required to permit adequate drainage and prevent runoff from building up and impacting the travel lanes. Bridges, including pedestrian bridges, should be inspected for proper drainage and falling ice potential. If falling ice potential is suspected, the DME and/or Division Duty Officer should be notified.

7. Any narrow raised features that may be storing snow in toll areas.

8. Buried or obscure signs and/or delineators, accumulated snow around work zone delineation.

E. Passive Snow Control

Passive snow control is the control of blowing and drifting snow through the use of fencing, plantings and other highway design features. Supervisors are expected to investigate and identify locations where further use of this type of snow control would be appropriate.

The Authority uses snow fencing in various configurations in a number of areas. Snow fencing should be used on bridge rail where the feature crossed is a highway, road, railroad, or other travel way. On the highway, a simple technique of leaving a gap of 10 percent of the fence height at the bottom of the fence will increase the snow storage capacity of the fence dramatically. Significant benefits can be realized even if setback distances from the highway are not optimum.

For further information on this technology, refer to the following:

- "Snow Fence Guide" published by the National Research Council, Strategic Highway Research Program (SHRP).
- "Living Snow Fence Design" Fact Sheet www.esf.edu/willow/lsf/documents/3livingsnowfencedesign.pdf

IV. ICE CONTROL GUIDELINES

Ice control includes all treatment operations directed toward preventing snow from bonding and ice from forming and bonding to the pavement, as well as the removal of snow or ice that has bonded to the pavement.

A. Ice Control Methods

The following are the basic ice control strategies used by the Authority:

1. Anti-Icing with Straight Liquid Chemicals

The strategy of anti-icing is to be proactive in the application of chemicals to prevent the formation or development of bonded snow and ice to the pavement surface. This tactic is generally used in advance of winter precipitation to increase safety by delaying the formation of snow and ice on pavement, preventing bonding of hard pack prior to the onset of a snow and ice event or anticipated black ice conditions, and to allow reduction in applications of salt during the storm. When the event actually begins, conventional snow and ice control strategies are then employed.

This strategy can be particularly useful where conventional methods may be slowed due to high traffic volumes. These methods are also useful for unique trouble areas such as bridge decks, high elevations, mountainous grades, shaded areas that freeze quicker than adjoining segments, and for locations that may have longer snow plow response times.

The preferred liquid chemical for pre-storm anti-icing is salt brine at 23.3% solution. Other liquid chemicals such as magnesium chloride (with or without agricultural additives) or salt brine with various chemical blends may be used. Liquids are sprayed directly on the pavement surface using a tank and spray bar system. Various tank and spray bar systems are now available.

Liquid Chemicals:

Liquid ice control chemicals are made up of solid ice control chemicals in a water solution. After application, the water evaporates and a residual dry chemical is left on the pavement surface. This material is not prone to scattering or dispersal from traffic conditions. However, the dried salt may be gradually disrupted by traffic.

The chemical composition of liquid chemicals should comply with specifications contained in current snow and ice control procurement contracts. Exceptions may be made if a product is covered under a Beneficial Use Determination granted by the New York State Department of Environmental Conservation (NYSDEC) for snow and ice control purposes. Other exception approvals may be granted through coordination with other agencies such as NYSDEC and the New York City Department of Environmental Protection.

Salt brine is most effective at a 23.3% solution. It can be produced in-house through the use of brine makers, purchased commercially, or from approved sources.

Certain non-chloride liquid chemicals, such as Potassium Acetate of Calcium Magnesium Acetate, are also available. Although generally higher in cost than salt brine, they can be more effective at lower temperatures.

Application Criteria:

Application guidelines of the use of anti-icing liquids for pre-storm situations are included in the Liquid Anti-Icing Guidelines found in Table 1 of Appendix F.

2. Deicing

Deicing is a method for dealing with snow or ice that has already bonded to the pavement surface. Deicing 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, break the bond, and then produce a chemical solution that flows across the pavement surface between the packed snow/ice and road surface. Any snow or ice that has not gone into solution should be removed by subsequent plowing.

3. Delayed or Passive Treatment

Delaying or not applying ice control materials is a tactic that may be used in support of the anti-icing strategy. Road weather conditions must be closely monitored to ensure success with this tactic. This tactic should be considered when pavement temperature is likely to remain above freezing, or during “dry” snow and blowing snow events where pavement surface

temperature is below 15°F and there is no residual ice control chemical on the pavement. Salt should not be applied in conjunction with plowing operations at these low temperatures or when plowing blowing and drifting snow at these low temperatures. Usually snow will not bond to the pavement and can be effectively and substantially removed by plowing. Traffic will whip the rest of the snow away. In this situation, salt or the salt in abrasives may make the snow stick to the pavement, causing icy spots.

4. Temporary Friction Improvement

Friction improvement is an immediate and short term improvement in surface friction that is achieved by spreading abrasives (sand) or abrasives/chemical mixtures on the snow/ice surface. This method should generally be used where low traffic volumes and/or low temperatures (below 12°F) exist as well as when sleet/freezing rain conditions are present. A major disadvantage of this method is that its effectiveness degrades quickly with varying levels of traffic, therefore it is very important that road conditions are closely monitored to determine if a change of tactic is warranted.

B. Properties of Ice Control Chemicals

The Authority uses a number of ice control chemicals in both the liquid and solid form (See Table 2 in Appendix F). 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.

The important properties of ice control chemicals include:

- The lowest (eutectic – relating to or denoting a mixture of substances [in fixed proportions] that melts and solidifies at a single temperature that is lower than the melting points of the separate constituents or of any other mixture of them) temperature it will melt ice.

- The amount of ice which will be melted at various temperatures.

- Hydroscopic - ability to draw water vapor from air. Each chemicals' hydroscopic ability is as follows:

    - Sodium Chloride – slight

- Magnesium Chloride – moderate
- Calcium Chloride – high

- The solution temperature of the solid ice control chemicals increases or decreases when water is added. Each chemical changes as follows:

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

Pavement temperature is an important factor in ice control operations. The following chart shows that the effectiveness of rock salt (sodium chloride) decreases with decreasing pavement temperature. Other ice control chemicals also exhibit a similar relationship.

Pavement Surface Temperature		Lbs. of Ice Melted Per Lb. of Sodium Chloride
° F	° C	
30	-1.1	46.3
25	-3.9	14.4
20	-6.7	8.6
15	-9.4	6.3
10	-12.2	4.9
5	-15.0	4.1
0	-17.8	3.7
-6	-21.1	3.2

C. Pre-wetting

Pre-wetting is the addition of a liquid agent to abrasives or a solid ice control chemical prior to distributing abrasives or chemical onto the pavement.

Benefits

- Improving retention of the ice control materials on the pavement or ice surface;

- Accelerating the working of the solid ice control chemicals; and

- Enabling the solid ice control chemicals to work better at lower pavement temperatures.

D. Factors Impacting Treatment Decisions

1. Pavement Surface Temperature

Pavement temperature is the key factor impacting treatment decisions. The following effects influence pavement temperature:

a. Solar Radiation or Sunshine

Solar radiation warms surface temperature significantly above air temperature. The darker the surface, the more pronounced this effect will be. During winter, it is not uncommon to have surface temperatures 30°F to 40°F above 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 (around December 21) and at sunrise and sunset of each day.

b. Clear Night Sky Radiation

Clear night skies tend to cool surfaces which often results 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.

c. Geo-Thermal Effects

Ground temperature influences pavement surface temperature primarily through thermal conduction.

- In the fall, 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 end of the season, pavement surface temperatures will remain cold although the air temperature is warmer (absent radiational effects).

- Bridge decks freeze quicker in the fall due to the lack of thermal conduction provided by the earth. However, in the spring, bridge decks warm more quickly than surrounding surfaces for the same reason.

d. Air Temperature and Wind

In the absence of radiational and geo-thermal effects, the pavement surface temperature will always be moving toward reaching the adjacent air temperature. The speed 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.

e. Traffic

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

2. Dilution of Ice Control Chemical

There are several factors that influence how quickly an ice control chemical reaches its freezing point.

a. Amount of water or snow and ice on the pavement at the time of treatment

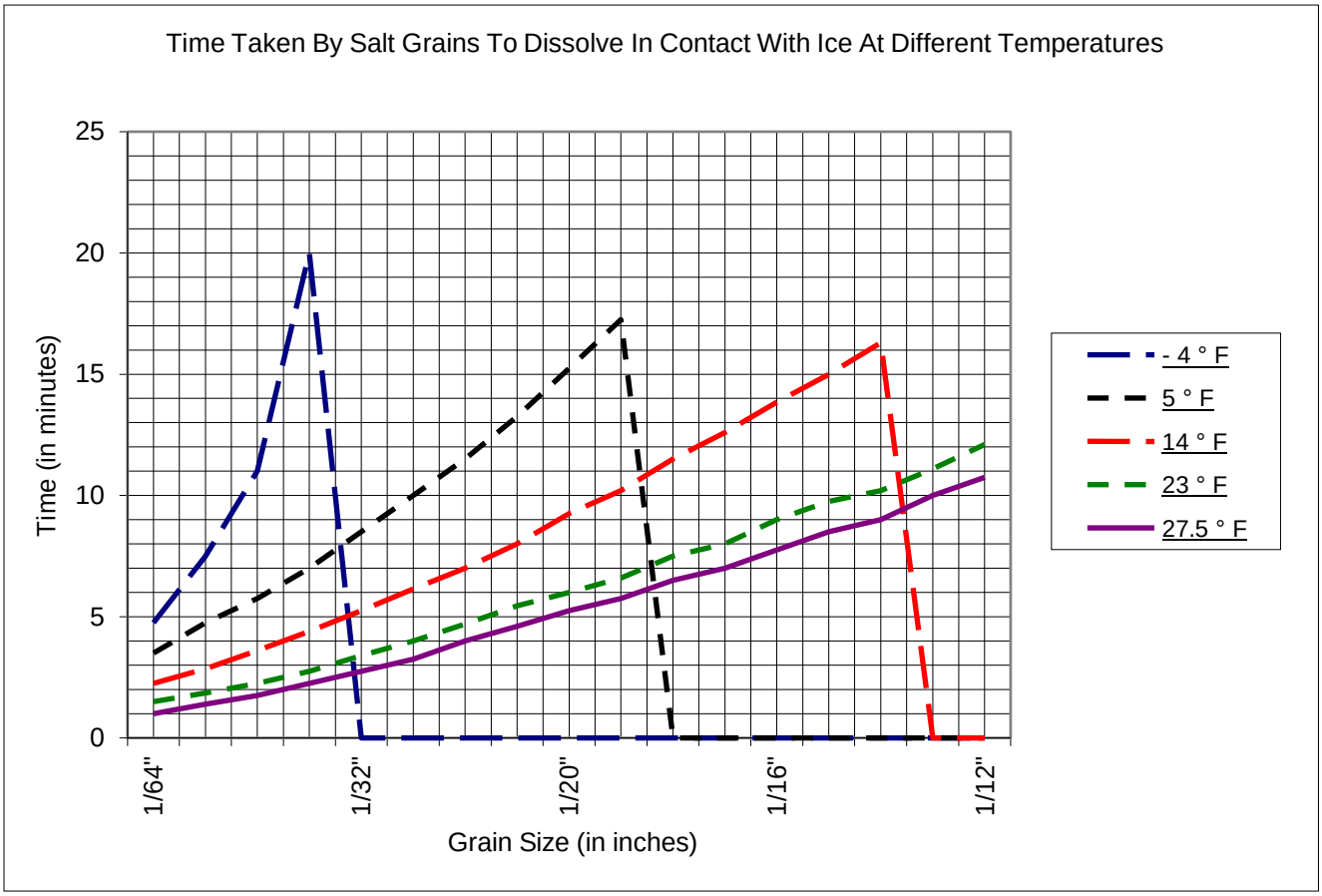
b. Surface temperature

c. Air temperature

d. Ice control chemical type and gradation

Liquid ice control chemicals are diluted 23% - 48% to begin with. When further diluted, they will reach their freezing point quicker than solid chemicals.

Some solid chemicals go into solution quicker than others. Finer graded solid chemicals go into solution quicker than coarser graded solids. (See chart below)



e. Ice or Water Content

The ice content of snow and ice events varies dramatically. Light, fluffy "dry" snow has an ice or water content in the range of 10%. Wetter "heavier" snow may be as high as 80% ice or water. Rain, sleet, and freezing rain all have nearly 100% ice or water. Higher ice or water content events will dilute ice control chemicals more rapidly.

f. Event Intensity

The more intense the precipitation rate, the quicker it will dilute an ice control chemical. A high ice or water content event falling at a high rate of accumulation is the worst case scenario.

g. 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. (See Appendix F)

h. Coordination of Plowing and Spreading Operations

Plowing and spreading operations must be coordinated so that ice control chemicals are not removed from the surface prematurely.

i. Traffic

Traffic can have positive and negative effects on ice control efforts. Mechanical agitation helps loosen snow and ice weakened by the ice control chemicals and keeps some potentially frozen brine solutions from actually freezing. Traffic can also remove ice control chemicals from surfaces and consolidate snow to form pack. Vehicle generated wind and natural wind can displace solid chemicals and cause tire spray to leave the pavement environment.

3. 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 the chemical solution freezing point until the next treatment.

E. Application Rates

Application rates for solid ice control chemicals are specified in pounds dispensed per lane mile. The discharge rate for material spreaders is calibrated to deliver pounds per mile. The formula for calculating the application rate is:

$$\text{Application Rate (lb/lm)} = \frac{\text{Amount Discharged (lb.)}}{(\text{No. Miles X No. Lanes})\ (\text{lm})}$$

Rate Determination Method

The factors considered in determining the application rate are:

- Present pavement temperature
- Pavement temperature trend (increasing or decreasing)
- Local weather forecast and radar interpretation

- Precipitation type and trend (rain, snow, sleet)
- Amount of snow/ice or water on the pavement (if any, otherwise amount expected)
- Ice-pavement bond characteristics (can be determined by how vehicle tires are physically discharging snow or ice).

Knowledge of the above information is important when referring to Table 3 in Appendix F.

Other items which may impact application rates would be traffic volumes and other operational considerations.

After obtaining the data on the above factors, the Supervisor should consult Table 2 in Appendix F to determine the ice control chemical dilution potential. After determining the ice control chemical dilution potential, and being familiar with the storm factors data, consult Table 3 in Appendix F for the recommended application rates for solid and liquid sodium chloride. It is likely that every treatment will be different as the critical factors are always changing. In addition, there may be a rare situation where chemical treatment is not effective. In such case, abrasives (sand) may be spread at 750 lbs/lm.

F. Application Techniques

1. 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 that can optimize treatment effectiveness.

   a. Mainline and Ramps

      Try to place solid ice control chemicals in a fairly narrow band near the high edge of each lane.

   b. Banked or Elevated Curves

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

   c. Bridges and Other Elevated Structures

      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. The application rate may 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.

d. Toll Areas, Parking Areas and Walkways

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

e. Shoulders

Ice control chemicals are normally not spread directly on the shoulders. However, safety or drainage conditions may warrant treatment.

f. 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. (See definitions of winds in Appendix D)

2. Worst Case Scenarios

The worst case scenarios usually occur when the chemical treatment is quickly overwhelmed (diluted) by excessive amounts of water or ice as described in the following examples.

a. Blizzard

Blizzard conditions (intense snowfall, wind, very cold temperatures) quickly dilute ice control chemicals and may render them virtually useless.

- When the pavement temperature is low going into a blizzard, and it is expected to be low coming out of the blizzard, then plowing only is probably the best strategy. After the blizzard,

use abrasives until warmer temperatures will allow chemical deicing to work.

- When the pavement temperature throughout and after the blizzard is fairly warm, applying a treatment with an ice control chemical before or early in the storm followed by plowing only during the storm will make deicing at the end of the storm much quicker.

b. Freezing Rain

The best strategy for rapidly accumulating freezing rain 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 steer and stop. This type of precipitation event is an excellent candidate for consideration of abrasives' use.

G. Material Spreading Equipment

Solid ice control chemicals are dispensed by trucks equipped with a frame-mounted V-Box that is outfitted with a chute and spinner assembly.

Liquid ice control chemicals are dispensed by trucks equipped with mounted tank systems. These tank systems can either pre-wet solid chemicals with the liquid chemical or apply the liquid chemical directly to the pavement.

1. Spreader Controller Setup[1]

To ensure uniform and consistent application rates of spreader controllers system-wide, each spreader controller shall be set up in accordance with the Spreader Controller Setup Guidelines. Annually, the TMS 2 or TMS 1 must verify controller settings, calibration and accurate reporting through the AT&T Webtech System.

2. Calibration

Material distribution systems must be calibrated to ensure that the proper amount of material is being applied. Over-application is wasteful and under-application will not achieve the desired results. Spreader Controller

[1] Exhibit 2

manuals are posted on the Equipment and Inventory Management Intranet page.

a. Calibration of Solid Material Spreaders

Solid material spreaders are usually calibrated by capturing and weighing materials 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.

b. Calibration of Liquid Material Spreaders

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.

3. Spread Pattern Control

Spread patterns may be adjusted on most commercial material spreaders. The patterns should be checked periodically during snow and ice removal operations to be sure that the materials are being distributed appropriately.

a. Solid materials

The most common device for spreading solid materials is a vane spinner plate. The distance material is cast is controlled by the speed of the spinner plate. The faster the spinner plate rotates the farther materials will be cast. The direction of materials cast from the spinner plate is controlled by the direction of rotation and the location where materials are dropped onto the plate. Materials are generally discharged on the opposite side of the plate from where they are dropped. Deflectors or skirts that divert the materials downward provide additional control.

Before spreading operations begin, spread patterns should be tested on the floor of the chemical storage facility.

b. Liquid materials

The spread pattern of a liquid material is usually accomplished by adjusting the direction and height of the nozzles.

4. 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. Generally, depending on road conditions, spreading speeds should be in the range of 30 - 35 mph.

V. OPERATIONAL PROCEDURES

A. Reporting Weather and Road Conditions

1. During the winter months each toll station reports its air temperature, pavement temperature (if so equipped), and weather conditions to the Dispatcher on an hourly basis as a part of the regular roll call procedure.

2. The Senior Dispatcher prepares a ROAD REPORT NOTICE (TA-N64118) based on the information that Dispatchers receive from toll stations, Troop T, Division Traffic, Highway Maintenance and other vehicles which travel the road. This notice is transmitted as conditions warrant, or at 0030, 0830 and 1630 hours if there is no change in reported conditions. It is broadcast to each toll station for posting by Toll Collectors on the Toll Booth Emergency Road Report Board.

   This information is also used to update the road condition report on the automatic answering machine that the public can call to get Thruway road condition reports at 1-800-THRUWAY (847-8929).

3. When an adverse weather forecast is received after normal working hours, the Senior Radio Dispatcher notifies the Division Duty Officer and, when appropriate, the HQ Duty Officer.

4. During severe or unexpected weather conditions, road and weather conditions may be broadcast on the Highway Advisory Radio (HAR) where it is available. Forecasts that are broadcast by the National Weather Service may be carried on HAR when programming permits. When weather conditions affect traffic, TRANSCOM and appropriate Divisions will be advised.

5. All field staff (i.e., Division Traffic Supervisors, plow operators, Maintenance Supervisors, etc.) shall immediately report significant changes in weather, traffic and/or road conditions to their Supervisor, Division Operations Center and/or TSOC as appropriate.

B. Road Closures and Openings During Storms

Road closure and re-opening activities due to storm conditions, by the Duty Officer System are carried out in accordance with the INCIDENT RESPONSE PLAN (600-0-03).

C. Ice/Snow Control Chemicals and Abrasives

The Ice Control Guidelines in Section IV, coupled with the following operational procedures, provide overall guidance for snow and ice control with chemicals and abrasives.

1. General Concerns

a. Guidelines for spreading, storing and handling ice control chemicals are included in Section IV of this manual. Those guidelines coupled with the following operational procedures must be followed due to the negative impact of excessive or careless use/storage of chemicals on the environment and infrastructure.

b. Sodium chloride or "rock salt" is composed chemically of about 40% sodium and 60% chloride ions and has ferrocyanide anticaking additives. In normal concentrations and during normal winter snow/ice control activities, these are harmless and non-toxic to plant and animal life. However, in higher concentration levels, they may have adverse effects on both plant and animal wellbeing, as well as contribute to the accelerated corrosion of metals (cars, bridges, toll booths, concrete reinforcing bars), deterioration of the concrete surface, and deterioration of paint systems. Therefore, it is essential to use rock salt as efficiently as possible.

c. NYSDEC has set groundwater standards and the New York State Department of Health has established drinking water guidelines for acceptable levels of sodium chloride and many other chemicals in water supplies.

- New York State and the Environmental Protection Agency (EPA) do not regulate sodium levels in drinking water. Some states have a 20 mg/l threshold for people on severe low sodium diets (about 3.5 mg in a 6-ounce glass of water). If one ton of salt leaches into the water supply from a single point source, there would be enough sodium there to bring about 5 million gallons of water to this threshold.

- The EPA recommends 250 mg/l as the maximum level of chloride in drinking water (Secondary Standard for taste rather than Primary Standard for health). One ton of salt leaching from a supply pile will bring about 600,000 gallons of water to this level.

Therefore, it is very important that prudent usage and storage practices be followed.

2. Storage

All solid chemicals - sodium chloride, calcium chloride, magnesium chloride, chemical mixtures - shall be stored under cover. Solid calcium chloride and solid magnesium chloride should be protected with air tight coverings during storage, otherwise these materials will absorb moisture and result in caking. If building storage is not available, use water repellant and mildew resistant canvas, reinforced plastic, or laminated burlap to cover the chemicals that are stored outside. When deliveries necessitate that chemicals be dumped outside of storage structures, the chemicals should be handled and placed under cover immediately.

Flake calcium chloride stored in sheds should have the exposed surface covered with 4 to 6 inches of dry sand or a polyethylene cover.

Solid chemicals stored outside must always be covered and installed on an impervious pad. In addition, runoff from storage areas should not be allowed to drain to surface watercourses (i.e., rivers, streams, creeks, etc.). Where possible, water flowing through the storage pile(s) should be directed to impervious ponding and evaporation areas prior to discharge to ditches and/or tributaries that feed regulated water bodies. Also, rainwater from surrounding areas should be diverted from the storage pile(s) by installing ditches and/or berms around the outside of storage piles to minimize flow through the pile(s).

Rain will reduce an uncovered salt pile at a rate of about 0.25% per annual inch of precipitation per year (a salt pile left exposed for 6 months in an area with 40 inches of precipitation per year, will lose 5% of its volume).

All bulk liquid deicing chemical storage containers must be labeled to identify the contents of the container.

3. Quantities

The following minimum quantities will generally be maintained in each Maintenance Section:

a. Salt storage structures are to be filled to their listed capacity prior to the start of the winter maintenance schedule, which is typically early November. Structure capacities and locations are based, in part, on historical consumption data (i.e., tons/lane mile, high accident areas, traffic volumes and identified levels of service criteria).

b. During the first half of the winter season (i.e., through the end of January or as determined by the Director of Highway Management), salt storage structures shall be filled to their listed capacity, which may require smaller and more frequent re-ordering. After the first half of the season and in periods of supply problems, adjustments can be made in re-ordering policies to ensure adequate supplies.

c. Salt storage structures should generally be maintained such that 30% or greater (determined by specific shed usage) of their capacity is filled at the end of the normal winter season. This will assure adequate supplies for any late season storms and for early storms or delivery problems the following fall.

d. Abrasives - as determined by the DME.

e. Flake Calcium (or Magnesium) Chloride - as determined by the DME.

f. Liquid Calcium Chloride and other deicing and anti-icing chemicals - quantities determined by the DME considering storage capacity and resupply rate.

4. Application

The key to effective snow and ice control is selecting the appropriate chemicals and applying them correctly. As such, their use should be carefully monitored and controlled.

a. Do's and Don'ts

(1) Do not overload spreaders; no material should spill over the sides of the spreader body.

(2) Do not continue spreading just to empty the spreader.

(3) Do clean up salt spills along the roadside or anywhere as soon as conditions permit.

(4) Do keep spinner flaps adjusted to keep salt being spread on the pavement area.

(5) Do not allow salt to be thrown outside pavement area.

(6) Do not, during cleanup operations, pile snow in the center mall of the roadway within 50 feet of either end of a bridge.

b. Timing

It is important to make as early an application of chemicals as possible. This tends to keep accumulated snow in a mealy condition and prevents packing and bonding to the pavement. Timing is critical.

5. Materials

SDSs are an excellent source of information on product safety.

a. Sodium Chloride – "Rock Salt"

- Sodium Chloride, also known as rock salt, is used as the principal deicer because it is extremely effective and readily available. The melting action of salt begins with only minor delay at 32°F. However, the melting action at 25°F is delayed approximately 10 minutes, and while it stops melting at -6°F, its effectiveness below 20°F is limited and quite slow (see Table 1 below). Rock salt requires an outside source of moisture to form a de-icing solution and it takes on heat as it dissolves (endothermic). Using a liquid (brine, MgCl, water, etc.) to pre-wet the salt when spreading will help kick start the time it takes to begin its melting action.

Table 1

Temperature °F.	Pounds of Ice Melted by One Pound of Rock Salt
30	46.3
25	14.4
20	8.6
15	6.3
10	4.9
5	4.1
0	3.7
-6	3.2

- Rock salt is mined, crushed and graded at the mine, treated with anti-caking additives and stockpiled for loading and delivery. Solar salt is produced from evaporation of seawater or brine then processed into a gradation similar to rock salt.

- Mixtures of sodium chloride and calcium chloride are used for specific applications as noted in Section IV. If mixed prior to a storm, the materials must be mixed dry and covered with a four inch blanket of dry sand or other moisture proof cover to prevent moisture and air circulation. To prevent caking, spreaders will not be kept loaded with this mixture, especially in a warm garage.

b. Salt Brine

- Salt brine is produced through on-site batch units located at some Section Maintenance facilities. These batch units produce salt brine for pre-wetting of salt for de-icing or anti-icing treatments. Once produced and the concentration known (using a hydrometer), the batch can be adjusted to the optimal concentration by adding more water to decrease or dilute the mix or add more salt to increase concentration.

c. Calcium Chloride

- Two methods are used to manufacture commercial calcium chloride: 1) extraction from natural brines obtained from deep wells, and 2) by a chemical process (Solvay process) in which sodium chloride is reacted with calcium carbonate to produce sodium carbonate (soda ash) and calcium chloride.

- Calcium chloride attracts moisture to obtain the necessary solution to produce melting action. This property means that care should be used when choosing this chemical to anti-ice with. Putting this down on an even moderately humid day (or night) when the pavement is cold and dry may produce a wet road where there wasn't one before. Calcium chloride gives off heat as it dissolves (exothermic).

- Personnel working with calcium chloride must be made aware of its drying effect on leather shoes and gloves as well as skin. Rubber gloves, boots or galoshes, and goggles should be worn at all times when handling this chemical.

d. Magnesium Chloride

- Brine from the Great Salt Lake is the principal source for this chemical and is used in liquid form for snow and ice control.

- Its eutectic temperature is about -28°F at a 21.6% concentration. Its ice melting capacity is about 40% greater than calcium chloride.

e. Magnesium Chloride Blends

- The chemical makeup of these blends is 50% magnesium chloride (at least 25 to 35% concentration) and 50% agricultural processing residue. The purposes of these blends are: the magnesium chloride brings the temperature at which snow/ice is effectively melted substantially below that of sodium chloride, and the agricultural processing residue provides a corrosion inhibitor.

- These blends can be used straight as a direct application for anti-icing or as a pre-wetting treatment for rock salt. The blends can also be used to treat salt stockpiles.

- These blends exhibit a corrosion rate at least 70% lower than that of rock salt tested under the same conditions. They must meet or exceed this corrosion rate requirement as established by the National Association of Corrosion Engineers (NACE) Standard TM-01-69 as modified by the Pacific Northwest States Coalition (PNS).

f. Calcium Magnesium Acetate (CMA)

- There is one currently commercial source for CMA, using the reaction of acetic acid with dolomitic limestone for production. The compound is available in pellets and although not as soluble as calcium or sodium chloride, solutions can be made at point of use for pre-wetting or straight use. Its benefit is that snow is made mealy and will not compact. Its eutectic temperature is about -18°F at a 32.5% concentration.

g. CG-90

- While very expensive, this product provides improved deicing performance with good protection against corrosion and scaling along the road surface. This product is made of rock salt mixed with flake magnesium chloride and monosodium phosphate. This is a dry product and put on the road surface dry.

6. Abrasives

Abrasives for snow and ice control shall consist of any of the following materials: sand, gravel or blast furnace tailings (slag sand). The sources must be thoroughly stripped and free of all sod, topsoil, overburden or any other objectionable material or coatings. Sand, gravel or blast furnace tailings shall be from an approved source as described in the most current Internet version of the New York State DOT Materials Bureau's Approved List Sources of Fine & Coarse Aggregates.

The main criteria of the specification is to provide a hard, angular, durable material of a size that will minimize accidental damage to windshields and provide traction, yet not blow off the road. This implies that all particles should pass through the 3/8" sieve size, but particles smaller than the #50 sieve are not effective as they contribute to bridging in the spreader and result in dirtier windshields.

During the winter maintenance season, abrasive stockpiles should be mixed with enough sodium chloride to keep the material from freezing solid. Minimum mixture should be 10:1 by volume for storage.

Abrasives are used as required to improve traction at low temperatures and to assist with break-up of hard pack ice and snow on pavement.

7. Quality Control

A qualified Authority employee should be present to observe and inspect all materials deliveries. If possible, product inspection should be made both before and after unloading. If there is any question that the material is in any way flawed, the delivery operation will be stopped immediately and the Supervisor shall be advised of the potential problem.

a. Salt

If inspection of the salt in the truck shows obvious indications of out of specification gradation and/or moisture content, the delivery shall be halted and the Supervisor informed. The Supervisor will sample the material as per the information in Appendix G and the DME shall be informed. Additional information on the quality control of salt is available in Appendix G.

b. Abrasives

If inspection of the abrasives in the truck shows obvious indications of out of specification gradation and/or moisture content, the delivery shall be halted and the Supervisor informed. The Supervisor will sample the material as per the information in Appendix G and the DME shall be informed. Additional information on the quality control of abrasives is available in Appendix G.

c. Sampling Liquid Chemical Deicers

Liquid chemical deicers shall be tested with a hydrometer at delivery. The reading will be checked against the specific gravity tables required to be supplied by the manufacturer. The material will also be inspected for abnormal precipitates, color and odor. The specifications for each material are also available in the Bureau of Purchasing.

A liquid chemical deicer that apparently fails to meet specifications shall be tested. Subsequent delivery of apparently unsatisfactory material shall be postponed pending the test results. Sampling and testing can be requested by Division Staff or the Bureau of Purchasing and accomplished by a commercial testing firm. Division Staff may be requested to perform the sampling under the guidance of the commercial testing firm. Coordination for using a commercial testing firm shall be made through the Office of Contracts and Construction Management.

The TMS 2 should verbally notify the DME when samples are requested. In addition, the Superintendent of Thruway Maintenance should also be notified to ensure proper follow-up and dissemination of any pertinent information to all supervisory Maintenance personnel.

8. Receiving Reports and TMMS

The ordering, purchase, receipt and usage recordkeeping of all ice control chemicals and abrasives shall be done according to established procedures.

a. Ice Control Chemicals (other than rock salt) and Abrasives

Each materials delivery shall be documented by Section staff on a BULK ORDERS SUMMARY SHEET (TA-N42139) and the delivery daily work report, for the correct amount, will be entered into TMMS. Also, Sections shall send delivery tickets attached to a BULK ORDERS DELIVERY TICKET TRANSMITTAL (TA-N42298) to Division Inventory Management. Division Inventory Management processes a receipt in TFP and forwards the form and delivery tickets to Accounts Payable in the Department of Finance and Accounts. These documents should be promptly transmitted between work units.

b. Rock Salt

Orders shall be recorded in TMMS at the time that the order is placed. It is important that the date, order number and person contacted be recorded (in the comment section) in the event that delivery delays occur.

Each delivery shall be documented in TMMS. A TMMS transmittal shall be generated for each day of deliveries. The TMMS transmittal must be attached to the corresponding receipt, which is entered in TFP. Once an order is fulfilled, the order should be closed in TMMS.

Usage of all ice control chemicals and abrasives shall be tracked through TMMS.

D. Equipment

1. Snowplow Mounting

Snowplows are to be mounted on the front of the trucks only when these trucks are engaged in plowing snow, are on standby to plow snow, or during operator training. The unnecessary carrying of snowplows and wings on trucks causes an inordinate amount of wear to the plows, the mounting pins, pin holes and braces. It also causes a great amount of unnecessary wear to the front springs and axle, pins and bushings. In addition, this practice contributes to excessive front spring breakage and front tire failure. Except for emergency situations, wings will not be mounted on the traffic side of a truck being used for movable maintenance. To facilitate the mounting of plows when the occasion arises, plows should be stored in an accessible location and blocked up to proper mounting elevation.

2. Spreading Equipment

a. Material Spreaders

Material spreaders will be mounted on truck chassis starting in early October or as directed by the DME. All spreaders should be mounted before November 1st.

b. Ground-Speed Oriented Spreader Controls

The ground-speed oriented spreader controls shall be calibrated each fall as soon as all the materials spreaders in the unit are frame mounted. They should also be calibrated two other times during the course of the winter season to ensure proper operation. Calibrations should be periodically checked throughout the entire winter maintenance season to ensure that proper application rates are being obtained.

The ground-speed oriented spreader control calibration procedures shall be followed. To ensure proper calibration, Spreader Controller manuals, posted on the Equipment and Inventory Management Intranet page, should be used. The current calibration record will be kept in Section files. The hard copy makes for a quick reference anytime a mechanic services the truck/spreader unit. During a storm this can be beneficial in expediting the repair.

3. Hydraulic Couplings on Reversible Plows and Trucks

Plows and trucks are to be equipped with one male hydraulic coupling and one female coupling. Whenever a plow has been disconnected from a truck, the plow's two hydraulic hoses (one of which will have a male coupling and one a female coupling) are to be hooked together until the plow is remounted. Couplings on the trucks will continue to be capped during plow idle time.

4. Plow Blades

Steel Blades, Tungsten Carbide Insert Blades and Kuper blades are included in Section Inventory and are handled exactly as other Inventory items with one exception: there should be confirmed order and delivery dates to ensure specified quantities are received prior to the winter season. The quantities of Carbide Insert Blades and Kuper blades for Section and Division Support use are determined by the MEM 1, in cooperation with the DME, based on past experience and the number and size of plows and wings of various sizes at each location.

Blades for Sections and Division Support Units should be stored in and issued from the Division Storerooms. Blades for Sections are kept in a secure location until issued.

All new Carbide Blades must be installed as complete sets. After the Carbide Blades are installed in proper alignment, the sections will be welded together to hold alignment and aid in keeping the sections tight. The exception to this rule is the Kuper blades. Under no circumstance should the sections of the Kuper blade be welded together.

Broken sections must be reported through Inventory Management to Administrative HQ.

5. Plow Shoes and Guards

Plow shoes and guards (which minimize damage to bridge joints) are included in the Section Inventory and are handled exactly as other Inventory items. (Defective or broken plow shoes or guards must be returned to Division Inventory Management)

6. Charging out Plow Blades, Shoes, Guards from Section Inventory

a. When plow blades, shoes and guards are charged out of a Section Inventory, it is to be done through TFP.

b. Plow blades, shoes and guards are considered to be consumable parts. Replacements are to be charged to the "665" snow and ice account.

7. Diesel Deliveries

There are two types of diesel fuel shipments:

a. Straight diesel (100% 2D Fuel Oil) or Summer fuel is normally received from May 1 to October 31.

b. Mixed diesel (50% 2D Fuel Oil & 50% 1D Kerosene) or Winter blend fuel is normally received from November 1 to April 30. Mixed diesel is typically delivered in two (2) ways:

- Unblended

  50% 2D Fuel Oil in one compartment of the vendor's truck and 50% 1D Kerosene in another compartment.

- Pre-mixed

  A diesel fuel test must be conducted to verify the fuel blend. The driver's delivery ticket must indicate the fuel blend being delivered. If no indication is provided, the receiving clerk will require the driver to obtain this information. The driver must sign, date, and note the fuel blend on the ticket.

(For testing information, see Appendix I.)

8. Fueling at Service Areas

Fueling, when practicable, should be done at any of the Authority Maintenance Sections. When this is not possible or practicable, fueling at service areas is acceptable. Fuel for snow and ice control equipment may be obtained from Service Area Gas Station Operators as authorized by the Supervisor when the Supervisor deems it an emergency or otherwise in the best interest of the Authority.

The procedure for making these credit card purchases is outlined in Maintenance Directives entitled SUPERVISOR'S STATE CREDIT CARDS.

Prior to the start of the winter maintenance season, the Supervisor should coordinate procedures with the gas station operator(s) for those situations when an Authority vehicle needs fuel but does not have an Authority credit card with it.

E. Preparation of Roadway for Snow and Ice Control Operations

1. Snowplow Markers

Snowplow markers are metal posts with green reflective markers that provide permanent, supplemental roadway delineation at the beginning and end of shoulder side obstructions such as guide rail or bridge pier protection

barrier. The markers are mounted in accordance with Thruway Drawing denoting Delineator and Snowplow Marker Details[2].

Two single-green snowplow markers shall be placed at the location where the rail or barrier first becomes essentially parallel to the shoulder. One single-green marker shall be placed at the location where the rail or barrier ends or ceases to be parallel to the shoulder. Where a Type III end assembly is present, two single-green snowplow markers shall also be placed at the start of the rail end assembly.

2. Drainage Delineation

Drop inlets, drainage outlets, or mall drainage inlets may be obscured during snowfall. To facilitate cleaning/snow removal, they will be delineated by pavement marking, rail marking, or green delineators.

3. Snow Fencing

Snow fencing shall be erected to prevent or reduce risk of injury or damage to vehicles from snow being pushed off bridges. Authority maintenance forces shall install snow fence on mainline bridges.

Snow fence installation on overpasses carrying roadways maintained by other municipalities is the responsibility of the municipality. However, the Authority is phasing in the contract installation of permanent protective screening on these bridges. Protective screening for bridges also provides the benefits of snow fencing.

Until the Authority's phased-in work is completed, the responsibility for both the erection and maintenance of the protective screening/snow fence remains with the municipality. Once a particular bridge has received permanent protective screening/snow fence, the maintenance of this permanent protective screening/snow fence is the responsibility of the municipality.

F. Snow Removal Traffic Safety

1. Method of Operations

Plowing shall be done with trucks moving in the direction of traffic, except in an emergency situations and/or where a roadway is closed to traffic.

[2] Exhibit 3

2. Arrowboard Displays

Each truck used for snow plowing or spreading operations is to be equipped with a flashing arrowboard facing to its rear, which can display a flashing left arrow indication, a flashing right arrow indication, and a caution mode.

Arrowboards day-time and night-time modes shall be inspected periodically during plowing operations to ensure proper visibility.

3. Mainline Plowing

When plowing on the mainline, unless all lanes are being plowed simultaneously, a right arrow indication shall be displayed when plowing to the left and a left arrow indication shall be displayed when plowing to the right. This includes shoulder plowing when there is encroachment on the travel lane. When all lanes are being plowed simultaneously and there is no lane available to pass the snow plowing operation, no arrow indication shall be displayed. The caution mode on the flashing arrowboard is appropriate during this condition.

4. Ramps and Service Areas

On two-way areas within an interchange and on single lane one-way ramps, trucks used for plowing shall display the caution mode on the arrowboards.

5. Other Warning Lights

During snow plowing and spreading operations, each truck shall display its amber radial light and its flashing amber warning lights. Directional signals should not be used during plowing operations except to indicate a turn. All lights shall be cleaned periodically to ensure visibility. Truck drivers shall be alert that patrons are aware of the driver's intentions and truck movements.

G. Bridges

Maintenance personnel must exercise extreme care when plowing snow on bridges that cross railroad tracks or highways to prevent any damage to persons or property as a result of snow being pushed off a bridge through the railing. Maintenance personnel are responsible for clearing accumulated snow from

bridge walks, malls, shoulders, and areas adjacent to the ends of bridges in accordance with the priorities established in Section I.B., Operational Priorities.

During clean-up operations, when snow is moved to the center mall, personnel must pile snow in the center mall of the roadway at least 50 feet from either end of a bridge (with the goal of keeping runoff from returning to the structure).

H. Service Areas

1. Cooperation

In order for the Authority's snow and ice control program to provide high levels of safety and service at service areas, the DME, in conjunction with the appropriate TMS 2, are required to coordinate snow/ice removal activity with the duties of the Maintenance Supervisor 2 (Building) and restaurant/gas station manager.

2. Responsibilities

a. Gas Station Operators/Restaurant Service Operators

They are responsible for sidewalks, walkways, and pedestrian overpasses within the curbed areas around the restaurant and the fuel service building as provided in the Authority contracts.

b. Thruway Maintenance Personnel

Unless otherwise provided in the Authority contracts with Service Area/Restaurant Service operators, Thruway Maintenance personnel are responsible for:

- The pavement of confined and curbed areas adjacent to fuel service and restaurant buildings, islands, parking areas, fuel dispenser island aprons, and waste treatment plant facilities;
- The immediate boundaries of Service Area utility buildings which are the outside edge of the structure and the walkways immediately adjacent to or that service these accessory structures;
- The pavement of all Service Area driveways, patron and employee parking lots;

- The portion of the service road under Authority jurisdiction; and

- The roads leading to the water wells, water and waste treatment facilities.

When conditions require, the appropriate Service Area personnel or designated Maintenance employee(s) will be notified by the responsible Supervisor on duty at that time, to report to the Service Area for snow and ice control operations. From the time of notification until released, these employees will be responsible to the TMS 2, TMS 1 or Crew Leader. Similar to other Maintenance employees, no one should be scheduled or allowed to work for more than sixteen consecutive hours except under emergency conditions.

The TMS 2, TMS 1 or Crew Leader may assign a tractor-mounted plow, truck with plow or other appropriate equipment to each Service Area for use by the personnel assigned for snow and ice control work.

VI. ORGANIZATIONAL POLICIES AND PROCEDURES

A. Winter Maintenance Schedule/Staffing

The following dates and staffing will be determined by the Superintendent of Thruway Maintenance and will be announced via Maintenance Directive:

1. Winter maintenance schedule

2. Staffing for weekdays, weekends and holidays

3. The "fully staffed weekend and holiday period"

4. The end date of the winter maintenance schedule

Sections will commence working twenty-four hours a day with three shifts as specified in the Maintenance Directive. The Superintendent of Thruway Maintenance may authorize changes in the specified schedule.

B. Winter Work Schedule Assignments/Postings

1. Weekday Shift Assignments

All weekday winter maintenance shift assignments are to be posted at least two weeks in advance, using WINTER SECTION MAINTENANCE SCHEDULE (TA-N4170).

2. Planning and Organization for Weekends and Holidays

a. The DME or the Division Duty Officer will contact each Supervisor on Thursday or Friday or the day before a holiday to review plans for addressing forecasted weather conditions, as well as construction activity and scheduled special events.

b. In the morning of Shift II on Fridays or the day before a Holiday, the DME or designated representative will advise the Director of Highway Management and the Division Duty Officer of any changes in scheduled staffing.

c. The DME shall advise Equipment Management, State Police, Toll Collection and Traffic Operations division units of changes in weekend/holiday staffing.

3. Winter Maintenance Patrol - Weekends and Holidays

The staffing of these shifts may include one CEOH as a Crew Leader. If there is no CEOH assigned to a weekend shift, either a CEOL, Trades Specialist (Bridge) or TMW will be designated as a Crew Leader.

4. Winter Tasks

All personnel working shifts are to be productively occupied at all times. The TMS 2 or TMS 1 is to post a list of tasks to be accomplished by each shift with the exception of Shift II, Monday through Friday, via the WINTER MAINTENANCE WORK ASSIGNMENT LIST (TA-N41205). Tasks will be accomplished under the direction of the Supervisor, CEOH, or Crew Leader in charge of the shift. Supervisors should use TMMS for this purpose.

C. Unscheduled Overtime

1. During the winter maintenance schedule, the TMS 2, the DME or Division Duty Officer can call for and/or assign additional personnel, as needed, to respond to actual or anticipated weather and/or roadway conditions.

Overtime opportunities will be offered to qualified employees in order of seniority and standing on the overtime opportunity list in accordance with the Unit I Agreement. Involuntary overtime shall be assigned to qualified employees in reverse order of seniority. All unscheduled overtime opportunities shall be posted on the UNIT I UNSCHEDULED OVERTIME OPPORTUNITY LOG (TA-41300).

2. In cases when Thruway Maintenance Supervisors are not available for emergency overtime assignments, the following steps will be taken in order:

a. Establish and schedule staffing needs during regular work schedules based on weather forecast, etc.

b. Utilize Unit I Crew Leader personnel as Supervisor in an out-of-title status.

c. Use Supervisors from other Division units (i.e. Division Support, Division Bridge, adjacent Sections).

d. Utilize appropriate Division Headquarters personnel.

3. Refusal to work overtime will be handled as with any other refusal to perform assigned duties. The incident is to be recorded thoroughly documented, including any witnesses present, and reported to the DME.

D. Shift Assignment

1. If a practice has been established in the work unit, employees may request a permanent shift assignment for the entire winter by contacting their TMS 2. If such assignments can be made without inconvenience to the Authority, they may be granted in seniority order.

2. Employees should not be scheduled or allowed to work for more than sixteen consecutive hours, except under emergency conditions (i.e., natural or man-made situations that threaten public safety). Reasonable measures should be taken to secure qualified relief before making any exceptions due to an emergency.

E. Meals and Lodging During Severe Winter Storms

During severe winter storms, the Executive Duty Officer may authorize meals and lodging for employees essential to the maintenance of vital Authority operations who are "off the clock", not in travel status, and unable to get home and return to work promptly when required. See the TRAVEL HANDBOOK (TAP-501).

Arrangements and reimbursements for such meals and lodging shall be accomplished according to current standards and practices. Lodging providers should be contacted during pre-winter activities to identify possible sources of lodging and meals during emergencies.

APPENDIX A - LIST OF EXHIBITS

Exhibit Number	Title	Number	Latest Publication Date
1	Memo Format - Recommended Changes to Winter Maintenance Manual	N/A	-
2	Spreader Controller Setup Guidelines	N/A	8/2018
3	Thruway Drawing - Delineator and Snowplow Marker Details	N/A	04/2009

APPENDIX B - SUMMARY OF FORMS

Number	Latest Form Publication Date	Form Title	Frequency
TA-N4159	01/2011	Maintenance Patrol Log	Each Patrol Shift
TA-N4170	09/2002	Winter Section Maintenance Schedule	Bi-Weekly by Section
TA-E41130	06/2000	Storm Activity Report	Each Storm by Section Supervisor
TA-41188	08/2015	Truck Operator Activity Log	Each Storm Shift
TA-N41205	10/2015	Winter Maintenance Work Assignment List	Daily by Section
TA-41300	12/2015	Unit I Unscheduled Overtime Opportunity Log	Post Daily
TA-N42139	05/2010	Bulk Orders Summary Sheet	Each Order by Section
TA-N42298	10/2014	Bulk Orders Delivery Ticket Transmittal (Intranet Version)	Each Order by Section
TA-N64118	12/2008	Road Report Notice	Per schedule
TA-N41204	09/2018	Annual Pre-Winter Maintenance Checklist	Annually by Section

APPENDIX C - REFERENCES

PROCEDURES

600-0-02	PROCEDURE FOR PROVIDING EMERGENCY ROADSIDE SERVICE FOR THRUWAY CUSTOMERS
600-0-03	INCIDENT RESPONSE PLAN

THRUWAY AUTHORITY PUBLICATIONS

TAP-501	TRAVEL HANDBOOK
TAP-520A	HIGHWAY MANAGEMENT ACTIVITY CARD

MAINTENANCE DIRECTIVES

EMERGENCY RESPONSE MANAGEMENT

WINTER MAINTENANCE SCHEDULE AND SEASONAL SECTION MAINTENANCE ACTIVITIES

MAINTENANCE AND OPERATION OF MOTORIZED EQUIPMENT

SUPERVISOR'S STATE CREDIT CARDS

MISCELLANEOUS

AASHTO Test Method T27-93

AASHTO Test Method T11-91

SDS Online Service – Employee Safety Intranet page

National Association of Corrosion Engineers Standard TM-01-69

NYS Department of Transportation Materials Bureau's Sources of Fine & Coarse Aggregates, Approval List

NYS Department of Transportation Procedure GCP-17

"Snow Fence Guide", published by National Research Council, Strategic Highway Research Program

New York State Thruway Authority Emergency Management Operations Protocol

APPENDIX D - DEFINITIONS AND TERMS

Common definitions of terms are important in standardizing the reporting and understanding of field conditions between the field patrols and Supervisors. The Supervisor, knowing the specific condition can then, with other tools, identify the proper method of snow/ice control to use for that portion of the roadway.

1. Precipitation

Light Rain
Small liquid droplets falling at a rate such that individual drops are easily detectable splashing from a wet surface. (Drizzle is included in this category.) Precipitation rate: greater than or equal to .01 and less than .2 inches per hour.

Moderate Rain
Liquid drops falling are not clearly identifiable and spray from the falling drops is observable just above pavement or other hard surfaces. Precipitation rate: greater than or equal to .2 and less than .5 inches per hour.

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. Precipitation rate: greater than or equal to .5 inches per hour.

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

Sleet (Ice Pellets)
Precipitation consisting of transparent or translucent pellets of ice.

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 reduced by ice pellets.

Heavy Sleet
Rapid accumulation on ground. Visibility reduced by ice pellets.

Light Snow
Snow alone is falling and the visibility is greater than 1/2 mile. (20 right side delineators)

Moderate (Ordinary) Snow
Snow alone is falling and the visibility is greater than 1/4 mile but less than or equal to 1/2 mile.

Heavy Snow
Snow alone is falling and the visibility is less than or equal to 1/4 mile. (10 right side delineators)

Blizzard
A severe weather condition characterized by snow with winds in excess of 35 mph and visibility frequently 1/4 mile or less, for an extended period of time, usually 3 hours or more.

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.

2. Pavement Condition

Dry
No wetting on the pavement surface.

Damp
Light coating of moisture on the pavement 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. Slush will displace when stepped or driven on until pavement surface is reached.

Loose Snow
Unconsolidated snow that can be blown by the wind or by moving vehicular traffic.

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

Frost
Ice crystals which form on pavement and other surfaces cooled by radiation.

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 so-called "black ice" and frost, that is formed from freezing rain, or from freezing of ponded water or poorly drained melt-water.

3. Ice Control Chemical

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

Gradation
A characterization and the distribution of particle sizes for solid chemicals and abrasives - i.e., 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 concentration level that results in a solution which begins to freeze.

Dilution
Reducing solution concentration by adding water.

Endothermic
Becomes colder when going into solution.

Exothermic
Becomes warmer when going into solution.

Hydroscopic
Having the ability to draw water vapor from the air.

4. Operational Procedure

Pretreating
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.

5. Other

Warning
A notice that is produced when a certain hazard (tornado, severe thunderstorm, flood or winter storm) is occurring or is imminent.

Watch
A notice issued when conditions are favorable for the particular weather event (e.g., tornado, severe thunderstorm, flood or winter storm) in or near the watch area.

Wind Advisory
Issued when sustained winds (not associated with thunderstorms) of 30-39 mph are expected for 1 hour or more or wind gusts of 46-57 mph are expected for any duration.

High Wind Warning
Sustained winds at least 40 mph for 1 hour or longer or gusts at least 58 mph for any duration.

Wind Chill

The additional cooling effect resulting from wind blowing on bare skin. The wind chill is based on the rate of heat loss from exposed skin caused by the combined effects of wind and cold. The (equivalent) wind chill temperature is the temperature the body "feels" for a certain combination of wind and air temperature.

Wind Chill Chart

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

APPENDIX E - PRE-WETTING

1. Techniques

   - Pre-treated salt - Salt mixed with a liquid chemical using a pugmill or auger system, then stockpiled until needed for spreading.

   - On-board Systems - Liquid is stored on the truck and sprayed on the solid material as the material leaves the materials spreader.

   - Shower or Load Saturation Systems - This technique is performed before a truck heads out onto the highway. Liquid is either applied to the solid material in the truck's material spreader or is applied to the material in the loader bucket before the bucket is unloaded into the truck.

   - Stockpile Spraying or Injection - Liquid is added to the stockpile of solid chemical or abrasives prior to being loaded on the truck.

2. Agents

   Pre-wetting agents are liquids that are mostly water and will not freeze during snow and ice control operations. They are selected not only for effectiveness but also for cost, corrosion resistance, and environmental safety. The Authority is currently using the following chemical solutions for pre-wetting: magnesium chloride, magnesium chloride/agricultural byproduct blend, and sodium chloride.

3. Application Rate

   The application rate for on board pre-wetting shall be eight (8) gallons of liquid per ton of solid chemical material.

4. Pavement Temperature

   The use of pre-wetting is most effective during storms in which pavement surface temperatures are between 10°F and 23°F. When the pavement is above 23°F and has sufficient moisture (snow, slush, water), pre-wetting a solid ice control chemical will not significantly improve the effectiveness of the chemical.

APPENDIX F - CHARTS FOR SPREADING

TABLE 1

LIQUID ANTI-ICING GUIDELINES

Surface Temp. Range (° F)	Surface Condition (*) (at time of initial operation)	Pre-Storm Anti-Icing			Comments
		Maintenance Action	Liquid Chemical Spread Rate (gal/lm)		
			Salt (NaCl) Brine	Magnesium Chloride ($MgCl_2$)	
Above 32 Steady or Rising	Dry or Damp	See Comments	40-60	-	Apply pre-storm anti-icing liquids if freezing precipitation is likely within 48 hours, and pavement surface temperature is 2° F or more above dew point. Treat targeted locations.
32 or Below is imminent	Dry or Damp	Apply Liquids	40-60	15-35	Application should be made as close to the forecast weather event as possible, within one day prior.
23 to 32	Dry or Damp	Apply Liquids	40-60	20-40	Applications should be made as close to the forecast weather event as possible, within one day or prior. Sufficient time should be provided for pavement to dry prior to temperature falling below 23° F.
15 to 23	Dry or Damp	Apply $MgCl_2$ Only	N/A	45-65	It is not advisable to apply liquid NaCl when the pavement temperature is below 23° F.
Below 15	Dry or Damp	N/A	-	-	It is not advisable to apply anti-icing chemicals when the pavement temperature is below 15° F.

(*) Do not apply anti-icing chemicals if sufficient residual chemical from previous applications is present on highway surface.

Notes:

- Salt (NaCl) brine should be checked regularly to ensure a solution concentration range of 23% - 24%; 23.3 being optimum.
- Magnesium Chloride ($MgCl_2$) and salt brine containing agricultural additives or other blended chemicals may be used.
- Do not apply anti-icing chemicals if rain is forecasted prior to snow and ice event.
- Do not apply anti-icing chemicals when air temperature or pavement surface temperature is less than 2° F above dew point.
- Do not apply anti-icing chemicals if relative humidity is above 70% for salt brine; 50% for $MgCl_2$.
- Do not apply anti-icing chemicals if winds are greater than 15 mph and loose or blowing snow is likely or present.

TABLE 2

ICE CONTROL CHEMICAL COMPARISON

CHEMICAL		TEMPERATURE, °F	CORROSION POTENTIAL		CONCRETE DAMAGE POTENTIAL	HANDLING CONCERNS	ENVIRONMENTAL CONCERNS
Formula Name	Form	Effective to [1]	Vehicles	Structure			
NaCl (Road Salt)	Solid	15	Yes	Yes	Some [2]	Dust	Water, Plants
NaCl (Road Salt)	Liquid	23	Yes	Yes	Some [2]	Dust	Water, Plants
$MgCl_2$ (Magnesium Chloride)	Solid	0	Low	Possible	Very Little	Dust	Water
$MgCl_2$ (Magnesium Chloride)	Liquid	10	Low	Possible	Very Little	Dust	Water
$CaCl_2$ (Calcium Chloride)	Solid	-20	Yes	Yes	Yes [2]	Generates Heat; Dries Skin and Leather	Water
$CaCl_2$ (Calcium Chloride)	Liquid	0	Yes	Yes	Yes [2]	Generates Heat; Dries Skin and Leather	Water
Blends	Liquid	0 to 5	No	No	No	None	BOD[3] in Water

1 Pavement Surface Temperature
2 If concrete is non-air entrained or has utilized poor materials or procedures
3 Biological oxygen demand

NOTE: Eutectic is the lowest temperature a concentrated (near saturated) solution begins to freeze or the lowest temperature it will melt ice.

TABLE 3

RECOMMENDED APPLICATION RATES FOR SOLID AND LIQUID SODIUM CHLORIDE (ROAD SALT)

Probable Pavement Temperature at Treatment and Before Next Treatment	**Ice Control Chemical Dilution Potential**	**Ice-Pavement Bond Characteristics Before Treatment**	**Application Rate**			
			Solid (Note 1)		**Liquid (Note 2)**	
			Pounds Per Lane Mile	Kilograms Per Lane Kilometer	Gallons Per Lane Mile	Liters Per Lane Kilometer
Greater than 32ºF (0ºC)	Low	Bonded/Packed	50 - 100	41 - 28	NR	NR
		Unbonded	Note 3	Note 3	Note 3	Note 3
	Medium	Bonded/Packed	100 - 200	28 - 55	NR	NR
		Unbonded	Note 4	Note 4	Note 4	Note 4
	High	Bonded/Packed	200 - 300	55 - 83	NR	NR
		Unbonded	50 - 100	14 - 28	22-44	52-104
23ºF to 32ºF (-5ºC to 0ºC)	Low	Bonded/Packed	100 - 200	28 - 55	NR	NR
		Unbonded	50 - 150	14 - 42	22-66	52-155
	Medium	Bonded/Packed	200 - 300	55 - 83	NR	NR
		Unbonded	150 - 200	42 - 55	66-88	155-207
	High	Bonded/Packed	300 - 400	83 - 100	NR	NR
		Unbonded	200 - 300	55 - 83	88-134	207-319
12ºF to 22ºF (-11ºC to -5.5ºC)	Low	Bonded/Packed	250 - 400	70 - 110	NR	NR
		Unbonded	100 - 250	28 - 70	NR	NR
	Medium	Bonded/Packed	350 - 450	98 - 125	NR	NR
		Unbonded	250 - 400	70 - 110	NR	NR
	High	Bonded/Packed	400 - 500	110 - 140	NR	NR
		Unbonded	350 - 450	98 - 125	NR	NR
Below 12ºF (-11ºC)	A. If unbonded, try mechanical removal without chemical. B. If bonded, apply chemical @ 450 to 500 pounds per lane mile. Plow when slushy and retreat when necessary. C. Apply abrasives when necessary.				NR	NR

SPECIAL NOTE: DEPENDING ON CONDITIONS – VEHICLE SPREADING SPEEDS SHOULD BE IN THE **30 TO 35 MPH** RANGE

These are starting points. Local experience should refine these recommendations. Pre-wetting chemicals generally allows application rates to be reduced by 15-20%. Application rates for chemicals other than sodium chloride will have to be adjusted. Before applying any ice control chemical, the surface should be cleared of as much snow and ice as possible.
NR = NOT RECOMMENDED

Notes:

1. Values include the equivalent dry chemical weight in the pre-wetting solutions.
2. Values are shown for 23% concentration solution.
3. If unbonded, try mechanical removal without applying chemicals. If pretreating, use 25-75 lbs/lm of or pre-wet solid chemical or 11-33 gallons/lm of liquid chemical.
4. If unbonded, try mechanical removal without applying chemicals. If pretreating, use 38-88 lbs/lm of or pre-wet solid chemical or 17-39 gallons/lm of liquid chemical.

TABLE 4

ICE CONTROL CHEMICAL DILUTION POTENTIAL FOR VARIOUS PRECIPITATION EVENTS

		Rate of Precipitation		
PRECIPITATION EVENT		**Light**	**Moderate**	**Heavy**
Snow Moisture Content	**Powder**	Low	Low	Medium
	Ordinary	Low	Medium	High
	Wet/Heavy	Medium	High	High
Rain		Low	Medium	High
Freezing Rain		Low	Medium	High
Sleet		Low	Medium	High

APPENDIX G - SAMPLING

a. Sampling Salt

(1) Typical Specification

Crushed Rock Salt, Type A. Size Grading

Sieve Size	Percent Passing*
1/2"	100
3/8"	95-100
No. 4	20- 90
No. 8	10- 60
No. 30	0- 10

* Tolerance of +5% on each sieve size except 1/2" and 3/8" sizes, on which no tolerance will be allowed.

Moisture content upon delivery shall not exceed 1.0 - 1.5% of dry weight.

(2) Sampling for Gradation

Material which apparently fails to meet the gradation portion of the specification cannot be properly sampled until it is unloaded. Subsequent delivery of apparently unsatisfactory material should be postponed pending the test results. Gradation sampling will be accomplished as directed by the DME. Sampling can be accomplished by Division Staff, the Bureau of Purchasing, or by a commercial testing firm. Coordination for using a commercial testing firm shall be made through the Office of Contracts and Construction Management. Sampling shall be done in accordance with New York State Department of Transportation Procedure GCP-17.

The TMS 2 should verbally notify the DME when samples are submitted or requested. In addition, the Superintendent of Thruway Maintenance should also be notified to ensure proper follow-up and dissemination of any pertinent information to all supervisory Maintenance personnel.

(3) Sampling for Moisture Content

The rock salt specification states that moisture content, upon delivery, must not exceed 1.0 - 1.5% of dry weight when dried to a constant weight at 103°C - 110°C. In order to ensure that the material is delivered as specified, we must be alert to wet rock salt deliveries and be prepared to take immediate steps to reject or sample suspicious loads. All loads are to be covered at the time of delivery.

Each truckload must be inspected before it is unloaded. The TMS 2, TMS 1 or Crew Leader on duty at the time of delivery is responsible for detecting, sampling and reporting deliveries of this nature.

Any salt delivery having questionable moisture content must be sampled. The sampled load must be temporarily stockpiled separate from other salt in the maintenance yard.

The following equipment is required to take a sample:

1 - 6 foot pole with a hook on one end
1 - 5 gallon paint mixing pail
1 - gallon friction top can
(part number 39-06-04-04)
1 - plastic liner for the above can

The sample is taken as follows:

As the load is being slowly dumped, stand to the side of the tailgate and obtain a sample in the 5 gallon pail using the pole at a time when approximately 20% of the load has been discharged. DO NOT STAND DIRECTLY BEHIND THE TAILGATE.

Place liner in gallon can and pour sample into it until 7/8 full.

Twist the top of the bag several times and tie tightly to insure moisture retention.

Submit sample at once to the Bureau of Purchasing at Administrative Headquarters or to a local commercial testing firm as determined by the DME.

Notify the Superintendent of Thruway Maintenance that a suspect load has been sampled.

b. Sampling Abrasives

(1) Typical Specification States:

All particles shall be hard, angular, durable, free from frozen lumps, and shall conform to the following gradation when tested by AASHTO Test Method T27-93 or the most current revision.

Sieve Size	Percent Passing*
3/8"	100
No. 10	40-80
No. 50	0-25
No. 200	0-3 (Wet)*

* as determined by AASHTO Test Method T11-91 or the most current revision.

All percentages shall be by weight. Stone dust, cinders and crushed limestone are not acceptable. Manufactured abrasives meeting the gradation requirements shown above will be considered.

(2) Sampling an Abrasive Stockpile or Truckload

A total sample of approximately 10 pounds is required. To be representative, the sample should be composed of several equal sized smaller samples taken from various points around the pile. Always push aside 6 to 12 inches of material before taking a sample. For stockpiles, the minimum of 4 samples should be taken approximately 1/2 to 2/3 up the pile. For a truckload, 2 to 4 samples taken in a similar manner is sufficient. Combine all small samples into the same bag for transmittal.

APPENDIX H - SPECIFIC GRAVITY VALUES FOR ICE CONTROL CHEMICALS

SPECIFIC GRAVITY VALUES FOR ICE CONTROL CHEMICALS

Magnesium Chloride Brine
(% by Weight & Freeze Point)

% by Weight	Specific Gravity	Freezing Point (°F)
5	1.013	26.4
6	1.051	25.0
7	1.060	23.5
8	1.069	21.8
9	1.070	20.0
10	1.086	17.9
15	1.132	4.0
20	1.180	-17.2
22	1.200	-27.0
25	1.230	-10.0
26	1.241	- 6.0
27	1.251	- 3.0
28	1.262	- 1.0
29	1.273	1.0
30	1.283	3.0

Calcium Chloride Brine
(% by Weight & Freeze Point)

% by Weight	Specific Gravity	Freezing Point (°F)
10	1.090	20.0
15	1.139	10.0
20	1.189	- 4.0
22	1.209	-12.0
24	1.228	-20.0
26	1.251	-31.0
28	1.275	-46.0
29.6	1.294	-60.0
30	1.298	-52.0
31	1.310	-34.0
32	1.322	-17.0
33	1.334	- 4.0
34	1.357	10.0
35	1.357	20.0
40	1.416	61.0

SPECIFIC GRAVITY VALUES FOR ICE CONTROL CHEMICALS (Cont'd)

SPECIFIC GRAVITY VALUES FOR ICE CONTROL CHEMICALS

Sodium Chloride Brine
(% by Weight & Freeze Point)

% by Weight	Specific Gravity	Freezing Point (°F)
5	1.035	26.7
6	1.043	25.5
7	1.050	24.2
8	1.057	22.9
9	1.065	21.6
10	1.074	20.2
15	1.112	12.4
20	1.152	2.4
21	1.159	0.0
22	1.168	- 2.5
23	1.176	- 5.2
23.3	1.179	- 6.0
24	1.184	- 1.4
25	1.193	13.3
26	1.201	27.9

M-50 or MAGic-0
(% by Weight & Freeze Point)

% by Weight	Specific Gravity	Freezing Point (°F)
4	1.034	30.0
5	1.042	29.0
6	1.050	29.0
7	1.058	28.5
8	1.064	28.0
9	1.072	27.0
10	1.078	26.0
15	1.108	21.0
20	1.144	13.0
22	1.154	10.0
25	1.169	6.0
30	1.194	0.0
31	1.200	- 3.0
35	1.216	-14.0
40	1.246	-40.0

APPENDIX I - DIESEL FUEL TESTING AND RECEIVING REPORTS

a. Diesel Fuel Testing

(1) Pre-mixed winter blend fuel delivery

A test should be conducted on a sample before the driver unloads the diesel fuel. This test will aid in determining whether the fuel blend noted on the vendor's delivery ticket agrees with the corresponding specific gravity obtained after testing.

When testing pre-mixed winter blend diesel fuel deliveries with a hydrometer, the following guidelines are to be followed:

- Each delivery is to be tested and recorded on the receiving report.
- The fuel temperature should be room temperature (65°F to 70°F) for an accurate reading.
- Specific gravity should never be below 32 or above 42.

  32 (heavy) - # 2D fuel oil
  42 (light) - # 1D diesel or kerosene

- Winter fuel should be 36-37. This is 50/50 blend. In extreme cold weather, further blending could be required. As a reference, summer fuel should have an approximate specific gravity of 32-34.

(2) Authority Storage Tanks

To ensure that the storage tank mixture is the appropriate 50/50 winter fuel blend by November 1, the fuel in the storage tank should be tested before ordering to determine the percent of 1D diesel or kerosene required to obtain the desired 50/50 winter fuel blend.

b. Receiving Reports

The receiving report must indicate the specific blend that is delivered to facilitate payment at the correct contract price. It is the responsibility of the receiving clerk to verify this information at the time of delivery and record it on the receiving report.

After the delivery has been completed the following information will be recorded on the receiving report:

- Specific gravity obtained after completing the Diesel Fuel test.
- The ratio or percentage of fuel blend delivered.

  Example: 1/1 Mix — 1 part 2D fuel oil
  1 part 1D diesel or kerosene

  or

  50/50 — 50% 2D fuel oil
  50% 1D diesel or kerosene

- If an unblended delivery, then state the percentage of each fuel type delivered.

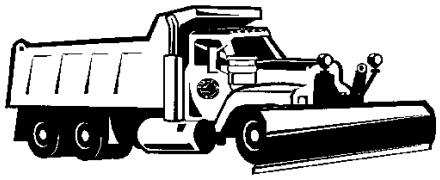
  Example: Unblended delivery 50% 2D and 50% 1D

EXHIBITS

EXHIBIT 1 (Reduced From Sheet Size 8-1/2" x 11")

NEW YORK STATE THRUWAY AUTHORITY

Memorandum



DATE:

TO: Director of Highway Management

SUBJECT: Recommend changes to Winter Maintenance Manual

FROM: Division _____

Section _____

Name/Group _____

Recommended Changes:

Section/Page No.: _____

Recommended Changes:

Section/Page No. _____

General Comments: _____

EXHIBIT 2

SPREADER CONTROLLER SETUP GUIDELINES

All spreader controllers must be set up with the following configuration:

- Gate setting programmed to 3 inches
- "Closed Loop" (CS-230) or "Auto Loop" (CS-440, 550, Dickey John)

Solids: Two solid materials (Untreat & Treated) must be programmed into the controller and setup as follows:

Untreat[1] - Application Rate Settings:
1 = 100 lbs/lm
2 = 200 lbs/lm
3 = 300 lbs/lm
4 = 400 lbs/lm
5 = 500 lbs/lm
6-9 = 600 lbs/lm

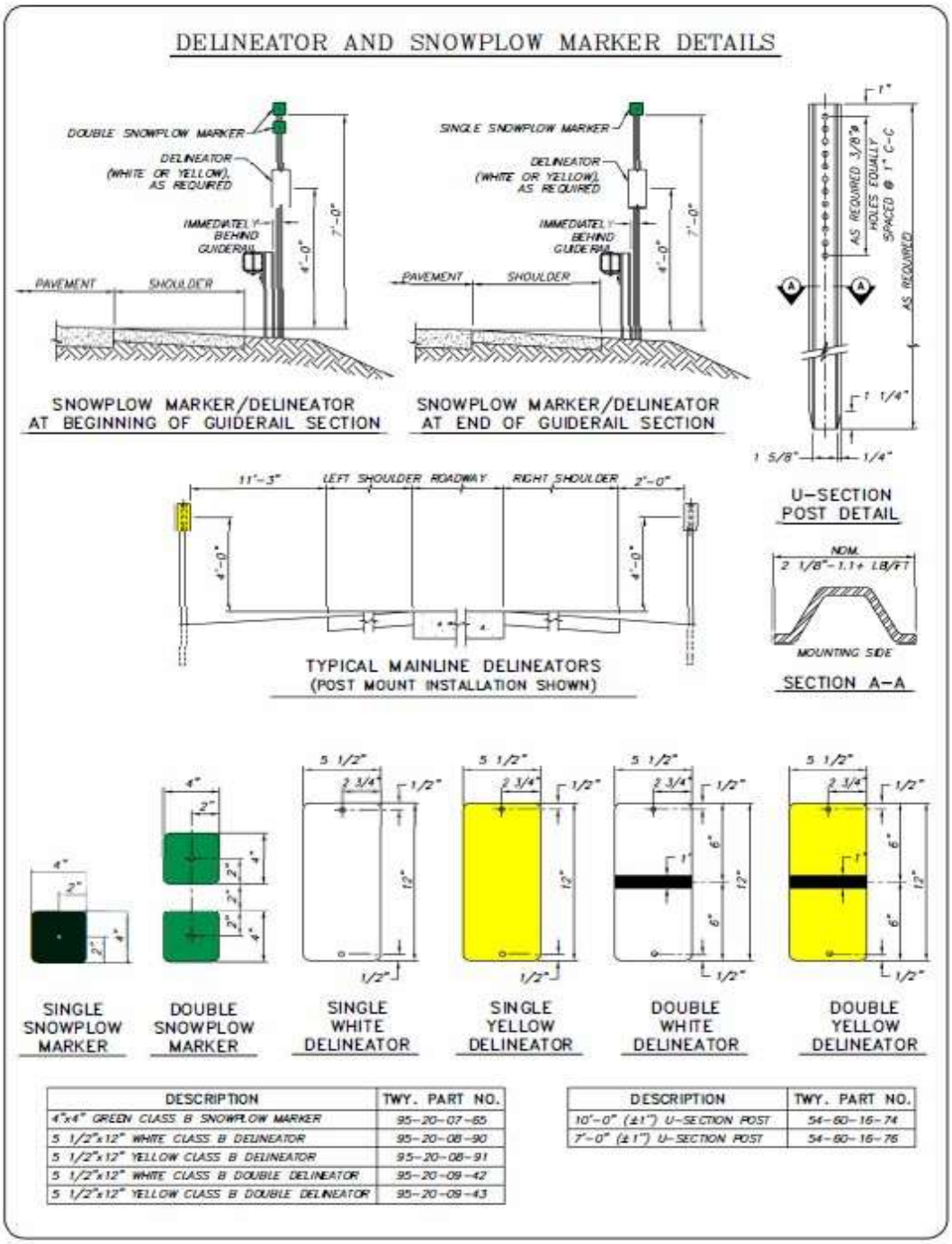
Treated – Application Rate Settings:
1 = 80 lbs/lm
2 = 160 lbs/lm
3 = 240 lbs/lm
4 = 320 lbs/lm
5 = 400 lbs/lm
6-9 = 480 lbs/lm

Blast Button:
Blast = 900 lbs/lm

Liquids: One liquid setting shall be programmed into the controller and setup for 8 gal/ton. All controllers shall be programmed so that there is a 20% reduction in solid material when the liquid pre-wetting system is turned on.

[1] Untreat = Untreated

EXHIBIT 3 (Reduced From Sheet Size 8-1/2" x 11")



DESCRIPTION	TWY. PART NO.
4"x4" GREEN CLASS B SNOWPLOW MARKER	95-20-07-65
5 1/2"x12" WHITE CLASS B DELINEATOR	95-20-08-90
5 1/2"x12" YELLOW CLASS B DELINEATOR	95-20-08-91
5 1/2"x12" WHITE CLASS B DOUBLE DELINEATOR	95-20-09-42
5 1/2"x12" YELLOW CLASS B DOUBLE DELINEATOR	95-20-09-43

DESCRIPTION	TWY. PART NO.
10'-0" (±1") U-SECTION POST	54-60-16-74
7'-0" (±1") U-SECTION POST	54-60-16-76

June 2019

DISTRIBUTION

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General Counsel
Chief Financial Officer
  Director of Fiscal Audit and Budget
Director of Audit and Management Services
Director of Media Relations
Director of Operations
   Director of Customer Relations
     Service Area Representatives
   Director of Toll Administration
  Director of Traffic Management
    Traffic Supervisors
Communications Supervisors
Major, State Police Troop T
SP Zone Captains
Director of Administrative Services
  Director of Human Resource Management
  Director of Labor Relations & Employee Safety
   Agency Safety & Health Director
Chief Engineer
Director of Maintenance and Operations
  Superintendent of Maintenance
  Director of Highway Management
  Senior Thruway Maintenance Specialist
  Director of Bridge Management
  Professional Engineers 1 (Civil/Transport) - Bridge Management
  Director of Facilities and Code Compliance Management
  Director Transportation Planning of Environmental Services
  Senior Building Maintenance Assistant
  Director of Equipment and Inventory Management

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Division Facility Engineers
Maintenance Supervisors 2 (Building)
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Maintenance Supervisors 1 (Motor Equip)
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