



**Highway Factors Attachment – Responses to Survey of Toll Facilities**

**Fort Worth, TX**

**HWY21FH005**

(368 pages)



**Chicago Skyway located in Chicago, IL responses to survey of toll facilities**

**Fort Worth, TX**

**HWY21FH005**

(88 pages)



## SURVEY OF TOLL FACILITIES

### General Operations:

1. Is the toll facility private or state regulated? **Private**
2. When was the toll facility officially opened to traffic? **1958**
3. How many lane miles does the toll facility maintain? **We have 22 lanes at the plaza area (11 lanes in each direction). Our entire roadway is a 7.8-mile-long toll road that connects the Indiana Toll Road to the Dan Ryan Expressway on Chicago's South Side. The main feature of the Skyway is a 1/2-mile-long steel truss bridge, known as the "High Bridge". The bridge itself spans the Calumet River and Calumet Harbor, a major harbor for industrial ships – its main span extends 650 feet long and provides for 125 feet of vertical clearance. We also have 7 intersections.**
4. How many days did the toll facility respond to snow and ice removal events in each of the last 5 years?

	2016	2017	2018	2019	2020
Days with Snow and Ice Removal Events	36	22	47	38	22

### Snow and Ice Removal Pre-treatment Operations: Describe and/or provide documentation of the following:

5. All pre-treatment options and subsequent chemical applications currently used by the toll facility during snow and ice removal events.

#### **SEE ATTACHED PLANS FOR INFORMATION**

4a. How long each specific pre-treatment option and subsequent chemical applications are effective in treating the roadway after initial application.

4b. Any formal criteria of when to use specific pre-treatment options and subsequent chemical applications.

### Snow and Ice Removal: Describe and/or provide documentation of the following.

6. An inventory (trucks, plows, front-end loaders, spreaders, etc.) including the number of covered salt storage facilities and quantities of salt that are dedicated to snow and ice removal events.

**SEE ATTACHED PLANS FOR INFORMATION (PAGE 9)**

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7. Methods/technologies to monitor moisture and ice formation on roadways, highway overpasses, or bridges.

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6a. If you use sensor detection systems, the systems, and procedures for their use.

6b. If you do not use sensor detection systems, any future plans by the toll facility to utilize them or other technologies capable of monitoring moisture and ice formation on roadways, highway overpasses or bridges.

8. Procedures for snow and ice removal.

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7a. If you have formal procedures in place, provide a copy of the established procedures.

9. Training procedures for maintenance technicians who perform spot checks and inspections of road conditions during snow and ice removal events. Provide details on the training procedures necessary to become a spot checker (i.e., initial number of training days/hours, certification (**NONE**) requirements, length of annual refresher courses, etc.)  
**(4 HOURS 2 DAY TRAINING ANNUALLY)**

**Documentation Checklist: Please provide the following if available.**

- ✓ Pre-treatment options, durations of effectiveness, and criteria for use
- ✓ Inventory of snow and ice equipment
- ✓ Systems/methods used to detect moisture and icy conditions
- ✓ Operational and training procedures for snow and ice removal
- ✓ Contract between toll authority and state, including snow and ice removal events



# **Skyway Concession Company LLC**

**Snow and Ice Plan 2021**





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Snow and Ice Plan 2021

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## Skyway Concession Company LLC Snow and Ice Plan 2021

### 1. Introduction

The Skyway Concession Company LLC (SCC) strives to provide customers with the safest, most efficient, limited access high-speed highway in Illinois. Since Illinois is located in a snow belt, the highest priority is placed on operating a winter maintenance program that can effectively respond to the varying weather conditions. To ensure the free-flow of customers, goods, and services, SCC quickly applies controlled snow and ice control measures regardless of winter weather conditions.

The Snow and Ice Control Plan (SICP) details the multiple systems that SCC has incorporated into the Skyway's winter maintenance program.

### 2. SICP Responsibilities

The responsibility of this plan relies on the Chief Operating Officer. This employee is responsible to assure that staffing and equipment needs are at the appropriate level for each storm event. It is also their responsibility to make all advance preparations and supervise the handling of each incident as well as monitoring the field supervisors in assuring that all measures are taken to provide a safe and efficient roadway.

#### 2.a Performance time frames

SCC will provide the City of Chicago a SICP prior to May 24th annually.

#### 2.b Acceptance Criteria

SCC prides itself in their level of service. The following table shows the parameters that, as required per the concession Lease Agreement (CLA) are complied with by SCC:

Operational Parameter	Maximum Time Duration
Maximum allowable driving lane accumulation	1-1/12" (1.5 inches)
Maximum reaction time until first snowplow pass	1 Hour
Maximum allowable driving lane snow pack time	1 Hour
Maximum time to bare pavement condition after storm end	4 Hours
Maximum time to bare shoulder condition after storm end	8 Hours

### 3. Definitions

**Anti-icer:** A chemical freezing point depressor for preventing the formation of frost, snow, or ice on a driving surface.

**ATDs (Automatic Traction Devices):** Equipment installed on some vehicles that are driver-deployed to improve the traction of the vehicle in adverse conditions.

**Bare Pavement:** A condition under which the entire driving surface is cleared of loose snow and ice. The driving surface may have isolated patches of ice, snow, or slush that, when treated with chemicals or abrasives or a combination of these, may be negotiated safely by the average driver at a reduced speed.

**Consulting Meteorologist:** Contract service that provides periodic, frequent, and specific weather forecasts, and predictions, for use by the SCC to determine the need for and locations of pre-positioned staff and equipment.

**De-icer:** Any one of several common freezing point depressors, such as salt (sodium chloride), CMA (calcium magnesium acetate), liquid potassium acetate, and liquid magnesium chloride. Deicers are used to melt already formed frost, snow, or ice and reduce the temperature whereby re-formation can occur.

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**Driving Surface:** The travelled way of the Skyway, consisting of all mainline roadway lanes and the entire width of all ramps. For the purpose of snow and ice control, the shoulders, medians, and curb and gutters of the Skyway mainline and ramps will not be counted as driving surface, but must be cleared as the next priority. This definition does not relieve the SCC of any responsibility from insufficient or incomplete snow and ice control of any level surfaces adjoining the normal Skyway travelled way that can be encroached upon by an errant vehicle.

**Maximum Accumulation:** The maximum thicknesses of ice and/or new snowfall that will be permitted to temporarily build up on the driving surface before the next required snowplow pass. The maximum accumulation does not pertain to the depth of ice and/or snow that falls, blows, or is plowed onto the shoulders or median of the Skyway mainline.

**Pack:** Refers to a temporary build-up of ice and/or snow on the driving surface, which accumulates between plowings due to continuing snowfall, blowing snow, etc.

**RWIS (Road Weather Information System):** An installed system of weather and pavement sensors that is used to monitor conditions at remote locations. Some RWIS can use historical data previously gathered to predict local weather as a decision-making tool for maintenance and construction operations.

**Snow Plow:** A truck or vehicle that has been equipped with plow blade(s), device(s), deicing device(s), lights, radio, and related features acceptable to operate on the Skyway to plow snow and ice and spread de-icers.

### **4. Advance Preparation Procedures**

The Skyway winter maintenance program prepares for the winter season by following the procedures included in this Snow and Ice Control Plan. Preparation for snow and ice control on the Skyway begins well before the start of winter. SCC makes a significant effort in the off-season to prepare vehicles and equipment designed for snow and ice control operations. That preparation extends to training SCC staff in the operation of this equipment, and ensuring that staff understands the effective application of equipment and materials designed for snow and ice control.

SCC reviews the snow and ice control systems prior to the winter season. Adjustments and enhancements are made to accommodate physical system changes that may have occurred during the year and to reflect changes in technology, materials, and procedures.

The accurate and timely identification of approaching storms is a key part of the snow and ice control program. Once SCC receives an advance storm warning from a professional meteorological service, supplemental weather data are obtained to improve SCC's understanding of the variable conditions winter storms present. This analysis determines the level of mobilization needed at the Skyway from the onset of the storm to its conclusion. Throughout each storm, SCC continuously reviews ongoing control efforts so that response procedures can be adapted to individual storm characteristics. Post storm review is also an important element in the overall winter maintenance approach.

The result is an efficient system-wide approach that has and will continue to provide Skyway users with the highest level of service currently available. Like any program that includes multiple resources and systems, the snow and ice control plan is a dynamic document that must undergo continuous review and modification to meet current and future demands.

#### **4.1. Organization Chart**

The Snow and Ice Control plan includes an organization chart that shows the titles of the SCC staff with responsibility for snow and ice control preparation. Figures E-1 and E-2 show the organization charts for the SCC Operations Department and the Snow and Ice Removal Staff Chart, respectively. The snow and ice removal staff consists of two 7-person crews, Crew A and Crew B.

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**Figure E-1  
Operations Department**

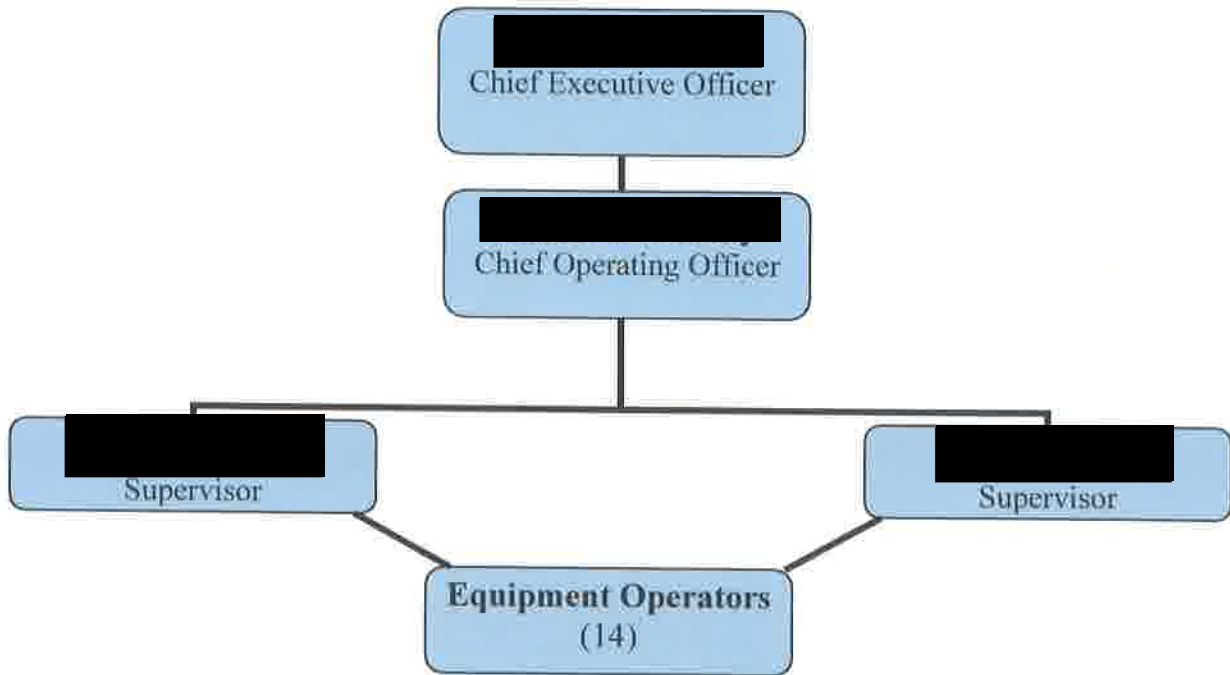
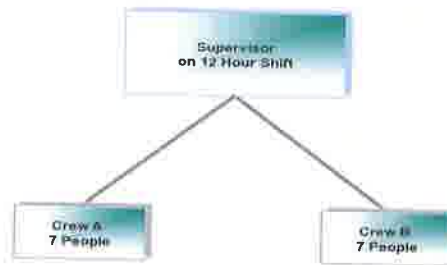




Figure E-2  
Snow and Ice Removal Operations Staff Chart

Chicago Skyway Toll Bridge  
Organization Chart



**4.2. Staff Training**

The demands of a winter season operation place special responsibilities on all staff. Training for winter maintenance, which includes familiarization with all snow routes and equipment, must be provided for all equipment operators by October 31 of each year. All operators must attend an annual snow and ice meeting performed by the Chief Operating Officer and/or Maintenance Supervisor. In this meeting, employees are to be made aware of the SCC's bare pavement policy and the entire snow and ice operation.

**4.3. Availability**

From Last Sunday of October through the third Sunday of April, when the SCC deems it necessary for snow and ice removal, employees assigned to maintenance may be required to work overtime, may be required to work prior to the start of their regularly scheduled shift and may be required to work Saturdays and Sundays. During this designated winter period, maintenance staffs are not permitted vacations. Maintenance staffs are subject to call 24 hours per day during the winter months. This mandatory availability for call out in the event of a storm means the employee must keep the SCC management informed at all times of a phone number where he/she can be reached. Winter staff reporting to the Skyway on a call to plow or de-ice, must be in acceptable physical condition and must report to their assignment within an acceptable time not to exceed two hours from the time of original call out.

**4.4. Scheduling/Organization**

The scheduling and organization of staff for winter season operations requires that two crews (A & B) be available on call 24 hours per day, with two twelve hour shifts, from 7:00 am to 7:00 pm. and 7:00 pm. to 7:00 am Each shift, A or B, has enough staff to operate the salt and plow trucks. Shifts rotate every two weeks. The A crew starts on days when a notification from the Chief Operating Officer is issued.



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The purpose of the night staff is to handle small storms, drifting after storm cleanup, dawn patrol, and miscellaneous road emergencies. The night shift crews also keep supervisors notified of road conditions during inclement weather; clean equipment; perform minor repairs; trash plazas, ramps, lighted areas; and clean the garage; etc., as assigned.

### **4.5. Dawn Patrol**

The SCC is prepared for dawn patrol by November 1. The Chief Operating Officer determines the actual starting time for dawn patrol based on observed weather conditions (generally, when temperatures drop below freezing). Dawn patrol should begin early enough to enable the crew to cover the Skyway before morning rush hour. Time is allowed for attending to possible trouble locations.

The responsibilities of the dawn patrol include the following:

- Check road for frost build up on bridges prior to morning rush.
- Check direction of most bridges first. Cover end with heavier traffic first.
- If problem occurs over whole section, then additional staffing should be added.
- Discretion should be used where and when not to spread. Do not spread bridges if they do not need it.
- Stop and check bridge with bare hand if necessary, and if safe to do so.
- If unsure, spread the bridge deck.

### **4.6. Schedules**

Winter maintenance shift schedules are designed to limit the number of hours an employee can work to twelve hours per day.

Upon advanced warning of an approaching storm with forecast duration of six or more hours, it is the practice for the A or B shifts (night) crew to be sent home as soon as possible. Several members of the A, B (day) crew are generally retained to operate equipment which otherwise would not be operated until the 3-11 shift. The day crew staff may be released at 3:00 pm. or held until 7:00 pm. When released, they may have to return to work at either 3:00 am or 7:00 am, as instructed. The 3-11-night shift may be called in early (prior to 3:00 pm.) or can work late (until 3:00 am). The 11-7 shift may be similarly called in early or held over four hours. The preceding is only one example of possible crew organization. The overall goal is to ensure maximum utilization of equipment and equalization of staff. It may be more efficient to organize activities on a twelve-hour basis around the A, B shift change times (i.e. 7:00 am and 7:00 pm.) depending upon the starting time, severity, and duration of the storm. The Chief Operating Officer, Maintenance Supervisor or designated individual can call out staff in the event of a storm warning.

### **4.7. Preparation Protocol**

Preparation for the winter begins at the conclusion of the previous winter's snow plowing and de-icing activities. Prior to the dismounting of the plows, vee-box hoppers, and spreaders, the condition and operation of each piece of equipment is evaluated for needed maintenance during the off-season. Maintenance of the vee-box, spreaders, and plows is completed so that mounting can begin by the last week of the following September. Starting in the second week of October, mounting of the spreaders

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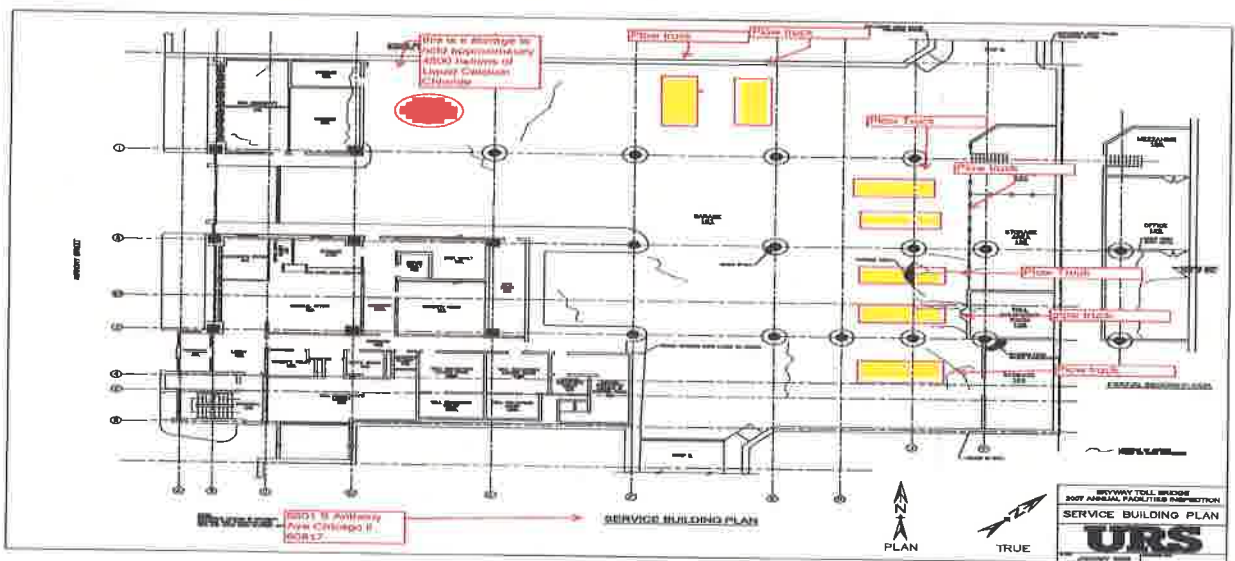
and vee-box begins on the snow removal trucks. All units are completed and tested by the last Sunday of October.

As hopper installation is completed on individual units, the plow is also installed and tested for proper hydraulic functions. Several cycles through the raising and reversing, the process should be attempted to properly test hydraulic components for weakness.

All front-end loaders should have scheduled preventive maintenance completed by the first week of November. All calibration of the trucks is completed by the last Sunday of October.

Spreading too little salt is inefficient as re-application will be necessary. Spreading too much salt is less effective than spreading too little, since it costs more money, time, and material, has no greater effect on the highway, and negatively affects the environment, roadway, and structures. Only by calibrating spreaders and developing a full application rate chart can the operations staff accurately control salt/chemical application. Accurate calibration of all salt-spreading equipment is performed as a preparation for the winter de-icing activities. The procedure for calibrating-salt spreading equipment is fully described in Sec 11.1 of the Snow and Ice Control Plan.

Below shows a map of the building with the location of the snow and ice equipment as well as the storage container for the liquid calcium chloride:



The map below shows the location of the Skyways Salt pile:



List of available equipment consists of

- 4 Peterbilt 348 Plow Truck ( Tandem Axle)
- 3 Peterbilt 348 Plow Truck ( Single Axle)
- 2 Case front End Loader
- See Equipment Plan for additional information on Equipment

#### **5. Call Out Procedures**

Once the Chief Operating Officer or the Maintenance Supervisor receives the alert from the meteorologists, he or she decides how many employees, how much equipment, and what type of material is needed to respond to the storm. Figure E-3 is an example of the employee call-out form. The Chief Operating Officer or the Maintenance Supervisor then contacts the employees on call for that time of day. For example, in the middle of the night, people on the night call would be contacted. SCC retains seven employees per shift for the duration of the storm if needed. During an alert, shift personnel are on call from:

7:00 am through 7:00 pm

7:00 pm through 7:00 am

3:00 pm through 3:00 am

3:00 am through 3:00 pm

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**Figure E-3  
Employee Call-Out Form**

Employee	Time	Phone Number	Spoke To	Response Yes or No	Comments

**Note: All equipment operator laborers /mechanic are on call for the winter month which consist of November 1 to April 1 (Weather permitting) all employees will be made of the hours that they need to be available by supervisor. Once employees arrive at work they are required to stay for snow and ice reason and not leave until their**

- **Relief has arrived**
- **When the storm is over and post storm clean-up is completed**
- **When advised to leave by supervision**

**5.1. Outside Agency Assistance**

When the Snow Operations Center receives a warning of a major snow storm that would require the assistance of an outside agency, the Chief Operating Officer notifies the CEO of the need for the outside assistance. Upon receiving approval to initiate a call for outside assistance, the Chief Operating Officer contacts the outside agency to request the staff that SCC expects to need, generally, 3 persons per 12-hour shift.

The outside agencies that SCC contacts for assistance when major storms are forecast include:

- Superior Snow Removal





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### **5.2. Snow Operations Center**

The Snow Operations Center's main activity is to gather, evaluate, and broadcast information obtained from the various operations involved in a storm alert. The centralization of this activity permits better coordination of efforts between maintenance staff and improves efficiency. This activity supports and assists field staff in accomplishing their snow and ice control plan. The Snow Operations Center is equipped with the following:

- Computer terminal
- Status monitor
- Printer
- Keyboard
- Color weather radar and
- Television (for weather channel and local news).

Staffing of the Snow Operations Center consists of the Chief Operating Officer and/or the Supervisor. They begin their duties upon receiving a storm warning from Murray and Trettle.

### **5.3. Priorities of Assignments**

The priorities of the operations staff's assignments are shown as follows:

- Mainline lanes (lanes 1, 2, and 3 Dan Ryan and Stony Island Ramps)
- Plaza lanes (all approaches to and departures from the Toll Plaza)
- Ramp lanes (all acceleration lanes and de-acceleration lanes).

Any storms that are forecast as little or limited effect will not require a full crew call out. Any storms that are forecasting any hazardous conditions with accumulative snow will require a full crew call out. The color-codes for little or limited effect will be a yellow/green. Any storms that are a yellow/green condition do not require full crew staffing. The color-codes for accumulative snow or problem areas will have a red or black. Any storms that have a red/black combined with a yellow or green will require a full crew call out. Any half/full crew call outs will require management on site. Any call outs that are red/black conditions, outside contractor will be notified to provide additional equipment for the snow and ice removal.

## **6. Storm Monitoring and On-Call Plan**

The preparation of equipment, organization of staff, and notification of approaching storms are basic to successful snow fighting. The SCC contracts Murray and Trettle, Inc., Certified Consulting Meteorologists to provide the maintenance supervisors with early warning forecasts, predicting the detail of the storms and effects on the Skyway road system. The storm notification policy is designed so that the first call from Murray and Trettle is directed to the Chief Operating Officer and/or Maintenance Supervisor. Depending on the time of day or weekend, the call is made to the residence or office as appropriate. During normal business hours, Murray and Trettle contact the Chief Operating Officer



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and/or Maintenance Supervisor at the Skyway. The Chief Operating Officer and/or the Maintenance Supervisor are provided with full details as shown on the Snow and Ice Storm Warning Form.

This information, with a description of SCC's response to the storm is communicated to designate outside contacts such as the Illinois Department of Transportation (IDOT), the City of Chicago, Chicago Police Department, the Indiana Toll Road, Illinois Tollway etc. As the storm ages, the Storm Operations Center requests periodic updates from Murray and Trettle. The revised weather information is passed on to the operators, as well as the designated outside contacts.

During a storm alert the Snow Operations Center staff log actions taken in the storm alert and the roadway and weather conditions. The Storm Operations Center staff calls Murray and Trettle hourly and relay information to the field staff (operators) with any updates or changes in the storm. Status and progress updates from the field staff are communicated to the Snow Operations Center on an hourly basis unless there is a change prior to the hourly updates. The Snow Operations Center staff direct the field staff on the type of material to use and the spread rate. The information relayed to field staff changes as the storm either intensifies or diminishes.

The information reported by the field staff to the Snow Operations Center is entered on the Storm Operations Information Form. This form includes information such as:

- Number of units on patrol and/or assignment
- Type of operation in progress
- Plowing and spreading
- Clean-up - shoulders, decks, etc.
- Standby
- Time snow operation started
- Material mixture being used
- Precipitation
- Additional revised/current forecast from Murray and Trettle
- Number of trucks down and the reasons
- Wind speed and temperature

The Snow Operations Center staff can use the information to expedite responses to hourly calls from the field staff. At the end of the storm, the snow operations staff gathers all available information on the storm in addition to the total amount of material used, man-hours, and equipment usage and logs all of the information into a work order. The operations staff also prepares a brief synopsis of the storm noting any problems that occurred. All information is filed for future reference.

**6.1. Storm Warning Call out Organizational Chart**

Murray and Trettle Inc., Certified Consulting Meteorologist

██████████ Chief Operating Officer

██████████ Maintenance Supervisor

██████████ Maintenance Supervisor

██████████ CEO

On Call Employees, Skyway Equipment Operators/Seasonal Employees

Other Authorities/Agencies outside of SCC

Contact Numbers:

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[Redacted]	Chief Operating Officer	[Redacted]
[Redacted]		
[Redacted]	Maintenance Supervisor	[Redacted]
[Redacted]		
[Redacted]	Maintenance Supervisor	[Redacted]
[Redacted]		

Communications should be kept with all outside agencies during and after the storm. The supervisor should communicate with IDOT District 1, Indiana toll road, as well as the City of Chicago snow command center. This communication should consist of but not be limited to the color codes, forecast predictions, start times, crew sizes, material spreading as well as accumulation.

If the Media needs information, this information is provided to them via the spokesperson. The information will consist of travel times, pavement conditions, and accidents, icy or hazardous areas. If the CEO or his designee directs to have someone else provide this information besides for our contracted spokesperson to the media, then the information will also be the same information and in general inform the commuters of regional travel problems.

**7. Operational Requirements**

The operational requirements of the Snow and Ice Control Plan are described in this section. To maintain traffic safety and the mobility of motorists during winter storms, SCC's highest operational priority is snow removal and ice control. The SCC will make every effort to keep the Skyway open to traffic at all times.

- In the event the Skyway becomes blocked due to uncontrollable conditions, SCC's managerial staff will contact the proper authorities via phone to advice of the situation. These proper authorities will include, but are not limited to, City of Chicago, Chicago Police Department, IDOT, Illinois Tollway and Indiana Toll Road. Detour routes will be posted for the motoring public. SCC snow and ice operations will continue in making every effort to expedite the re-opening of the Skyway as soon as conditions warrant. For additional information on agencies and procedures see Emergency Management operations Plan.

The procedures for using chemicals and other materials to control snow and ice on the Skyway are describes in the following:

**7.1. Salt**

Salt is used generally on road surfaces where the lowest temperature anticipated is 20° F. Salt absorbs moisture from the humid atmosphere at approximately 70% humidity or greater. This produces brine, which has a lower freezing point than water. Salt requires heat and moisture to work. As the air temperature and humidity drops, the effectiveness of salt as an ice control becomes decreased.

**7.2. Liquid Calcium Chloride**

Salt requires moisture to work. This moisture can be provided by the wetting of salt before application to the pavement through spraying a solution of 32-34% concentrate liquid calcium chloride on each

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truckload of salt. This method of enhancing the melting property of salt results in nearly an instant production of brine independent of humidity. A wetted salt crystal penetrates immediately through the snow to the road surface. Chloride's ability to absorb moisture and generate heat accelerates brine and melting action. Chloride's characteristics permit salt to continue melting snow when the two are mixed or the salt is pre-wetted and applied at temperatures below 20 degrees F.

### **7.3. Understanding Material Usage**

Understanding material usage in fighting a storm is best explained using examples of simulated storm conditions. The following examples are for illustration only and are not meant to suggest that all storms fall neatly into four types. Each storm is a separate, dynamic, evolving event. The location, traffic volume, and the changing nature of the storm (i.e., wind, temperature, intensity, form of precipitation) are all factors influencing the materials that are used in the de-icing operation.

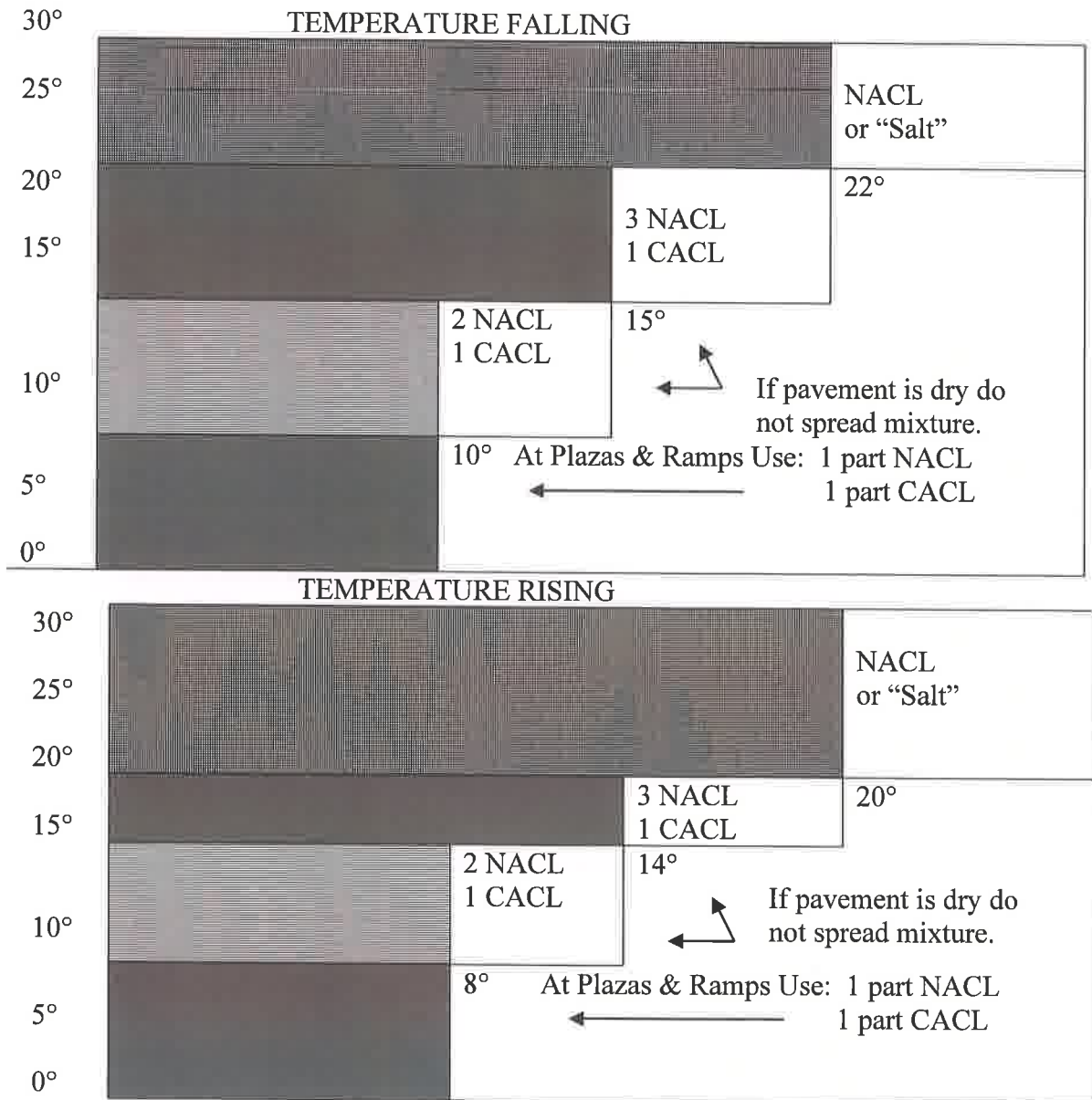
- **Example #1:**
  - Temperature near 30 degrees
  - Type precipitation – snow- sleet – freezing rain
  - Road surface – wet
  - Rate of accumulation – moderate to light
  - Type mix – straight salt
  - Rate of application – 300 lbs. per lane mile
  - Prior to rush hour – 500 lbs. per lane mile – if warranted
  
- **Example #2:**
  - Temperature below 30 degrees and falling, but not below 20 degrees
  - Type precipitation – snow – sleet – freezing rain
  - Rate of accumulation – moderate to heavy
  - Type mix – straight salt
  - Rate of application – 300 lbs. per lane mile
  - Prior to rush hour – 500 lbs. per lane mile – if warranted
  
- **Example #3:**
  - Temperature below 20 degrees and falling to 10 degrees above
  - Type precipitation – wet to dry snow
  - Wind – 15 mph
  - Rate of accumulation – heavy
  - Type mix – salt and liquid calcium chloride
  - Rate of application – 300 lbs. per lane mile
  - Prior to rush hour – 500 lbs. per lane mile – if warranted
  
- **Example #4**
  - Temperature down to zero to 10 above
  - Type precipitation – dry snow
  - Wind – in excess 15 mph
  - Road Surface - Tracking
  - Rate of accumulation – moderate to heavy
  - Type mix – salt, liquid calcium chloride
  - Rate of application – 300 lbs. per lane mile
  - Prior to rush hour – 500 lbs. per lane mile – if warranted



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For the type of precipitation and temperatures described for examples 3 and 4 the ratio of mixes varies at the time of application because traffic would have a large bearing on the choice of mixes. The snow and ice control temperature mixture guide is a tool useful in planning the course of action that will be pursued in fighting a storm and is a general guide relating temperature to the appropriate de-icing chemical. Weather conditions other than temperature also influence the choice of material or mixture that will be spread. The accumulation form, rate, depth, traffic, and predicted duration and intensity are all the factors influencing the actions taken to control a snowfall (see Figure E-4) **Figure E-4**

**Snow and Ice Control  
Temperature – Mixture Guide**





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### 8. Training

The demands of a winter season operation place special responsibilities on all staff. Training and familiarization with all snow routes and equipment must be performed for all equipment operators and must be completed by last Sunday in October each year. All operators must attend an annual snow and ice meeting performed by the Chief Operating Officer and the Maintenance Supervisor. In this meeting the employees are to be made aware of the SCC's bare pavement policy and the entire snow and ice operation.

### 9. Record Keeping

During a storm alert the Snow Operations Center staff log actions taken during the storm alert and track the roadway and weather conditions. The Storm Operations Center staff calls Murray and Trettle hourly and relays information to the field staff (operators) with any updates or changes in the storm. Status and progress updates from the field staff are communicated to the Snow Operations Center on an hourly basis unless there is a change prior to the hourly updates. The Snow Operations Center staff direct the field staff on the type of material to use and the spread rate. The information relayed to field staff changes as the storm either intensifies or diminishes.

The information reported by the field staff to the Snow Operations Center is entered on the Storm Reports. This report includes information such as:

- Number of units on patrol and assignment
- Type of operation in progress
- Plowing and spreading
- Clean-up - shoulders, decks, etc.
- Standby
- Time snow operation started
- Material mixture being used
- Precipitation
- Additional revised/current forecast from Murray and Trettle
- Number of trucks down and the reasons
- Wind speed and temperature

The Snow Operations Center staff can use the information to expedite responses to hourly calls from the field staff. At the end of the storm, the snow operations staffs gathers all available information on the storm in addition to the total amount of material used, man-hours, and equipment usage and logs all of the information into a work order. The operations staffs also prepare a brief synopsis of the storm noting any problems that occurred. All information is filed for future reference.

### 10. Environment

All snow and de-icing materials are removed from any areas that may be considered environmentally sensitive. The areas that may be threatened are landscaped areas or water ways such as irrigation systems. Other environmentally sensitive areas include bridges that cross water bodies such as the



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Calumet River. The material that is built up along the bridge walls is removed and stored at the salt storage areas.

### 11. Snow and Ice Control Materials

The SCC uses chemicals and other materials for controlling snow and ice on the Skyway. This section describes the procedures and requirements for stockpiling these materials.

#### 11.1. Inventory of De-Icing Material

The Chief Operating Officer or the Maintenance Supervisor is responsible for ensuring that the inventory of de-icing material is held at a level adequate for the demands of the SCC's snow and ice control program. The Chief Operating Officer or the Maintenance Supervisor reviews the on-hand quantity of de-icing material for the Skyway during the summer. They arrange purchases to bring the de-icing material inventory to a level appropriate for the start of the winter season. The Skyway generally begins the winter season with approximately 5,000 tons of salt, 2,500-5,000 gallons of liquid chloride. During every de-icing activity, the operators are required to log all material used on a load tally sheet. The Skyway's rubber tire loader is equipped with a 2.5 cubic yard bucket. The amount of chemicals loaded on the truck is calculated as follows.

1 bucket salt = 5,000 lbs.  
Liquid chloride = gallons used

This is a calculation of material used. Single axle trucks will take approximately two buckets of material, while tandem axle trucks will take three buckets of material. Two one hundred and twenty five gallon tanks are installed on both single and tandem axle trucks for wetting applications. An accurate tally must be maintained for use in preparing the snow and ice material report. The Chief Operating Officer through the snow and ice material report orders the on-hand material when the material falls below the following balances:

- Salt - 1,000 tons
- Liquid - 1000 gallons

#### 11.2. Locations and Capacities of Storage Areas

The 95<sup>th</sup> street storage yard that the city used to store their salt is the same location that SCC uses to store our rock salt. We will have an area of approximately 5000 square feet to store this salt. A Liquid calcium chloride Tank will be stored at the 88<sup>th</sup> street garage that holds a capacity of 4500 gallons of Liquid Calcium Chloride.

All deicing products will be stored in accordance with the National Pollution Discharge Elimination Systems to prevent any contamination to local waterways

See maps in section 4.7 for locations

### 12. Equipment and Responsibilities

The number, classifications, and types of vehicles used in the Skyway snow and ice control operations are listed as follows.

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**Skyway Concession Company LLC  
Snow and Ice Plan 2021**

- Four (4) tandem axle dumps with pre-wet systems for the mainline plowing and spreading;
- Three (3) single axle dumps with pre-wet systems for the ramps and plaza spreading;
- One (2) rubber tired front-end loader for bulk materials;

For more information on snow and ice control equipment, see the Equipment Plan.

**12.1. Calibration Procedures**

Calibration procedures are conducted by the I.T Department and the Roadway Department. These calibrations are performed electronically with the use of a Lap-top. All settings in the Force America spreader systems are calibrated through the lap top at settings of 200 pounds per lane mile, 300 pounds per lane mile, 500 pounds per lane mile and also 800-pound blast. For additional Calibration information refer to the Force America Owners manual.

**12.2. Post Storm Equipment Service**

Post Storm clean up will consist of the removal of snow from the drains so that weather conditions in the thawing process will have access to the drainage in melting of the snow. The snow that is built up on the bridge walls will be removed on the off hours before hardening occurs. The material will be hauled to an area under the skyway, preferably 76<sup>th</sup> Street underneath the Skyway. Drift patrols as well as bridge deck patrols will be out monitoring for frost conditions and any drifting problems.

After each storm, all units used for snow and ice control are thoroughly cleaned of salt and other materials. When the vehicle clean up is completed, all spreader bearings lubricated, and hopper drag chains adjusted to proper tension in preparation for the next usage.

Vehicle lighting is inspected and repaired as required. All plow blades should be inspected for wear, loose bolts, or cracks. Operators should report any other items that would require repair, immediately prior to another duty cycle.





Skyway Concession Company LLC  
Snow and Ice Plan 2021

**APPROVAL OF PLAN**

Chief Executive Officer

[Redacted Signature]

Chief Operating Officer

[Redacted Signature]

\_\_\_\_\_  
Signature & date

\_\_\_\_\_  
Signature & date

**VIII. REVISION HISTORY**

Revision	Effective Date	Page	Description of Change
0	5/24/2005	1-20	Initial Issue
1	5/24/2006	1-20	1st Annual Update
2	5/24/2007	1-20	2nd Annual Update
3	5/24/2008	1-20	3 <sup>rd</sup> Annual update
4	5/24/2009	1-20	4th Annual update
5	5/24/2010	1-20	5 <sup>th</sup> Annual Update
6	5/24/2011	1-20	6 <sup>th</sup> Annual Update
7	5/24/2012	1-20	7 <sup>th</sup> Annual Update
8	5/24/2013	1-19	8 <sup>th</sup> Annual update
9	5/24/2014	1-19	9th Annual update
10	5/24/2015	1-20	10 <sup>th</sup> Annual Update
11	5/24/2016	1-20	11 <sup>th</sup> Annual Update
12	5/24/2017	1-20	12 <sup>th</sup> Annual Update
13	5/24/2018	1-20	13 <sup>th</sup> Annual Update
14	5/24/2019	1-19	14 <sup>th</sup> Annual Update
15	5/24/2020	1-19	15 <sup>th</sup> Annual Update
16	5/24/2021	1-19	16 <sup>th</sup> Annual Update

## SCC Snow and Ice Control Procedure

### I. PURPOSE

The Skyway Concession Company LLC (SCC) strives to provide customers with the safest, most efficient, limited access high-speed highway in Illinois. Since Chicago Skyway is located in a snow belt, high priority is placed on well-functioning winter maintenance program that effectively responds to weather conditions. To ensure the free-flow of traffic, SCC applies snow and ice control measures regardless of winter weather conditions.

The Snow and Ice Control Plan details the components incorporated into Skyway's winter maintenance program.

### II. SCOPE

This policy applies to all Roadway Maintenance personnel.

### III. REFERENCES

Snow and Ice Plan – SCC's annual Snow and Ice Plan submitted to the City of Chicago for approval

F-RM-999S Storm Report

F-RM-777S Load Sheet

F-RM-502S Daily Work Order Form

Murray and Trettel Form (*Murray and Trettel is a subcontracted Certified Consulting Meteorologist company*)

Snow and Ice power point presentation

### IV. RESPONSIBILITIES

It is the responsibility of all employees of SCC Roadway Maintenance Department to adhere to this policy and/or procedure. It is the responsibility of SCC Roadway Maintenance Supervisors to administer and ensure compliance with this policy.

### V. PROCEDURE

#### 1. Advance preparation

The Skyway winter maintenance program prepares for the winter season by following the procedures included in this Snow and Ice Control Plan. Preparation for snow and ice control on the Skyway begins well before the start of winter. SCC makes a significant effort in the off-season to prepare vehicles and equipment designed for snow and ice control operations. That preparation extends to training SCC staff in the operation of this equipment, and ensuring that staff understands the effective application of equipment and materials designed for snow and ice control.

## SCC Snow and Ice Control Procedure

SCC reviews the snow and ice control systems prior to the winter season. Adjustments and enhancements are made to accommodate physical system changes that may have occurred during the year and to reflect changes in technology, materials, and procedures.

The accurate and timely identification of approaching storms is a key part of the snow and ice control program. Once SCC receives an advance storm warning from a professional meteorological service, supplemental weather data is obtained to improve SCC's understanding of the variable conditions winter storms present. This analysis determines the level of mobilization needed at the Skyway from the onset of the storm to its conclusion.

Throughout each storm, SCC continuously reviews ongoing control efforts so that response procedures can be adapted to individual storm characteristics. Post storm review is also an important element in the overall winter maintenance approach.

The result is an efficient system-wide approach that has and will continue to provide Skyway users with the highest level of service currently available. Like any program that includes multiple resources and systems, the Snow and Ice Control Plan must undergo continuous review and modification to meet current and future demands.

### 2. Training

The demands of a winter season operation place special responsibilities on all staff. Training for winter maintenance, which includes familiarization with all snow routes and equipment, must be completed by all equipment operators by October 31 of each year. All operators must attend an annual snow and ice meeting performed by the Chief Operating Officer and/or Roadway Maintenance Supervisors. During training, employee's shall become familiar with SCC's bare pavement policy and the entire snow and ice operation.

### 3. Availability

From November 1<sup>st</sup> through April 15<sup>th</sup>, when the SCC deems it necessary for snow and ice removal, roadway maintenance personnel may be required to work overtime, work prior to the start of their regularly scheduled shift, and/or work Saturdays and Sundays. During this designated winter period, roadway maintenance personnel cannot take vacation time.

Roadway maintenance personnel are subject to call 24 hours per day during the winter months. This mandatory availability for call out in the event of a storm means the employee must keep SCC management informed at all times of a phone number where he/she can be reached. Winter staff reporting to Skyway on a call to plow or de-ice must be in acceptable physical condition and must report to their assignment within an acceptable time, not to exceed two hours from the time of original call out.

### 4. Scheduling and Organization

The scheduling and organization of staff for the winter season requires that two crews (A & B) be available on call 24 hours per day, with two twelve hour shifts, from 7:00 am to 7:00 pm. and 7:00 pm. to 7:00 am; each shift, A and B, must have enough staff to operate the salt and plow trucks. Shifts rotate every two weeks. The A crew starts on days when a notification from the Chief Operating Officer is issued.

The purpose of the night staff is to handle small storms, drifting after storm cleanup, dawn patrol, and miscellaneous road emergencies. The night shift crews must also keep supervisors notified

## SCC Snow and Ice Control Procedure

of road conditions during inclement weather; as well as clean equipment; perform minor repairs; trash plazas, ramps, lighted areas; and clean the garage; etc., as assigned.

### 5. Dawn Patrol

SCC is prepared for dawn patrol by November 1 each year. The Chief Operating Officer determines the actual start date of dawn patrol based on observed weather conditions (generally, when pavement temperatures drop below freezing). Dawn patrol should begin early enough to enable the crew to cover the Skyway before morning rush hour. Time is allowed for attending to possible trouble locations.

The responsibilities of the dawn patrol include the following:

- Check road for frost build up on bridges prior to morning rush.
- Check direction of most bridges first. Cover end with heavier traffic first.
- If problem occurs over whole section then additional staffing may be needed.
- Discretion should be used when deciding where and when not to spread. Do not spread bridges if they do not need it.
- Stop and check bridge with bare hand if necessary, and if safe to do so.
- If unsure, spread the bridge deck.
- Material must be removed from vehicle after being used. This is to prevent frozen loads and damage to the equipment.

### 6. Preparation Protocol

Preparation for the winter begins at the conclusion of the previous winter's snow plowing and de-icing activities. Prior to the dismounting of the plows, vee-box hoppers, and spreaders, the condition and operation of each piece of equipment is evaluated for needed maintenance during the off-season. Maintenance of the vee-box, spreaders, and plows is completed so that mounting can begin by the last week of the following September. Starting in the second week of October, mounting of the spreaders and vee-box begins on the snow removal trucks. All units are completed and tested by the last week of October.

As hopper installation is completed on individual units, the plow is also installed and tested for proper hydraulic functions. Several cycles through the raising and reversing, the process should be attempted to properly test hydraulic components for weakness. All front-end loaders should have scheduled preventive maintenance completed by the first week of November. All calibration of the trucks is completed by the last week of October. Spreading too little salt is inefficient as re-application will be necessary. Spreading too much salt is less effective than spreading too little, since it costs more money, time, and material, and has no greater effect on the highway, and negatively affects the environment, roadway, and structures. Only by calibrating spreaders and developing a full application rate chart can the operations staff accurately control salt/chemical application. Accurate calibration of all salt-spreading equipment must be completed as preparation for the winter de-icing activities. The procedure for calibrating salt spreading equipment is fully described in Sec 12.1 of the Snow and Ice Control Plan.

### 7. Priorities of Assignments

The priorities of the operations staff's assignments are shown as follows:



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## SCC Snow and Ice Control Procedure

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- Mainline lanes (lanes 1, 2, and 3 Dan Ryan and Stony Island Ramps);
- Plaza lanes (all approaches to and departures from the Toll Plaza); and
- Ramp lanes (all acceleration lanes and de-acceleration lanes).

Any storms that are forecasted as little or limited effect will not require a full crew call out. Any storms that are forecasting any hazardous conditions with accumulative snow will require a full crew call out.

The color-codes for little or limited effect will be a yellow/green. Any storms that are a yellow/green condition do not require full crew staffing. The color-codes for accumulative snow or problem areas will have a red or black. Any storms that have a red/black combined with a yellow or green will require a full crew call out. Any half/full crew call outs will require management on site. Any call outs that are red/black conditions will require a full crew call out of all seven operators.

### 8. Storm Monitoring and On Call

The preparation of equipment, organization of staff, and notification of approaching storms are basic to successful snow fighting. SCC contracts Murray and Trettel, Inc., Certified Consulting Meteorologists, to provide the maintenance supervisors with early warning forecasts, predicting the detail of the storms and effects on the Skyway road system. The storm notification policy is designed so that the first call from Murray and Trettel is directed to the control room. The control room operator records the information provided to them during the call on the Murray and Trettel form. Next, The Control Room Operator must contact the Chief Operating Officer and/or Roadway Maintenance Supervisor. The appropriate people will make the determination of the crew size and materials to be used. In the event of a full crew call out, the Roadway Maintenance Supervisor will distribute this information with a description of SCC's response to the designated contacts, such as the Illinois Department of Transportation (IDOT), the City of Chicago, Chicago Police Department, the Indiana Toll Road, and Illinois Tollway. As the storm ages, the Storm Operations Center can request periodic updates from Murray and Trettel. Any updates must be communicated to the operators, as well as the designated outside contacts. During a storm alert, the Snow Operations Center staff log actions taken in the storm alert and the roadway and weather conditions. The Storm Operations Center staff calls Murray and Trettel hourly to relay information to the field staff (operators) with any updates or changes in the storm. Status and progress updates from the field staff are communicated to the Snow Operations Center on an hourly basis unless there is a change. The Snow Operations Center staff direct the field staff on the type of material to use and the spread rate. The information relayed to field staff changes as the storm either intensifies or diminishes. The information reported by the field staff to the Snow Operations Center is entered on the Storm Report (F-RM-999S). This report includes information such as:

- Number of units on patrol and assignment;
- Type of operation in progress;
- Plowing and spreading;
- Cleanup - shoulders, decks, etc.;
- Standby;
- Time snow operation started;

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## SCC Snow and Ice Control Procedure

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- Material mixture being used;
- Precipitation;
- Additional revised/current forecast from Murray and Trettel;
- Number of trucks down and the reasons;

The Snow Operations Center staff can use the information to expedite responses to hourly calls from the field staff. At the end of the storm, the snow operations staff gathers all available information on the storm in addition to the total amount of material used, man-hours, and equipment usage and logs all of the information into a Daily Work Order Form (F-RM-502S). The operations staff also prepares a brief synopsis of the storm, noting any problems that occurred. All information is filed for future reference.

### 9. Operational Requirements

To maintain traffic safety and the mobility of motorists during winter storms, SCC's highest operational priority is snow removal and ice control. SCC will make every effort to keep the Skyway open to traffic at all times.

- In the event the road becomes blocked due to uncontrollable conditions, SCC's managerial staff will contact the proper authorities to advise of the situation. These authorities will include, but are not limited to, City of Chicago, Chicago Police Department, IDOT, Illinois Tollway and Indiana Toll Road. Detour routes will be posted for the motoring public. SCC recognizes that CPD has the authority to halt Skyway traffic due to poor road conditions. In this event, SCC Snow and Ice operations will continue to make every effort to expedite the re-opening of the Skyway as soon as conditions warrant.
- Skyway Concession Company LLC uses the following criteria in accordance with the Concession Lease Agreement (CLA) (section E.3.4. Acceptance Criteria). This is the maximum accumulation on mainline lanes, response times, and time expectations.

Operational Parameter	Maximum Time Duration
Maximum allowable driving lane accumulation	1 ½" (1.5 inches)
Maximum reaction time until first full snowplow pass	1 Hour
Maximum allowable driving lane snow pack time	1 Hour
Maximum time to bare-pavement condition after storm end	4 Hours
Maximum time to bare-shoulder condition after storm end	8 Hours

**SCC Snow and Ice Control  
Procedure****10. Inventory of De-icing products**

The procedures for using chemicals and other materials to control snow and ice on the Skyway are as follows:

The Chief Operating Officer or the Roadway Supervisor are responsible for maintaining the inventory of de-icing material at a level adequate for the demands of SCC's snow and ice control program. The Chief Operating Officer or the Roadway Supervisor reviews the on-hand quantity of de-icing material for the Skyway during the summer. They arrange purchases to bring the de-icing material inventory to a level appropriate for the start of the winter season. The Skyway generally begins the winter season with approximately 3,600 plus tons of salt and 2,500-5,000 gallons of liquid chloride. During every de-icing activity, the operators are required to log all material used on a Load Sheet (F-RM-777S). The Skyway's rubber tire loader is equipped with a 2.5 cubic yard bucket. The chemical load on the truck is calculated as follows:

$$\begin{aligned} 1 \text{ bucket salt} &= 5,000 \text{ lbs.} \\ \text{Liquid chloride} &= \text{gallons used} \end{aligned}$$

All dry materials that are loaded on a truck before during and after a storm must be recorded on the Load Sheet (F-RM-777S).

This is a calculation of material used: Single axle trucks will take approximately two to three buckets of material, while tandem axle trucks will take three to four buckets of material. Two seventy-five gallon takes are installed on both single and tandem axle trucks for wetting applications.

An accurate tally must be maintained for use in preparing the snow and ice material report. Using the snow and ice material report, the Chief Operating Officer orders the on-hand material when the inventory is less than:

- Salt - 500 tons
- Liquid - 1,000 gallons

**11. Post storm Equipment Service**

Post Storm clean-up consists of snow removal from drains so that weather conditions in the thawing process will have access to the drainage in melting of the snow. The snow that is built up on the bridge walls will be removed on the off hours before hardening occurs. The material will be hauled to an area under the Skyway, preferably 76<sup>th</sup> Street underneath the Skyway. Drift patrols as well as bridge deck patrols will be out monitoring for frost conditions and any blowing and drifting problems.

After each storm, all units used for snow and ice control are thoroughly cleaned of salt and other materials, from the, body, engine compartment and interior floor. When the vehicle clean up is completed, all spreaders are to be checked for salt build up, debris, broken fins etc. Augers are to be free of salt after rinsing and inspected. Vehicle lighting is inspected and repaired as required. All fluid levels should be inspected and refilled to proper levels. Fluids such as deicing agents, washer fluids, DEF and fuel. All wiper blades should be inspected and replaced as needed. All plow blades should be inspected for wear, loose bolts, tears, uneven wear or cracks. Operators must report any other items that would require repair, immediately prior to another duty cycle.



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## SCC Snow and Ice Control Procedure

Procedure ID: RM-010S

### VI. RECORDS AND FILES

All reports relating to snow storms are kept on file for two years in the Roadway Maintenance department office.

### VII. APPROVALS

CEO	Quality Coordinator	Process Owner
		
Signature & date	Signature & date	Signature & date

### VIII. REVISION HISTORY

Revision	Effective Date	Page	Description of Change
0	5/24/05	1 - 11	Initial Issue
1	11/01/08	1-7	Revision for formatting
2	8/12/2009	1-7	Revised for quality
3	4/5/2013	1-7	Revised for additional information, clarifications and Title changes
4	11/1/2018	1-7	Revised for clarification/cleanup, and editing in post storm clean-up. Editing includes references to fluid refill and inspections of augers.



# Skyway Concession Company LLC

## *Snow and Ice Training*

Providing a safe and efficient travel service for our customers, is always our top priority



## General Fact about the Chicago Skyway

- The Skyway is an Elevated road. The Skyway has:
  - 1) 2.6 Miles of Bridges
  - 2) 5.2 Miles of Roadway
  - 3) 3 – 12' Lanes in Each Direction
  - 4) 9 access ramps
  - 5) 2- Toll plazas ( 1 in each direction)
  - 6) 7 Plow trucks consisting of 14 equipment operator/laborers



## Weather information

- How do we know what type of precipitation we are expecting ?
- How do we know what the accumulation of snowfall is?
- How do we know when the snow is going to start, or when it will end ?
- How do we know what type of weather is following the storm?





The answers to all of these questions are provided to the Skyway by a Meteorologist firm (Murray & Trettel). This Company is contracted by the Skyway on a 24 hour basis, between the months of:

November 1<sup>st</sup> to April 1.

This company provides us with all of the information that we need to operate an efficient snow and ice program.





# Discuss the M&T Weather Forecast Report



**WEATHER COMMAND**  
**MURRAY & TRETTEL, INC**  
 Consulting Meteorologists

**SNOW and ICE STORM WARNING**  
**STORM NUMBER**

600 FIRST BANK DRIVE, SUITE A  
 PALATINE, ILLINOIS 60067  
 847-985-8000 FAX: 847-985-0245

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_ Given By: \_\_\_\_\_ Received by: \_\_\_\_\_

1. FORECAST CONDITION		PROB(1-10)	2. FORECAST CONDITION		PROB	3. FORECAST CONDITION		PROB
<b>A. Operational Color Code</b>			<b>A1. Color Code Change</b>			<b>G. Temperature:</b>		
2. Condition <b>YELLOW</b> (LITTLE or LIMITED Effect)			44. Primary:			88. HIGH TODAY:		
3. Condition <b>RED</b> (SIGNIFICANT Trouble)			45. Alternate:			89. LOW TONIGHT:		
4. Condition <b>BLACK</b> MAJOR "Storm" Trouble)			46. Time:			90. HIGH TMRW:		
5. Condition <b>GREEN</b> (NO Trouble)			<b>B1. PRECIP Change Time</b>			91. Remaining below 32 degrees		
<b>B. Type of Precipitation</b>			47. Primary:			92. Holding near 32 degrees		
6. None			48. Alternate:			93. Holding above 32 degrees		
7. Snow			<b>C1. PRECIP RESTART Time</b>			94. Falling during storm		
8. Snow Showers/Flurries			49. Primary:			95. Rising during storm		
9. Lake Snow			50. Alternate:			96. Falling Below 32 degrees by:		
10. Snow-dry			<b>D1. PRECIP RE-END Time</b>			97. Falling Below 15 degrees by:		
11. Snow-wet			51. Primary:			98. Rising above 15 degrees by:		
12. Snow Melting			52. Alternate:			99. Rising above 32 degrees by:		
13. _____ bcrmg			<b>E. Snowfall Accumulation</b>			100. Falling Below:		
14. Freezing Rain (Glaze)			53. ADDITIONAL Accumulation			by:		
15. Freezing Drizzle (Glaze)			54. TOTAL Accumulation			<b>H. Winds</b>		
16. Borderline:			55. TRACE or NONE			101 North _____ North 105		
17. Combination/Snow-Sleet-Ice			56. Less than 1/4 Inch			102 South _____ South 107		
18. _____ bcrmg			57. Less than 1/2 Inch			103 East _____ East 108		
19. Other:			58. Less than 1 Inch			104 West _____ West 109		
<b>C. Time of Beginning</b>			59. 1 - 2 Inches			110 Wind direction probability		
20. 11 p.m. - 1 a.m.			60. 1 - 3 Inches			111 Speed:(mph)		
21. 1-3 a.m.			61. 2 - 4 Inches			112 Increasing to:		
22. 3-5 a.m.			62. 3 - 5 Inches			113 Time:		
23. 5-7 a.m.			63. 4 - 7 Inches			114 Decreasing to:		
24. 7-9 a.m.			64. 7 - 10 Inches			115 Time:		
25. 9-11 a.m.			65. 10 - 15 Inches			116 Gusts:(mph)		
26. 11 a.m. - 1 p.m.			66. 15 - 20 Inches			117 Drifting Wind (over 20 mph)		
27. 1-3 p.m.			67. 20+ Inches			<b>I. Weather Following Storm</b>		
28. 3-5 p.m.			<b>F. Recommendations and Comments</b>			118 Freezing nights, thawing days		
29. 5-7 p.m.			68. Little / no trouble expected			119 Temps holding below 32 deg. F		
30. 7-9 p.m.			69. Alert supervisors only			120 Cold wave (Below 15 deg. F)		
31. 9-11 p.m.			70. Prepare crews for spreading			121 Sub-zero cold wave		
<b>D. Time of Ending</b>			71. Prepare crews for plowing			122 Slowly rising temps		
32. 11 p.m. - 1 a.m.			72. No rush hour trouble			123 Falling temps		
33. 1-3 a.m.			73. Morning rush hour trouble			124 Rapidly Falling Temps		
34. 3-5 a.m.			74. Evening rush hour trouble			125 Freezeback/Refreeze		
35. 5-7 a.m.			75. Bridge Decks and Viaducts			126 Drifting Winds Continuing Until:		
36. 7-9 a.m.			76. Intersections/Medians			127 Snow Flurries/No accumulation		
37. 9-11 a.m.			77. Cold Spots/Shaded Areas			128 Snowshowers		
38. 11 a.m. - 1 p.m.			78. Snow packing on ALL Roads			a. Less than 1 Inch		
39. 1-3 p.m.			79. Rapid accumulation of Snow			b. More than 1 Inch		
40. 3-5 p.m.			80. Drifting Snow			(See remarks)		
41. 5-7 p.m.			81. General Glazing			c. Beginning:		
42. 7-9 p.m.			82. Icing due to cold pavement			d. Ending:		
43. 9-11 p.m.			83. No Icing-pavement too warm					
DAY			84. Borderline trouble condition					
			85. On edge of trouble:					
			86. Precip intermittent (off & on)					
			87. All Periods of Rain-Snow-Ice					
<b>J. Remarks:</b>								

N.B. All warnings and details contained herein are made subject to the inherent limitations of the science of Meteorology. Because of this, these warnings and details therein should be considered supplementary to and are not intended to replace other pertinent weather information or road condition reports. As the probability factors, herein illustrate, there is a margin of error in all weather forecasting that must be acknowledged and accounted for.(SnowAndIceMaster.xls)

## Types of Winter Precipitation

- Light Snow
- Moderate Snow
- Heavy Snow
- Sleet/Freezing Rain
- Frost
- Black Ice



## Light Snow

- Good Visibility
- Snow not sticking to the Roadway
- Spreading as needed
- Spread rate 200 LBS per lane mile
- Mainline trucks are in tandem formation and spaced approximately 1500-2000 feet apart.



## **Moderate to Heavy Snow**

- Snow is sticking to the road and starting to cover
- Spread rate is at 300 to 500 pounds per lane mile
- Mainline trucks are now plowing and spreading in a closed tandem. This closed tandem is in a formation where no traffic is allowed to pass the trucks .





- This allows traffic to work the material into the pavement.
- SCC is able to provide a wet pavement sooner than running in split formations
- Plowing and spreading should be done at a speed of travel no greater than 35 M.P.H













## **Sleet and Freezing Rain**

- Rain that freezes when it hits the ground
- Watch your Mirrors, antennas and grill
- When spreading for freezing rain go slower than normal so that the salt stays on the road. Salt will blow off the road with traffic, so keep as much of the material on the road as you can.
- Adjust the shields to play with this wind and spread heavy. Use your mirrors to see where the salt is going and that you have proper coverage

## **Frost and Black Ice**

- Commonly occurs over bridge decks and in shaded areas first
- This is taken care of by spreading in just those isolated areas
- Black Ice is difficult to get rid of once it occurs. Be sure to use extreme caution.



## **Dawn Patrol**

- SCC is prepared for dawn patrol by November 1.
- The Director of Roadway and Toll Operations determines the actual starting time for dawn patrol based on observed weather conditions (generally, when temperatures drop below freezing).
- Dawn patrol should begin early enough to enable the crew to cover the Skyway before morning rush hour.





- Time is allowed for attending to possible trouble locations.
- The responsibilities of the dawn patrol include the following:
  - 1) Check road for frost build up on bridges prior to morning rush.
  - 2) Check the heaviest direction of travel of most bridges first.
  - 3) If problem occurs over whole section then additional staffing should be added.
  - 4) Discretion should be used where and when not to spread. Do not spread bridges if they do not need it.
  - 5) Stop and check bridge with bare hand if necessary, and if safe to do so.
  - 6) If unsure, spread the bridge deck.





- Spreading of these areas should be done so that all lanes are getting a spread on them
- To do this the operator needs to make sure that
  1. The trucks shields are raised to allow the material to reach all lanes
  2. Travel in the center lane ( Lane 2) when spreading
  3. Spread rate should be at 300-500 pound per lane mile



## **Areas to be covered**

- Mainline from Dan Ryan to Indiana border (PRIORITY)
- Stony Island and Dan Ryan Ramps (these are also a priority being that they are our main artery of traffic)
- Toll Plaza ( ramps and Lanes at the plazas)
- Employee Parking Lots and McDonalds Parking Lot



## Mainline

- Listen to the Supervisor
- Do Not spread a dry road
- Notify your Supervisor when you start spreading
- Plow skip line, solid line, then shoulder
- Watch your speed when spreading and/or plowing. 35 M.P.H is the maximum speed your vehicle should be traveling





- Ramp drivers should plow the shoulders to and from your ramps. This will help in the long run
- One truck on the shoulder at a time in the same direction
- Do not plow shoulders over 25 miles per hour





- Bridge decks freeze first, watch interchanges and at the bottom of ramps where traffic is expected to stop.
- When on stand-by or in the lull of the storm keep making frequent checks of your area . Do not sit in one spot
- Try to keep at least one truck on each end of the road to watch for problems



## Understanding Material Usage

- The materials that the Skyway use for deicing is Salt and Liquid Calcium Chloride
- Understanding material usage in fighting a storm is best explained using examples of simulated storm conditions. The following examples are for illustration only and are not meant to suggest that all storms fall neatly into four types. Each storm is a separate, dynamic, evolving event. The location, traffic volume, and the changing nature of the storm (i.e., wind, temperature, intensity, form of precipitation) are all factors influencing the materials that are used in the de-icing operation.

## **Example #1**

- Temperature near 30 degrees
- Type precipitation – snow- sleet – freezing rain
- Road surface – wet
- Rate of accumulation – moderate to light
- Type mix – straight salt
- Rate of application – 300 lbs. per lane mile
- Prior to rush hour – 500 lbs. per lane mile – if warranted





## Example #2

- Temperature below 30 degrees and falling, but not below 20 degrees
- Type precipitation – snow – sleet – freezing rain
- Rate of accumulation – moderate to heavy
- Type mix – straight salt
- Rate of application – 300 lbs. per lane mile
- Prior to rush hour – 500 lbs. per lane mile – if warranted



### Example #3

- Temperature below 20 degrees and falling to 10 degrees above
  - Type precipitation – wet to dry snow
  - Wind – 15 mph
  - Rate of accumulation – heavy
  - Type mix – salt and liquid calcium chloride
  - Rate of application – 300 lbs. per lane mile
  - Prior to rush hour – 500 lbs. per lane mile – if warranted

## Example #4

- Temperature down to zero to 10 above
- Type precipitation – dry snow
- Wind – in excess 15 mph
- Road Surface - Tracking
- Rate of accumulation – moderate to heavy
- Type mix – salt, liquid calcium chloride
- Rate of application – 300 lbs. per lane mile
- Prior to rush hour – 500 lbs. per lane mile – if warranted



- For the type of precipitation and temperatures described for examples 3 and 4 the ratio of mixes varies at the time of application because traffic would have a large bearing on the choice of mixes.
- The snow and ice control temperature mixture guide is a tool useful in planning the course of action that will be pursued in fighting a storm and is a general guide relating temperature to the appropriate de-icing chemical. Weather conditions other than temperature also influence the choice of material or mixture that will be spread. The accumulation form, rate, depth, traffic, and predicted duration and intensity are all the factors influencing the actions taken to control a snowfall
- ( see next slide)



# SALT (NaCl)

Salt is used generally on road surfaces where the lowest temperature anticipated is 20° F. Salt absorbs moisture from the humid atmosphere at approximately 70% humidity or greater. This produces a brine, which has a lower freezing point than water. Salt requires heat and moisture to work. As the air temperature and humidity drops, the effectiveness of salt as an ice control becomes decreased.

# Liquid Calcium Chloride (CACL)

- Salt requires moisture to work. This moisture can be provided by the wetting of salt before application to the pavement through spraying a solution of 32-34% concentrate liquid calcium chloride on each truckload of salt. This method of enhancing the melting property of salt results in nearly an instant production of brine independent of humidity. A wetted salt crystal penetrates immediately through the snow to the road surface. Chloride's ability to absorb moisture and generate heat accelerates brine and melting action. Chloride's characteristics permit salt to continue melting snow when the two are mixed or the salt is pre-wetted and applied at temperatures below 20 degrees F.



# Sand (ABRA)

- Sand can be used alone or added to salt or chloride as temperature and accumulation dictate. Sand may be applied to assist in drying up pavement, as temperatures drop, to prevent water from freezing on the pavement surface. Sand prevents the snow from packing and sticking to the road by maintaining any accumulation in the worst condition. While mixtures of salt, abrasive, and chloride are nearly ineffective at providing any significant duration of control at zero degrees, they will serve as an aid to traction and, as the temperature rises in the melting process.





TEMPERATURE FALLING

30°  
25°  
20°  
15°  
10°  
5°  
0°

25° to 30°			NACL or "Salt"
15° to 20°		3 NACL 1 CACL	22°
5° to 10°	2 NACL 1 CACL 1 ABRA	15°	If pavement is dry do not spread mixture.
0° to 5°	ABRASIVES ONLY	10°	Use abrasives only. At Plazas & Ramps Use: 1 part NACL 1 part CACL 1 part ABRA

TEMPERATURE RISING

30° 25° 20°			NACL or "Salt"
15°		3 NACL 1 CACL	20°
10°		2 NACL 1 CACL 1 ABRA	14°  If pavement is dry do not spread mixture. Use abrasives only.
5° 0°	ABRASIVES ONLY	8°	At Plazas & Ramps Use: 1 part NACL 1 part CACL 1 part ABRA



## Toll Plaza

- Pre-spread the Toll Plaza only if directed to do so by your Supervisor
- Check Plaza on a regular basis
- Off ramps should be watched more closely than on ramps
- Always plow with traffic and not against traffic
- Plow your points in gore areas, don't pile
- When possible team up to clear ramps
- Mainline trucks should never drive through the same lane. Spread out and take different lanes





- Use caution when going through lanes not to damage booth, cars or other appurtenances at the plaza
- Booths and Intercom Boxes are close to the curbs, use caution
- The plaza needs to be cleaned shoulder to shoulder to be complete
- Move cones coming up to the lanes when cleaning, do not leave wind rows
- Check plaza at the end of your shift to relay status to your replacement driver and Supervision
- Watch out for traffic entering and exiting the plaza, they will not be watching for you











## **Spreading**

- Listen to your Supervisor ( or partner in your area)
- Spread as close to the skip dash as you can
- Keep your spinner turned down and your shields not fully open.
- Never spread over 35 M.P.H
- Always slow down before bridges, DO NOT throw snow over the wall onto vehicles below



- Use chemicals with salt when instructed to by Supervision, ask for application rates
- Light snow, spread lightly. Do not over salt. Over salting could cause more harm than good
- Always record your salt usages on the Load sheet and advise your supervisor at the end of your shift the amounts used and the amounts that are on the truck







## Drifting

- Usually happens at lower temperatures when snow is dryer
- Needs to be stopped on the shoulders and kept off and out of the roadway
- Spread salt on shoulder only where drifting occurs
- Allow time for salt to work before plowing it off the shoulder
- Make sure you try to keep as much salt off the road that is possible to allowing the pavement to dry



## Loading the Trucks

- Load trucks as close to the loading ramp as possible
- Always load from the drivers side of the vehicle
- Always remain in the truck if someone else is loading you
- Keep loader bucket low to the ground
- Do not over load trucks



- Be sure to remove clumps from grates, using the rake and staircase provided at the yard. Never leave yard with clumps on grates
- Avoid hitting the trucks with the loader bucket. If this occurs contact your supervisor
- Watch for other driver when loading
- **Do not** approach the loader on foot when it is in the operation of loading
- Take the time after you load to check your blades and look for leaks





- Shut off all warning lights, flashing lights and wiper blades when in yard while waiting to get loaded or when getting loaded
- Keep salt off cab of truck
- Don't park trucks in loading area
- Don't back the loader into the salt pile
- Watch the driver side of truck when leaving yard so you don't spill onto the road











## Unloading trucks

- Watch when backing your truck up to the pile
- Empty as close to the pile as possible, do not smash the spinner
- Push the salt in to the pile when you are finished. Clean up after yourself
- Dump loads frequently in extreme cold weather







## **Accident/10-50's**

- Advise the tower of any and all accidents. Including but not limited to
  - 1) Weather conditions in that area
  - 2) Any injuries
  - 3) If a wrecker is needed
  - 4) Are you involved
  - 5) If there is any Skyway damage





- If the accident is not life threatening then you should not stay on the scene. Bare in mind that the longer you are away from your plow route the chances of another accident occurring is very probable



## **General Information**

- Run with all warning lights on
- Check your blades regularly
- Do not spread dry pavement
- Slow down when turning, go easy on the brakes
- Keep your radio traffic to a minimum
- Slow down for bridges and don't throw snow over the bridge walls
- Do not leave piles of salt in lots or on ramps.



- Always monitor your radio and answer when called
- Clean your lights every chance you can
- If you cant see SLOW DOWN
- Take your lunch and beverage with you on the road
- Be courteous to our customers as well as the toll collectors
- Watch out for traffic because they are not watching out for you
- LISTEN TO YOUR SUPERVISOR





## Truck Maintenance

- Check your truck out
- Check your blades ( the rule of thumb is two fingers depth before they need to be changed)
- Unload your trucks before parking them in the garage (unless otherwise directed)
- Let truck warm before running it, and let it cool down before shutting it off
- Know how to shut off your hydraulics ( using the by-pass) in case of a blown line
- Be sure to fuel up all equipment before parking



## Shift change

- Keep plowing until called
- Tell your relief driver
  1. About the truck
  2. When you last spread
  3. What truck is with you
  4. What your area was
  5. What you have/have not done
  6. Clean your debris out of the truck when exiting the vehicle. You would not like to be sitting in someone else's lunch wrappers or debris. Therefore remove yours.





### **Post storm clean-up**

Just because the snow has been removed from the road does not mean the storm is over. Post storm clean-up still needs to be performed to complete the storm.

- All equipment must be rinsed/washed and interiors cleaned/vacuumed within 24 hours from the end of plowing and spreading. This is important because our equipment is a major part of our operations. If the equipment is not cleaned, the salt starts rusting/corroding all the components that are critical to our operations.
- Pressure wash the engines. The pressure washer is only for the engines not the body, interior or underbody. All that will do is move the salt to a different location. Use a garden hose or fire hose with cold water when rinsing salt off these areas, be sure to get the battery box as well.
- Make every attempt to get all the salt off the trucks and V-boxes. Again this is to prevent rusting.











The Skyway has proven to be  
"SECOND TO NONE"



When it comes to Snow and Ice control.

This is a tribute, to the dedication and commitment all of you have given.  
Lets have a safe snow season and Thank You All for keeping our road safe





# QUESTIONS & ANSWERS



**Dulles Greenway located in Sterling, VA responses to survey of toll facilities**

**Fort Worth, TX**

**HWY21FH005**

(3 pages)

# SURVEY OF TOLL FACILITIES

## General Operations:

1. Is the toll facility private or state regulated? Private
2. When was the toll facility officially opened to traffic? 1995
3. How many lane miles does the toll facility maintain? 156
4. How many days did the toll facility respond to snow and ice removal events in each of the last 5 years?

	2016	2017	2018	2019	2020
Days with Snow and Ice Removal Events	8	13	13	9	11

## Snow and Ice Removal Pre-treatment Operations: Describe and/or provide documentation of the following:

5. All pre-treatment options and subsequent chemical applications currently used by the toll facility during snow and ice removal events.

4a. How long each specific pre-treatment option and subsequent chemical applications are effective in treating the roadway after initial application.

Pre-treatment option include Magnesium Chloride and the results depends on the weather conditions. We follow the Virginia Salt Management Strategy Toolkit.

4b. Any formal criteria of when to use specific pre-treatment options and subsequent chemical applications.

General guideline related to when to use; however, pre-treatment depends on the condition of the roadway and weather. See the Virginia Salt Management Strategy Toolkit.

## Snow and Ice Removal: Describe and/or provide documentation of the following.

6. An inventory (trucks, plows, front-end loaders, spreaders, etc.) including the number of covered salt storage facilities and quantities of salt that are dedicated to snow and ice removal events.

Covered salt storage facilities = 1  
 Quantity of salt = 3,000 lbs  
 Tandem trucks equipped with snow plows and spreaders = 12  
 Small trucks (3500, F-350 type) with snow plows and spreaders = 7  
 Front-end loaders = 3  
 Motor grader = 1



7. Methods/technologies to monitor moisture and ice formation on roadways, highway overpasses, or bridges.
- 6a. If you use sensor detection systems, the systems, and procedures for their use. No sensor detection systems
- 6b. If you do not use sensor detection systems, any future plans by the toll facility to utilize them or other technologies capable of monitoring moisture and ice formation on roadways, highway overpasses or bridges. Not at this time.
8. Procedures for snow and ice removal.
- 7a. If you have formal procedures in place, provide a copy of the established procedures. No formal procedures in place; however, there are guidelines for general snow removal procedures based on each snow event.
9. Training procedures for maintenance technicians who perform spot checks and inspections of road conditions during snow and ice removal events. Provide details on the training procedures necessary to become a spot checker (i.e., initial number of training days/hours, certification requirements, length of annual refresher courses, etc.)

Employees are trained for about 2 weeks on spot checking bridge/roadway/toll plaza temperature, and remedial training for anyone needing a refresher. No certification required.

**Documentation Checklist: Please provide the following if available.**

- ✓ Pre-treatment options, durations of effectiveness, and criteria for use
- ✓ Inventory of snow and ice equipment
- ✓ Systems/methods used to detect moisture and icy conditions
- ✓ Operational and training procedures for snow and ice removal
- ✓ Contract between toll authority and state, including snow and ice removal events



**Intercounty Connector located in Montgomery and Prince George's County, MD responses  
to survey of toll facilities**

**Fort Worth, TX**

**HWY21FH005**

**(32 pages)**

## SURVEY OF TOLL FACILITIES

### General Operations:

1. Is the toll facility private or state regulated?  
**State Regulated.**
2. When was the toll facility officially opened to traffic?  
**February 23, 2011**
3. How many lane miles does the toll facility maintain?  
**215 miles including mainline, shoulders & ramps.**
4. How many days did the toll facility respond to snow and ice removal events in each of the last 5 years?

	2016	2017	2018	2019	2020
Days with Snow and Ice Removal Events	13	20	15	16	7

### Snow and Ice Removal Pre-treatment Operations: Describe and/or provide documentation of the following:

5. All pre-treatment options and subsequent chemical applications currently used by the toll facility during snow and ice removal events.  
**Salt Brine & Salt.**
  - 4a. How long each specific pre-treatment option and subsequent chemical applications are effective in treating the roadway after initial application. **Salt Brine approximately 30 minutes / Salt approximately 30-45 minutes after precipitation saturates the roadway.**
  - 4b. Any formal criteria of when to use specific pre-treatment options and subsequent chemical applications. **Salt Brine most effective during beginning of frozen precipitation, not liquid. Salt effective on both liquid & frozen precipitation. We do not pretreat roadway with Salt Brine when precipitation is forecast to start out as rain with temperatures above freezing.**

### Snow and Ice Removal: Describe and/or provide documentation of the following.



6. An inventory (trucks, plows, front-end loaders, spreaders, etc.) including the number of covered salt storage facilities and quantities of salt that are dedicated to snow and ice removal events.

**20 Dump Trucks with plows & spreaders, 3 Front-end Loaders, 1 Front-end Loader mounted Snow Blower, 10 Pick-up Trucks with Plows, 2 Liquid Brine Applying Trucks.**

**12000 Ton Salt Storage Barn, 3000 Ton Salt Storage Dome and 4 6000 Gallon Salt Brine Storage Tanks.**

7. Methods/technologies to monitor moisture and ice formation on roadways, highway overpasses, or bridges. **Starting in the beginning of the Winter Season we assign two trained Maintenance Technicians to work on what we call our “Frost Patrol” which monitors on-site roadway and weather conditions between the hours of 12:00am until 8:00am. We utilize RoadWatch gauges on all our vehicles that measure air/road temperature. Management consistently monitors weather conditions via local news, internet and NOAA Weather Alerts after normal working hours and weekends. In addition, our MDTA Police force will assist in reporting adverse weather conditions to Operations.**

6a. If you use sensor detection systems, the systems, and procedures for their use. **Our Toll Facility utilizes two “LUFFT” roadway embedded weather sensors that record Wind Speed, Wind Direction, Air Temperature, Dew Point, Relative Humidity, Precipitation Type & Road Conditions. Management as well as the public can view and utilize this information through the Maryland Department Of Transportations “CHART” Coordinated Highways Action Response Team website.**

6b. If you do not use sensor detection systems, any future plans by the toll facility to utilize them or other technologies capable of monitoring moisture and ice formation on roadways, highway overpasses or bridges.

8. Procedures for snow and ice removal.

**MDTA Operations utilizes the North American Salt Institutes “Snowfighter’s Handbook” which can be accessed at <http://ndltap.org/resources/snow/downloads/snowfighters-handbook.pdf>.**

7a. If you have formal procedures in place, provide a copy of the established procedures.

9. Training procedures for maintenance technicians who perform spot checks and inspections of road conditions during snow and ice removal events. Provide details on the training procedures necessary to become a spot checker (i.e., initial number of training days/hours, certification requirements, length of annual refresher courses, etc.) **Maintenance Technicians study and refer to the “Snowfighter’s Handbook and are required to complete two qualifications, Snowfighter I & II. This includes written test and practical exercises.**

**Documentation Checklist: Please provide the following if available.**

- Pre-treatment options, durations of effectiveness, and criteria for use
- Inventory of snow and ice equipment
- Systems/methods used to detect moisture and icy conditions
- Operational and training procedures for snow and ice removal
- Contract between toll authority and state, including snow and ice removal events

A photograph of a paved road winding through a winter forest. The road is dark with a white dashed line down the center. Both sides of the road are covered in snow. Tall evergreen trees are heavily laden with snow, their branches drooping. The sky is a clear, bright blue. The overall scene is peaceful and serene.

# Safe and *Sustainable* Snowfighting





# Safe and *Sustainable* Snowfighting

— *The* —

## Snowfighter's Handbook

*A Practical Guide for Snow and Ice Control*



*Dedicated to the people  
who provide safety and mobility  
on roads in winter — **the snowfighters***



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PUBLISHED BY THE SALT INSTITUTE: The Salt Institute is a North American based non-profit trade association dedicated to advancing the many benefits of salt, particularly to ensure winter roadway safety, quality water and healthy nutrition. See [saltinstitute.org](http://saltinstitute.org) and [safewinterroads.org](http://safewinterroads.org) for more information.



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## FOREWORD

**T**his manual, prepared by the Salt Institute, is dedicated to the thousands of men and women in public works agencies at all levels whose task is providing safe streets and highways during winter storms.

The modern snowfighter must be accountable for meeting the community's needs for safety and mobility, as well as the safeguarding of our environment.

We commend all those agencies practicing the Safe and Sustainable Snowfighting approach to snow and ice control, which emphasizes getting the most from every application of deicing salt while maintaining the safest roads possible in the most economical way, and protecting the environment.

Every winter, over 115,000 people are injured and over 1,000 are killed on snowy or ice American roads. Clear roads protect lives and commerce and salt is a necessary strategic resource.

- Road salting and effective plowing can reduce injury crashes by up to 88%.

- The economic impact of snow-related closures far exceeds the cost of timely snow removal. A one day major snowstorm that shuts down roads can cost a state between \$300 and \$700 million in direct and indirect costs.

- Deicing pays for itself within the first 25 minutes after salt is applied.

Modern strategies to effectively deal with winter road hazards depend upon having the most up-to-date information regarding expected weather conditions, the timely deployment of anti-icing to prevent ice-pavement bonding, properly calibrated application of road salt, improved equipment, automatic spreader controls, sufficient covered storage, and stockpile logistics to make salting of roads the most effective and safest customer-driven method for snow and ice control.

Environmental problems concerning use and storage of salt need not exist if there is a balanced and sustainable approach to the use of salt for snow and ice control – one that demonstrates excellent practices in achieving safety, mobility and care for the environment.

The Snowfighter's Handbook was originally published in 1967. It has been widely accepted as a recommendation for proper salting procedures and techniques.

The purpose of this manual is to provide the snowfighter with information and suggestions for combatting winter storms.

The Sustainable Snowfighting methods contained in this manual are the cornerstones of an effective winter maintenance program which will help snowfighters provide the public with the most effective snow and ice control program possible at the lowest overall cost and least impact on the environment.

Two other practical publications, Road Salt and the Environment and the Safe and Sustainable Salt Storage Handbook, are also available from the Salt Institute. Two websites, [saltinstitute.org](http://saltinstitute.org) and [safewinterroads.org](http://safewinterroads.org), are further resources. ❄



# 1 WHAT IS SUSTAINABLE SNOWFIGHTING?

**S**ustainability has become a bit of a slippery word – it seems to mean all sorts of different things to different people. That makes it very difficult if you are trying to make some of your practices sustainable, since different people may well have different views of what constitutes sustainability.

Originally, and ideally, sustainability is defined as the practice that balances societal, economic, and environmental outcomes according to the needs of the community being served by the practices in question. It can be represented as the area of overlap between three circles, one each for the three outcomes. But even this is a little tricky to get our hands around.

In winter maintenance, sustainable practice can be defined as practice that meets the societal needs of a community, for example safe roads that can be used for transportation of goods and people during winter time, with economic constraints. Because nobody has an infinite budget, we must take care not to burden the environment by the actions taken to meet the societal needs within the economic constraints. Even that is a bit difficult to grasp but a few things come from it pretty directly.

First, different communities have different needs and so should, if they wish to be sustainable, have different approaches to their winter maintenance. Put another way, when it comes to sustainable Snowfighting, one size does not fit all! That is not to say that we cannot use good practices and be sustainable, but rather that the end goals in one community may be very different than those in another, and so the practices of those two communities will differ.

Because sustainable Snowfighting is, of necessity, community dependent, it might sound as if it would be impossible to tell if you are doing it or not! However, by using a checklist of practices it is possible for an agency to determine whether they are using the practices that best move them toward accomplishing the end goals appropriate to their community and its societal needs.

The Salt Institute provides such a checklist as part of our Safe and Sustainable Snowfighting Award program. Agencies can

use this as a way to determine areas of practice where they are doing well, as well as to identify areas where improvements can be made.

The key thing to remember about winter maintenance and sustainability is that it is not just about the environment. Instead, it is about balancing three things – societal needs, economic constraints, and environmental stewardship. Safe and sustainable Snowfighting allows agencies to do that balancing act. ❄️



## 2 HOW IMPORTANT IS THE WINTER MAINTENANCE FUNCTION?

**S**now and ice control is often the single largest cost item in the maintenance budget for streets and highways. In a recent year, snow removal in 33 snow belt states accounted for 20-25% of total maintenance costs and almost 5% of all highway expenditures.

For this reason, and because of its impact on public safety and essential mobility, snow and ice control deserves special attention from top highway management as well as from those in maintenance at all levels.

With more than 300 million motor vehicles registered in the U.S. and more than four million miles of roads and streets, more must be done with the winter maintenance dollar than simply providing traction over ice and snow.

Most Canadian road authorities have an even tougher job than their U.S. counterparts. Canada's commerce and industry depend upon safe transportation and communication throughout the vast nation. Yet, Canadian winters threaten for six months every year, with colder temperatures and more frequent snows than in the United States.

The common practice for snow and ice control on many miles of streets and highways is removal of these substances as soon as possible to provide safe pavement through Sustainable Snowfighting. Nearly every state, province, city and toll road in the snow belt has some mileage on a clear pavement program. These facts about our motorized economy show why:

- Motorists now travel more than three trillion vehicle miles each year.
- More than 75% of workers who commute drive to work.
- More than 80% of intercity travel is by motor vehicle.
- Suburban growth has drastically increased traffic densities on most street and highway systems.

- Access to retailers, service establishments, and other businesses is often wholly dependent on auto or truck transportation.
- Just-in-time manufacturing practices require reliable highway access for economic efficiency and competitiveness in snow belt areas.
- Web-based sales are pushing incredible parcel delivery growth.
- Increasing traffic volumes, the reliance of our society on daily mobility, and the urgency of moving emergency vehicles without delay demand efficient snow and ice removal to keep traffic moving all year around.

Sustainable Snowfighting provides safe pavement in an environmentally sensitive manner. By preventing the bonding of snow and ice to pavement and clearing all snow and ice from pavements as soon as possible, snow fighting materials are used most efficiently with minimal loss to the environment. Benefits of this high maintenance are apparent:

- Traffic keeps moving.
- Commerce and industry go on at near normal pace.
- There are fewer accidents, injuries, and deaths.
- There is minimal environmental impact.
- Emergency vehicles get through.

The public is less tolerant of failure in snow and ice control than in any other highway or street department function. A snowstorm affects the entire community – often entire states. Unless a storm is handled capably by the maintenance forces, it can upset considerably the daily routines of individuals, endangering public safety and adversely affecting business and commerce. ❄️





# 3 LEVELS OF SAFETY AND SERVICE

**T**here is an old saying, that “if you don’t know where you’re going, you’ll end up somewhere else.” Setting levels of safety and service for your agency ensure that you will not find yourself in that unintended other place!

So how do you set those levels of service, and what should they be? Well, first for most agencies, the levels of service are set by the elected officials with the oversight of the road agency. But, having said that, the elected officials will almost certainly listen to the folks charged with meeting those levels of service (that means you!).

A side note here – in some Canadian provinces, in addition to any local political requirements, there are also minimum maintenance standards that must be met. However, no such minimum maintenance standards exist in the US and it can be argued that such a top down approach is inherently unsustainable, since it does not take into account the needs and concerns of the local community.

Typically, the first step in determining levels of service involves setting priorities. Some roads in an agency’s jurisdiction are more important than others, and so should receive priority treatment over other roads. Setting of priorities can be done in several ways, but typically average daily traffic is considered (the more traffic per day, the higher the priority) along with other factors such as school bus routes, emergency access routes, and areas that face particular challenges in the winter time (e.g. hills and bridges).

One example of setting priorities is shown here, taken from the Snow Plan for the City of West Des Moines:

*In order to make the most efficient use of available resources, the City has established priorities using the assumption that the severity of a storm is not beyond the normal capabilities of the City’s snow removal resources. Depending on the nature of the snowstorm, deviations could occur. The established priorities are as follows:*

Arterials - The minimum network which must be kept open to provide a transportation system for police, fire and rescue squad units.	<b>1st Priority</b>
All remaining Streets including Cul-De-Sacs	<b>2nd Priority</b>
Alleys and Parking lots	<b>3rd Priority</b>

Having determined the priorities of the roads in your care, the next step is to figure out what to do with each priority level. Put another way, what is the end result that you want to achieve for that priority of road? It is not enough to say that this sort of road is your highest priority – you have to set goals for your activities during and after the winter storms you will face.

Again, there are lots of ways of doing this. And the decisions made here will to a large degree determine the costs of your winter maintenance program. The higher the end level of service that you want to achieve, the more equipment, material, and manpower it takes to get to that end point. Many agencies express the desired end point in terms of photographs of road conditions. So you can see here, the level of service increases from the top left through to the bottom right. Which of these end points is right for your agency? Does every road need to be as clear as an Interstate (bottom right), or could some of your residential streets make do with some residual snow left on them (top left)?

Of course, the level of service an agency has for a given priority group of roads will impact the costs of clearing those roads. And it is important that your elected officials understand that – if they decide they want all their residential streets to look like an Interstate after a storm, there will be additional costs associated with that. There will also be additional safety benefits – a cleaner road is a safer road, but remember that nobody should be driving at interstate speeds on residential streets anyway!

There are three other important factors to consider with levels of service. First, the level of service will be easier to attain with some storms than with others. Another way of thinking about this is that an inch of snow is easier to handle than an inch of ice! You need to build into your levels of service enough leeway to account for different storm conditions. This need not be complex – a statement like “Depending on the nature of the storm, deviations in the level of service may occur,” would likely be enough.

Second, just as cities grow and change, so too should your levels of service. Including a periodic review of your level of service, which involves your elected officials and the public that you serve, can be a very effective way of keeping your officials and your public (your customers, in other words) informed about what you do.

Third, the levels of service that you have can, depending on the law in your state or province, provide you with a degree of risk management. With this in mind, it is important that you do not exceed your levels of service on a regular basis – for example, if your plan says you do not plow residential streets until after the storm is finished, then you should stick to that. It may be that your plan needs to change (or it could be just fine), but the time to decide that is not in the thick of a snow storm because a resident is complaining! ❄️



# 4 MATERIALS USAGE

If your levels of service include attaining bare pavement, then you will need to use materials to get there. And using materials effectively and sustainably requires that you consider some questions. Later sections of the handbook will dig into some tactics for materials application in more detail, but a few ground rules can be very helpful in this regard.

First of all, how you apply the material makes a big difference. You can use solids or liquids or pre-wet solids. Each has a place, but making sure you are using materials in the right form for your agency is important.

Second, the amount of material you apply should be a function of three things: the pavement temperature, the type of storm you are fighting, and the cycle time of your trucks (when another truck will be along to apply more material, if needed, to the place where you are right now – and that other truck might be yours!).

Third, having the right materials to apply is critical. This too is one of those sustainability issues – every agency has different needs and expectations, so there will be many “right answers” out there. Lots of guidance is available, and one recent example would be the NCHRP Report 577, which has a method for determining what are the most effective and efficient materials for an agency.

Finally, there is sand or abrasives. Remember that sand will not melt snow or ice – it simply provides a temporary increase in friction on the snow or ice covered road. If you have a level of service goal that calls for bare pavements or bare wheeltracks, sand will not get you there. So, only use sand when it makes sense (when pavement temperatures are too low for your other materials to work for example) and remember that a sand-salt mix is always half wrong. If you need salt, put down salt. If not, don't. ❄️

Pounds of Ice Melted Per Pound of Salt	
Temperature Degrees F	One Pound of Sodium Chloride (Salt)
30	46.3 lb of ice
25	14.4 lb of ice
20	8.6 lb of ice
15	6.3 lb of ice
10	4.9 lb of ice
5	4.1 lb of ice
0	3.7 lb of ice
-6	3.2 lb of ice

Application of Salt	
Rate of Application Per Two-Lane Mile	Coverage Per Cu. Yd. of Salt Per Two-Lane Mile
800 lb	2 1/2
700 lb	2 3/4
600 lb	3
500 lb	4
400 lb	5
300 lb	6
200 lb	10

*Note: Salt meeting ASTM Specification D632 weighs approximately 80 lb per cubic foot.*





# 5 ANTI-ICING

The idea behind anti-icing is relatively simple – if you stop the snow or ice from freezing to the pavement, it becomes much easier to remove it with a plow than if it has frozen to that pavement. That means you have to get a thin layer of ice control material at the pavement surface and keep it there.

Anti-icing is a proactive process, with an initial goal of placing brine at the road surface and a subsequent goal of maintaining a layer of brine at the surface by additional applications of either brine or solid, pre-wet salt during the storm. Various studies have shown that using anti-icing and being proactive rather than reactive can reduce costs substantially (by up to 90% in some studies) and also reduce the total quantity of salt used during a storm by up to a factor of four.

Hydrometer/Salometer Chart for Salt Brine		
% Salt	Hydrometer Specific Gravity	Salometer Using 0-100%
0	1.000	0
1	1.007	4
2	1.014	7
3	1.021	11
4	1.028	15
5	1.036	19
6	1.043	22
7	1.051	26
8	1.059	30
9	1.067	33
10	1.074	37
11	1.082	41
12	1.089	44
13	1.097	48
14	1.104	52
15	1.112	56
16	1.119	59
17	1.127	63
18	1.135	67
19	1.143	70
20	1.152	74
21	1.159	78
22	1.168	81
23	1.176	85
24	1.184	89
25	1.193	93
26	1.201	96
27	-	100

## Anti-Icing Advantages

- Anti-icing returns road surfaces to normal faster, resulting in fewer accidents and delays.
- Anti-icing can reduce airborne dust and salt particulates.
- Salt needs moisture to be effective. Applying brine jumpstarts the melting process.
- Brine sticks to the road surface. It will not be as easily blown off the road by wind or traffic, so material is more efficiently and sustainably used.
- If the storm is delayed, salt residue remains on the road ready to begin work when precipitation begins.
- Crews can begin treatment in advance of a storm. Because anti-icing prevents the bonding of snow and ice to pavement, snowfighters have less work to maintain safe roadways as the storm progresses.
- Increased efficiency results in the use of less ice control material and manpower, thereby lowering the cost of maintaining safe road conditions. The use of less materials also minimizes environmental concerns and highlights the sustainable nature of anti-icing.

As indicated above, a liquid is needed for the first part of anti-icing. Five products are typically used: salt (sodium chloride) brine, calcium chloride brine, magnesium chloride brine, potassium acetate, and calcium magnesium acetate. In addition, a number of agencies are blending their brines with carbohydrates to enhance persistence on the road surface, and some of the blends include mixtures of the above mentioned five products as well as the carbohydrates.

Each product and blend has its own advantages and disadvantages. The most common material in use is sodium chloride brine (or salt brine as it is commonly called) made from a mixture of rock salt and water. Salt brine is effective at pavement temperatures above 15° F and is a proven anti-icing agency in use throughout the snow-belt.

Some agencies use calcium chloride brine or magnesium chloride brine both of which are effective at pavement temperatures colder than 15°F. However, for most of North America these sorts of pavement temperatures are unusual during or just before storms. Further, these other brines are more than six times more expensive than salt and are more difficult to handle. Also, calcium and magnesium chloride brines leave a residue on road surfaces that can attract moisture at lower relative humidity than salt, resulting in potentially slippery conditions in certain limited circumstances.

## Salt Brine Manufacture

One of the reasons so many agencies use salt brine is that it can be easily made by mixing rock salt or solar salt with water. The process is simple: the resulting brine should be approximately 23% NaCl.

The proportion of salt to water is critical to the effectiveness of the brine. Too much or too little salt affects the freeze point depressing qualities of the brine. The proper brine mixture is 23.3% salt content by weight. This is the concentration at which salt brine has the lowest freezing point, -6° F, also known as the eutectic point. If we keep adding salt at this point we do not lower the freezing point any further. If we add more salt it will start to come out of solution as salt crystals. When we are making salt brine, we can measure the percentage of salt with a salometer, a specialized hydrometer, and when the salometer reaches a measurement of 88.3% we have reached the optimal 23.3% salt content.

Some road agencies have built their own brine makers, while others are purchased from brine maker manufacturers, of whom there are now several in North America who specialize in the winter maintenance market. Brine is usually made at the local maintenance facility sites and stored in large tanks in locations convenient for loading into saddle tanks on the sides of V-box spreaders or into other anti-icing equipment.

## Application Equipment

There are a number of ways in which brine can be placed onto the road surface. Some agencies use specialized trucks or slide-in units on their dump trucks. Other agencies use tow-behind trailers. Typically the brine is pumped onto the road surface by a spreader bar and nozzles. Most agencies recommend streaming rather than spraying the brine onto the pavement – that is, feeding it through a tube from the nozzle down onto the pavement rather than spraying it into the air from the nozzle. Control should be available to vary spreading rates from 25 to 60 gallons per lane mile.

If large, horizontal tanks are used in the design, consider installing baffles inside the tanks to help prevent the liquid from suddenly shifting in the tank, which may create a hazardous control situation for the operator.

## Application

Accurate weather and road surface information are critical for the efficient use of anti-icing materials. Road surface temperatures, precipitation amounts and form, wind conditions, and road environment (sunlight exposure, surface condition, bridges, etc.) all affect the use and application of anti-icing measures.

The phase diagram of the salt-water system, shown here, indicates what happens when we place brine on the pavement surface. We place the brine at 23.3% solution (the eutectic solution). As moisture collects on the pavement surface, we dilute out the brine (move to the left on the phase diagram) so that our solution drops below 23.3%. Eventually we cross the line into the area labelled “Too little salt – refreezing occurs” and at that point, the snow and ice on the pavement will begin to freeze to the pavement – the very thing we are trying to avoid by anti-icing. We cannot stop this dilution process – it is in fact how the brine stops the snow and ice freezing to the pavement, but we have to recognize that it will happen.

**ADDITIONAL PRECIPITATION ALWAYS RESULTS IN A DILUTION OF BRINE AT THE ROAD SURFACE.**

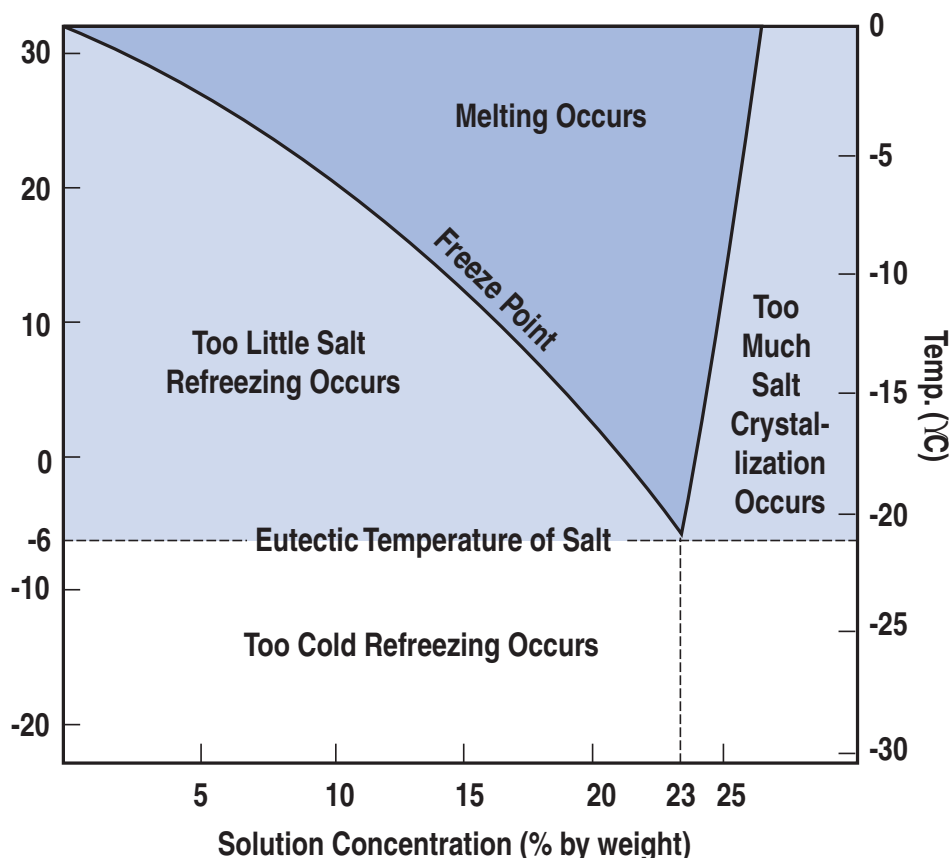
Put another way, the clock starts ticking as soon as precipitation begins to fall on our brine-treated pavement. The strategy of anti-icing depends not only on the initial pretreatment with a brine before the storm but on subsequent treatments (most often with pre-wet solid salt) during the storm, in conjunction with plowing.

The proactive nature of anti-icing means that good weather forecasts are absolutely critical. And a very important part of those forecasts are pavement temperature forecasts, which the National Weather Service does not

supply. In addition to forecast information, some agencies use Road Weather Information Systems (RWIS) to track pavement temperatures in real time and some also use traffic cameras and cameras in trucks to monitor road conditions visually. These tools help to determine the right application of anti-icing materials, and when best to make that application.

Do not apply anti-icing brine under blowing conditions, particularly in areas prone to drifting as the blowing snow may stick to the brine, dilute it, and create ice. Don't apply too much brine or the roadway may become slippery. Always follow application recommendations.

## Phase Diagram for Salt



## Summary

Anti-icing measures are an important weapon in the sustainable snowfighter's arsenal. The appropriate use of anti-icing techniques results in:

- Returning to bare pavement conditions more quickly, saving lives and reducing property damage due to fewer accidents, as well as the reduction of traffic delays and the resulting reduction of losses to local economies;
- Reduction in the quantity of ice control material used, resulting in cost savings and fewer environmental concerns; and
- Reduction in the manpower necessary to maintain safe road conditions, resulting in less overtime costs, less operator fatigue, and safer working conditions. ❄️





## 6 PRE-WETTING

Let's begin with a definition of pre-wetting. It is applying liquid brine to rock salt prior to the salt being placed on the road surface. Pre-wetting can be done in three ways. You can pre-wet the stockpile of salt you have (this is sometimes called pre-treating the salt), you can pre-wet the salt in the back of the truck by using a shower type system (essentially wetting the whole load in one single wetting event), or you can pre-wet the salt as it is applied to the road, either in the augur or on the spinner of the spreading unit.

Which method is best? Experience suggests that pre-wetting at the augur or spinner is the best of the three methods. But, that method involves having tanks on your trucks as well as equipment to mix the brine with the salt either in the augur or at the spinner. Some agencies do not have that capability.

If you do not have the ability to carry liquid on your trucks and to pre-wet the rock salt as it is applied to the road, the second best option is to pre-treat your whole salt stockpile. This is typically done prior to the winter season, and uses some sort of pug mill to ensure the rock salt is thoroughly coated. The drawback with this method is that you cannot vary the pre-wetting rate (which sometimes can be very helpful for you as discussed below).

Of the three methods, pre-wetting the whole load is the least desirable, since the pre-wetting tends to be very non-uniform, and if all the salt that has been pre-wet this way is not used in a given storm, there may be some issues with returning it to the stockpile.

BUT, and this is important, any of these three methods is MUCH, MUCH better than not pre-wetting at all. That is a strong statement, so let's unpack it a bit and explain why.

Back in the 1970s, Michigan DOT looked at how salt bounced and scattered from the back of a truck as it was spread on the road. What they found surprised them. They applied salt at a rate of 400 pounds per lane mile, with the truck traveling at 30 mph, down the center lane

of a three-lane road (it was closed to the public at the time). They found that dry (i.e. non-pre-wet) salt scattered so much that fully 30% went into the ditch rather than into any of the three lanes of the road. When they pre-wet with only 6 gallons per ton of salt, they found that they lost only 4% of salt into the ditch.

And that is the primary, number one, do not miss, reason you should pre-wet your rock salt with brine prior to spreading it on the pavement - unless you can afford to waste 30% of your salt. However, it turns out that this is not the only reason for pre-wetting.

For salt to be effective as an ice control material, it needs moisture. If it is pre-wet it has that moisture already and "gets to work" right away. If it is put down dry, it will not start working as quickly and thus it is more prone to being swept off the road before it can do any good.

More recent work is showing that pre-wetting can be even more effective if the rate of pre-wetting is increased. A number of agencies have been investigating using pre-wet rates as high as 50 gallons per ton, and finding that this works extremely well, especially on heavy-traffic routes. The slurry that this high pre-wet rate forms splats onto the pavement (rather than bouncing in any way) and is effective essentially immediately. This is another reason for having the capability to pre-wet on your trucks - slurries are incredibly effective in normal winter maintenance operations and have resulted in substantial increases in performance.

So, pre-wetting works and it is a critical part of a safe and sustainable winter maintenance program. If you are not pre-wetting, please start taking steps so that you can. ❄️



# 7 DE-ICING

**E**ven if your agency has an anti-icing strategy for your winter maintenance operations, it will occasionally happen that a storm occurs during which you are not able to prevent the bond forming between the snow (or ice) and the pavement. The most common example of this sort of storm is an ice storm, but it can happen during other winter storms too. When it does, you need to switch from an anti-icing mode to a de-icing strategy. That means you will have to break the bond that has formed, by using some sort of ice control material, and taking steps to get that material to the snow-pavement bond as quickly as possible.

More than a dozen compounds have been tested for de-icing use. The most common products used are sodium chloride, calcium chloride, and magnesium chloride. Sodium chloride in the form of rock salt or brine is by far the most commonly used material in de-icing operations, due to its lower cost and proven effectiveness. Therefore, in the words of the transportation Research Board in its 1992 analysis of de-icers, salt remains the “de-icer of choice.”

Abrasives have no melting effect for de-icing operations; in fact research by the Strategic Highway Research Program (SHRP) and the University of Wisconsin suggests that sand inhibits the melting process of de-icing materials.

## Applying the Materials

As discussed in the previous chapter, salt can be applied as a pre-wet solid or as a liquid brine. Application methods are determined by weather and road conditions as well as equipment available. Salt needs moisture to provide melting action and break the bond. When we are in a de-icing situation and the bond between snow and pavement has formed, we typically have to melt through some snow or ice before we can begin to break the bond. Once we have done that, the removal operations can be successful in restoring bare pavement conditions.

Direct application of liquids is not recommended for packed snow as the liquid destroys surface friction and the brine may become so diluted before melting action is completed that refreezing can occur. When packed snow exists, then pre-wet salt is typically the optimal approach. If the issue is black ice or frost, however, direct application of liquids is very effective.

Ice control materials should be applied close to the crown or high point of the road. The resulting brine will run downhill from the crown to the rest of the surface. Spinner speed should be low enough to ensure that de-icing materials remain on the road surface. Spinner speed and application rates should be higher at intersections and other high traffic areas to spread de-icing material over a larger area or in higher concentrations as required by the conditions. However, use of the BLAST override on automatic controls while stopped at a stop sign or light is not appropriate.

Road conditions, pavement temperature, amount of snow and ice cover, storm progress, moisture content of precipitation and traffic conditions, all affect material application rates.

## Materials Selection

Generally, all ice control chemicals work in the same way. They depress the freezing point of water, and thus either prevent the formation of a bond between snow and pavement or melt that bond if it has already formed. If that bond is broken then the ice and snow can be plowed off the road relatively easily.

Agricultural by-products have been added to chloride-based ice control materials and they serve to enhance the performance of the chloride-based materials. While the agricultural by-products on their own would also serve to depress the freezing point of water (thanks to the carbohydrates in the by-products) their performance on their own in that regard is in general less than the chloride-based materials. One of the primary reasons for combining these by-products with the chloride-based materials is to enhance the persistence of the materials on the pavement surface. The

carbohydrates tend to make the materials sticky or tacky, and anecdotal reports suggest that ice control materials last longer on the road with such by-products than without.

Although these materials all work in essentially the same way, their performance can vary widely. The performance factors that are typically considered will include: effective temperature range, speed of action, amount of material required, duration of melting action, availability, cost, infrastructure and environmental impacts, and persistence on the pavement.

Each community will place a particular emphasis on each of these criteria to suit their own specific needs. Indeed, such local emphasis is a core part of a sustainable Snowfighting approach – in this regard one size does not fit all! Local needs may change over time, as political priorities shift. The ability to be able to make a rational decision on material selection to closely fit with ongoing needs is of tremendous importance to winter maintenance planners.

In order to come to grips with this issue, a consortium of state DOTs commissioned a study to develop an evidence-based decision tool for materials selection. This was published by the Transportation Research Board (TRB) of the National Academy of Sciences in May 2007. The full report (NCHRP Report 577) can be downloaded from the TRB website.<sup>1</sup>

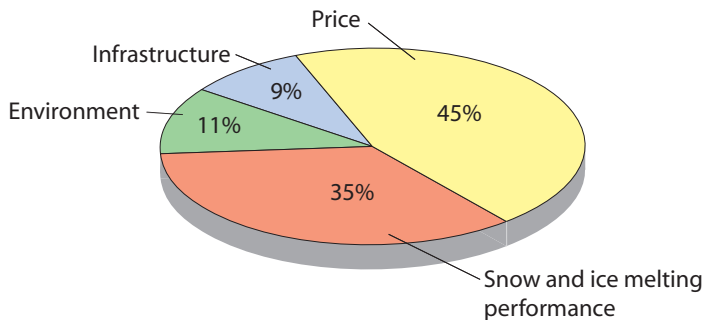
Now agencies can objectively compare the ice control materials they use in terms of the sustainable Snowfighting priorities that each agency defines and determines for itself. The computer program (called the Material Selection Wizard<sup>2</sup>) crunches the data based upon the agency's set of priorities. The following example demonstrates how the Wizard works.

A winter maintenance agency has had budget cuts and decides that the following priorities reflect their particular needs – see Chart 1.

<sup>1</sup> [http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp\\_rpt\\_577.pdf](http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_rpt_577.pdf)

<sup>2</sup> <http://www.trb.org/Main/Blurbs/158876.aspx>

Chart 1



Price is the primary concern (45%), snow- and ice-melting performance is almost but not quite so important (35%), while environmental (11%) and infrastructural (9%) are somewhat lower priorities for the agency at this time.

Using the Wizard, the data are input and the following results are obtained showing which material will fit the agency's needs for which temperatures – see Chart 2.

The Wizard presents an informed choice based on specified priorities. It is a choice that can, for example, be defended before City Council. Citizens value their hard-earned dollars and expect them to be spent wisely to keep roads open and safe, while safeguarding the environment. The City Council and the citizens determine the policy. This tool turns the policy into a practical and functional choice.

As another example, here is an extreme environment/infrastructure priority model. It disregards ice control material costs and weights performance low (25%, with the logic that a lower weighting would be irresponsible since the material must perform its life-saving deicing mission). Environment and Infrastructure together account for three-fourths of the total weighting, split evenly with 37.5% weight for each. Chart 3 shows how the various materials stack up with these changed priorities. So, the choice belongs to the agency that can now be assured that at the temperatures to be encountered they are choosing materials that comply with their community's particular priorities. \*

Chart 2

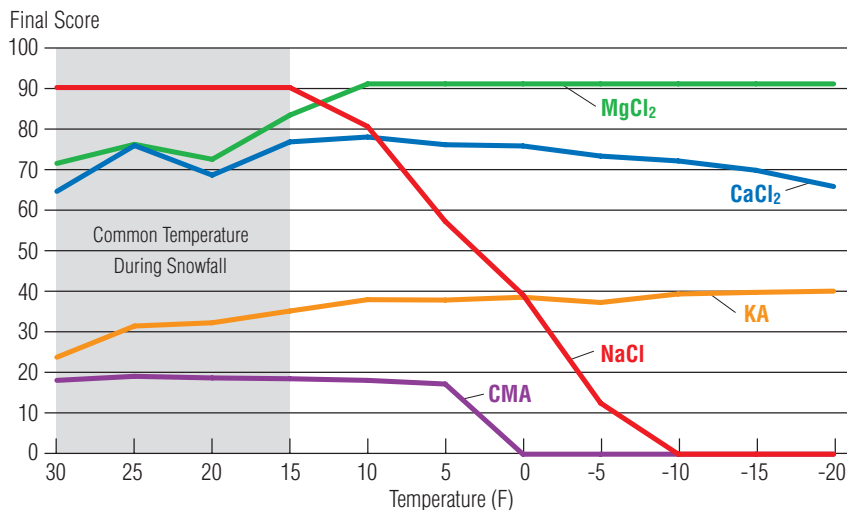
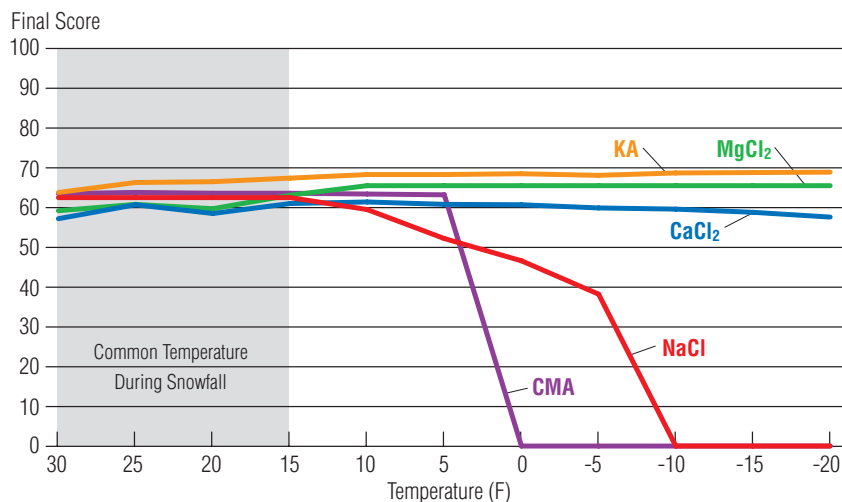


Chart 3





## 8 EQUIPMENT

**W**inter maintenance equipment typically has come in three varieties – a vehicle on which to put various pieces of equipment or stuff, stuff to remove snow and ice from the pavement (e.g. plows of one sort or another) and stuff to put snow and ice control material down onto the pavement (e.g. spreaders). To this, we can now add a fourth sort of equipment – information gathering equipment which can be stationary (e.g. an RWIS station) or mobile (e.g. a pavement temperature probe mounted on a truck).

The exact equipment types you need will be driven by decisions on level of service and by decisions about the materials you will use. So, obviously, if you are going to use an anti-icing strategy you will need equipment that can make direct liquid applications (DLA) to the pavement. Of course, this is not a one way decision – depending on the current equipment mix your agency has now, your level of service goals may have to be modified until your fleet can acquire the capabilities that will allow you reach the levels of service your community really wants – and that will take time, and money.

While you may not be able to have all the equipment you want right now, it is well worth knowing what you do want your equipment mix to look like eventually so you can develop a plan to get there. There are a few key factors to consider as you build the equipment mix that will allow you to achieve your desired service levels.

First, you need to have a calibration plan in place. We deal with this in more detail in the next two sections in the guide, but your equipment needs to be calibrated regularly and systematically. Why? Well, there is an old saying that you cannot manage it if you do not measure it. And you cannot measure what you are doing if you do not calibrate your equipment to measure properly.

Second, as you almost certainly already know, if you want a piece of equipment to break, put it on a plow truck. Being on a truck during a storm is one of the toughest environments for vehicle-borne equipment

around. And the last thing you want is for your equipment to break down during a storm event, because then instead of that truck being on the road achieving your level of service goals, it is in the shop achieving not very much at all. That means a pro-active maintenance system is a must. There are increasingly sophisticated systems for doing this becoming available, and an important decision is what level of sophistication is going to work best for your operations, but you need a system in place to catch problems before they become catastrophes.

Third, if at all possible you want flexibility in your equipment. That means that a given plow should be able to work on multiple trucks. Most agencies mate up a plow and a truck at the start of the season and they stay that way until spring. There is nothing necessarily wrong with that, but if the truck breaks down, you have lost the plow as well if it cannot be moved to a different vehicle (and vice-versa).

Fourth, in selecting your equipment you need to consider not just up-front cost, but a number of other factors as well. For example,

certain cutting edges reduce vibration substantially in comparison with “regular” cutting edges. That can provide savings in terms of reducing operator fatigue and reducing wear and tear on the plow and the vehicle to which it is mounted. You need a system that allows you to roll those savings into the final costs, along with some form of life-cycle costing. Those reduced vibration cutting edges might be a lot more expensive than a “regular” cutting edge, but if they last a lot longer, how will you fold that factor into your cost mix?

Fifth, and this ties back into the pro-active maintenance issue, you need to keep your equipment clean. Chlorides of any sort will cause corrosion in metals and the best way to avoid that is to clean your equipment. Waiting until the end of the season to wash your trucks and spreaders is a sure way to guarantee a short lifetime for your equipment. ❄️



# 9 CALIBRATION

As alluded to previously, calibration of equipment is critical to ensuring that an agency has the information it needs to operate in a safe and sustainable manner. While the primary concern is material delivery systems, other equipment (in particular, sensors such as pavement temperature measuring devices) also need to be calibrated regularly.

As a minimum, equipment needs to be calibrated at least once a year. However, equipment may need to be calibrated more frequently than this, and until a record of performance has been established for a spreader or liquid dispensing system, it should be calibrated monthly. Once a system has stayed within calibration for three straight calibration cycles, then the length of time between calibrations can be increased.

Different materials will spread at different rates even when equipment settings are exactly the same, so spreaders and liquid dispensing systems must be calibrated with the material that will be used. If more than one material will be used for a given system it needs to be calibrated for each material separately.

## Procedure

Calibration of spreaders is simply calculating the pounds per mile actually discharged at various spreader control settings and truck speeds. It is carried out by first counting the number of auger or conveyor shaft revolutions per minute, measuring the salt discharged in one revolution, then multiplying the two and finally multiplying the discharge rate by the minutes it takes to travel one mile. An excellent example of a calibration chart in spreadsheet format can be found on the Salt Institute website. Operational spreadsheets can be found on the same page. A sample calibration chart is shown on this page.

With hopper-type spreaders, specific gate openings must be calibrated. Measure from the floor of the conveyor to the bottom edge of the gate.

Each spreader must be calibrated individually; even the same models can vary widely at the same setting.

## Equipment needed:

1. Scale for weighing
2. Canvas or bucket/collection device
3. Chalk, crayon or other marker
4. Watch with second hand or stop-watch

## Calibration steps

1. Warm truck's hydraulic oil to normal operating temperature with spreader system running.
2. Put partial load of salt on truck.
3. Mark shaft end of auger or conveyor.
4. Dump salt on auger or conveyor.
5. Rev truck engine to operating RPM (at least 2,000 RPM).
6. Count number of shaft revolutions per minute at each spreader control setting, and record.
7. Collect salt for one revolution and weigh, deducting weight of container. For greater accuracy, collect salt for several revolutions and divide by the number of turns to get the weight for one revolution. This can be accomplished at idle or very low engine RPM. Multiply the shaft revolutions per minute (Column A) by the discharge per revolution (Column B) to get the discharge rate in pounds per minute for each control

setting (Column C), then multiply discharge rate by minutes to travel one mile at various truck speeds to get pounds discharged per mile.

8. So, for example, at 20 mph (or 3 minutes per mile) with 30 shaft revolutions per minute, and a 7 lb discharge per shaft revolution, we would get  $30 \times 7 \times 3 = 630$  lbs per mile.

## Calibrating Automatic Controls

Automatic controls come with factory calibration cards that indicate the proper rate of spread for each setting. However, when there is a need to calibrate, use the following steps:

1. Remove or turn off spinner.
2. Set auger on given number, such as No. 2.
3. Tie sack or heavy canvas under discharge chute.
4. Mark specific distance, such as 100 or 1,000 ft.
5. Drive that distance with spreader operating.
6. Weigh salt collected in sack or canvas.
7. Multiply weight of salt by 5.3 (in case of 1,000 ft) or 52.8 (in case of 100 ft).

This will be the amount of salt discharged per mile, which remains constant regardless of speed, but calibration must be done for each control setting. \*

## Calibration Chart

Agency: \_\_\_\_\_  
 Location: \_\_\_\_\_  
 Truck No.: \_\_\_\_\_ Spreader No.: \_\_\_\_\_  
 Date: \_\_\_\_\_ By: \_\_\_\_\_

Gate Opening (Hopper Type Spreaders)			Pounds Discharged Per Mile											
Control Setting	A Shaft RPM (Loaded)	B Discharge Per Revolution (Pounds)	C Discharge Rate (lb/min)	Minutes to Travel One Mile										
				5 mph x 12.00	10 mph x 6.00	15 mph x 4.00	20 mph x 3.00	25 mph x 2.40	30 mph x 2.00	35 mph x 1.71	40 mph x 1.50	45 mph x 1.33		
1		This weight remains constant												
2														
3														
4														
5														
6														
7														
8														
9														
10														

## 10 MEASURING PERFORMANCE

**A**n important part of sustainable practice is measuring what you are doing so that you can evaluate your practices and, if necessary, improve upon them. That means that a safe and sustainable Snowfighting agency will have a system in place to measure their performance, and to use those measurements in continuous improvement efforts.

The most central step in this action for an agency is to measure whether they have achieved their levels of safety and service. Currently, most levels of service are expressed in terms of road conditions (e.g. bare pavement, or bare wheel tracks) and these definitions are subject to some interpretation. For example, if there is a small amount of snow present along the mid-line of a road, the road is technically not in a bare pavement condition, but operationally, as long as that small amount of snow does not obscure pavement markings, it can be considered to be bare. Operators (or those charged with determining whether the level of service has been met) need to be trained in determining whether levels of service have been met.

One particularly helpful tool that agencies have used to keep track of their performance is a post-storm review. This will include a description of the storm itself, and possibly even some index value describing how severe the storm was, followed by an inventory of the resources applied to dealing with the storm. Ideally, all members of an agency's winter maintenance team should be involved in the post-storm review, so that successes can be identified, celebrated, and shared, and failures can be discussed and methods to avoid those same failures in the future can be identified and implemented.

Safe and sustainable winter maintenance requires that an agency commits to improvement in the long term, since such improvement implies an agency that is becoming both more efficient and more effective. Efficiency and effectiveness are clearly parts of a safe and sustainable program. \*

## 11 STRATEGIC (ANNUAL) OPERATIONS

**C**learly, a safe and sustainable Snowfighting operation requires long term thinking, and that means there are certain actions that need to be planned and executed on an annual basis. A key example of this is training which is discussed further below. But there are many other annual actions that can be taken to improve your agency's commitment to safe and sustainable Snowfighting.

Some actions can be considered part of an annual review of operations. For example, taking a look at your snow plow routes on an annual basis means that you keep the lane miles properly balanced between routes and that you handle long term growth impacts in your community incrementally, rather than in sudden large changes in operations. Some agencies also like to conduct a post-winter review in the spring (once all the snow has stopped!) to see what worked well in the previous winter and what did not work so well. This also provides an opportunity to review any experimental changes that were made in the previous winter to see if the experiment should be continued, or if perhaps it is ready for full implementation.

Other coordination efforts with appropriate emergency service agencies are very helpful. This is especially important when issues such as disaster declarations are considered. When a disaster is declared, typically some sort of Emergency Management protocol is invoked and it is important that agencies understand their roles in such situations.

Other annual activities are more along the lines of tracking activities taken by the agency. This could include tracking total loading of materials on different road segments, developing pro-active frost treatment programs, having a snow drift prevention program in place, having a system to designate and track environmentally sensitive road segments, developing and deploying systems that provide real time information on road surface conditions to road users, and even surveying the public to ascertain how well they think your agency is performing. Not every agency needs to do all of these things, but considering which would be of special benefit to your own community has been found to be a very valuable activity. \*





# 12 TACTICAL (PER STORM) OPERATIONS

Once you are in the winter season, your activity is going to be much more focused on dealing with each storm as it comes along. One of the key concerns you will face in this context is getting a good forecast that will allow you to take pro-active measures.

In the ideal situation you want forecasts that are pavement focused – that is, they predict what the pavement temperature will be through the storm. This allows you to determine how much material you need to apply. Remember that the amount of material you apply will be a function of pavement temperature, cycle time, and precipitation type. The table nearby shows some typical application rates based on these factors. Your particular rates may vary a bit from these values, but if you do not have your own application table, this is a really good place to begin and make adjustments from.

In addition to having pavement temperature forecasts, you will also want site specific forecasts. We all know that there are parts of our road system that are “trickier” than others – perhaps they are always colder, or more prone to snow-drifting or whatever. Put another way, not all your roads are going to see the same weather so your forecast should account for that. Obviously, the larger the area for which you have responsibility, the more likely this is to be true.

To get these sorts of forecasts, you are going to need to get some sort of value-added meteorological service. The US National Weather Service does not provide pavement forecasts and is not intended to either – it was developed primarily as a tool for aviation, not highways.

Other things to think about in a tactical sense would include, especially for more urban areas, adjustments to your maintenance plan to account for varying traffic levels due to commute times. If you know certain roads get very busy during the commute, then you need to get them dealt with before the commute begins if a storm is happening, otherwise they are just going to jam up, and your trucks do no good at all stuck in a traffic jam.

Also, because Murphy will always strike when he can cause the most problems, it is good to have some contingency plans in place for when you have equipment failure or similar events during storms. Can you pull trucks off lower priority routes if a truck on a high priority route is disabled for some reason? Such flexibility of operations can be critical. \*

## Example Salt Application Rates

Prewetted salt @12' side lane (assume 2-hr route)							
Surface Temperature	(Fahrenheit)	32–30	29–27	26–24	23–21	20–18	17–15
lbs of salt to be applied per lane mile	Heavy Frost, Mist, Light Snow	50	75	95	120	140	170
	Drizzle, Medium Snow 1/2" per hour	75	100	120	145	165	200
	Light Rain, Heavy Snow 1" per hour	100	140	182	250	300	350
Prewetted salt @12' side lane (assume 3-hr route)							
Surface Temperature	(Fahrenheit)	32–30	29–27	26–24	23–21	20–18	17–15
lbs of salt to be applied per lane mile	Heavy Frost, Mist, Light Snow	75	115	145	180	210	255
	Drizzle, Medium Snow 1/2" per hour	115	150	180	220	250	300
	Light Rain, Heavy Snow 1" per hour	150	210	275	375	450	525

# 13 EXPERIENCE BASED TIPS

**A**ny sort of operational activity benefits from the hard won lessons of experience and Snowfighting is no exception to this. The following suggestions are just some of the tips that may help you and your agency going forward:

- Salt bridges first. Bridges freeze long before road surfaces because they do not hold warmth as a roadbed does, since cold air reaches both the top and bottom surfaces of bridge decks. They should receive early attention and an application of salt. Bridge decks may ice over or frost may form on them, when there is no precipitation.
- Apply salt on the high side of elevated curves. Salt brine will flow down and across a banked curve. If salt is spread on the centerline, everything above it will remain icy. Spread salt on the high side of the curve and let gravity do the rest of the work.
- Leave no gaps. Operators must ensure that when they come to the end of their assigned route they go a bit beyond to plow and salt a potential gap in coverage. A short, neglected stretch of roadway can be very hazardous to an unsuspecting motorist.
- Watch for drifting. In continued high winds (above 15 mph) maintain a patrol to watch for drifting and slick spots, even after the pavement has been cleared. Treat icy buildups with a salt application. If there are spots where you have drifting often, consider using snow fences to stop the drifting.
- During some very low temperature storms with dry blowing snow, the use of salt may not be appropriate. The dry snow may blow off the pavement if no salt is used.
- Avoid slick conditions from buildup of ice or packed snow by applying a salt application heavy enough to prevent refreezing.
- Traffic icing can be very dangerous. Occasionally, under certain weather conditions, a paper-thin sheet of ice forms in wheel paths on a bare pavement even when pavement looks clear. This black ice formation can be deadly. Maintenance operators should be instructed to watch for this condition and to apply salt immediately when it is detected.
- Get equipment on the road. Once word of an impending storm has been received get vehicles out of the yard and onto their plowing and spreading routes as soon as possible. Delay in getting to critical areas may cause severe traffic tie-ups. Also, nothing is more reassuring to motorists than to see anti-icing sprayers or loaded spreaders and plows patrolling prior to storms.
- Make a list of trouble spots that operators should keep a close eye on during storms. Make sure all personnel understand that bridges, intersections, ramps, hills, and curves may all cause problems and so need full attention. A safe road or street is of little value without safe entrances and exits. Have operators out patrolling routes rather than waiting in the maintenance area for direction.
- Make use of new technology where it can help. Systems such as GPS/AVL, traffic light controls, variable message signs, various camera systems, and others all have the potential to improve the management of operations during a winter storm. Additionally, by using such systems to track your operations, you can better measure your performance over time and identify areas for possible improvement. ❄️



## 14 A WORD ABOUT SAFETY

**T**he main purpose of snow and ice removal is, of course, to provide safe travel for motorists. In doing this, those in maintenance must not overlook their own safety; neither must they overlook the possibility that in trying to provide safe pavement, they may be creating another safety hazard.

Become familiar with a few “do’s and don’ts” that can make your work far safer:

- Do check all equipment before each use. Make sure lights, brakes, windshield wipers, exhaust systems, tires, chains, and steering are safe. Don’t leave the yard without having done those pre-trip inspections.
- Do promptly report all mechanical trouble. Don’t expect that a problem will magically disappear if you ignore it.
- Do remember that speed can kill, especially in a snowstorm and at night.
- Do resist the urge to get the job done in a hurry.
- Do respect the rights of others. Be considerate of motorists who have trouble driving in snow; report stranded motorists when possible.
- Do keep first aid kits completely stocked. Check fire extinguishers and flares often.
- Do observe traffic laws.
- Don’t drive distracted.
- Do watch for signs of fatigue in equipment operators. ❄️

## 15 BUILDING THE TEAM

**M**aintenance people typically feel a keen obligation to the traveling public. They have the kind of *esprit de corps* that comes only with training and experience.

Proper training for maintenance personnel is vital. It provides the know-how to get the job done and encouragement to perform in a way that brings praise rather than discredit to your organization. They are also crucial to ensuring efficient and effective operations. If an operator does not understand how the tools at their disposal work – how can they be effective?

Many maintenance organizations conduct training courses in the early fall months to assure that:

- Equipment operators fully understand how to operate and maintain plows, spreaders, loaders, and other equipment used for winter maintenance.
- All employees are thoroughly familiar with their responsibilities.
- All employees receive a full review of snow removal schedules, snow routes, and personnel and equipment assignments.
- Dry-runs are made over areas to be covered during actual Snowfighting operations.
- All employees understand how salt works in snow and ice, so they know how, when, and in what amounts it should be applied.

The underlying theme of all training sessions should be the Sustainable Snowfighting concept, which includes:

- Concern for public safety
- Concern for mobility and commerce
- Concern for the environment
- Proper covered storage
- Good maintenance of storage areas
- Good equipment maintenance and knowledge of equipment
- Proper spreader calibration
- Proper salt application

Every agency should have a fall meeting.

A session on snow and ice removal well ahead of winter gives a chance to discuss your plans with the people expected to carry them out. This meeting is a refresher course on Snowfighting tactics for experienced employees and an introduction to winter maintenance for new personnel.

This meeting gives management a chance for a formal review of the previous winter’s operations with operators and supervising personnel. Use it to determine what may have gone wrong last winter, and then make corrections for the coming season.

Promote a free exchange of ideas at the fall meeting. Encourage all personnel to speak up. New ideas and better tactics can come out of this session. ❄️



# 16 KEEPING THE PUBLIC IN THE LOOP

It is very important for an agency to engage with the public that they serve, and to this end media relations need to be considered as part of an agency's annual strategies. Some agencies hold annual open days (typically in the fall) to inform the public about their winter activities and to engage the local media. Others have a media interaction meeting in the fall to prepare local media for the coming winter activities. Along with this, some form of system to allow media contact during storms can be very helpful (some would say critically so) while activities that encourage media engagement (such as reporter ride-alongs) can provide substantial benefits to an agency.

Publicize snow emergency procedures and regulations. Keep broadcasters and newspapers periodically informed of snow clearing progress and specific problem areas. This way, motorists will know on which routes they will be able to travel with the least difficulty. Advance publicity on snow clearing priorities will reduce time-consuming calls from people demanding to know when their streets or roads will be cleared.

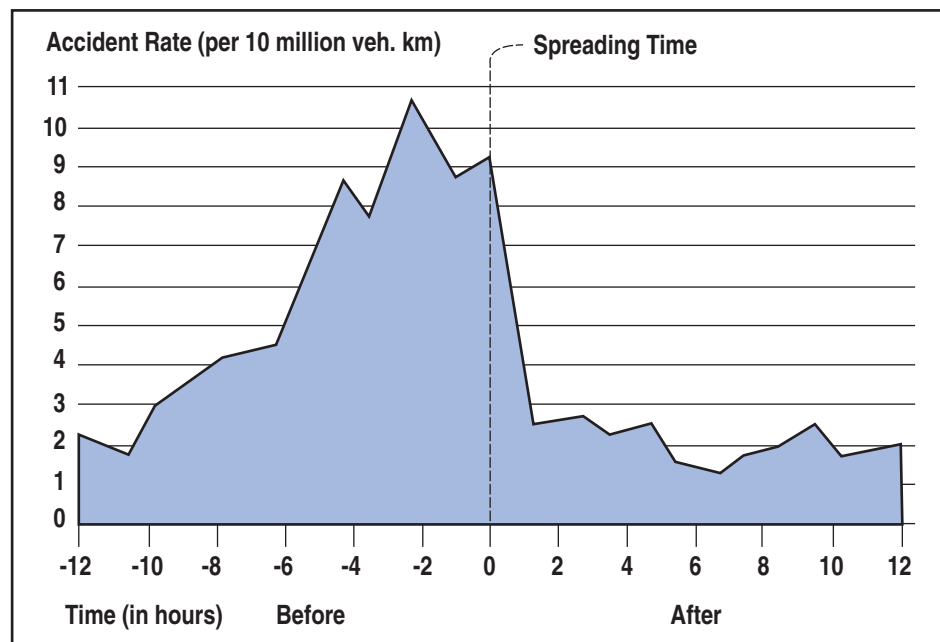
Before storms arrive, pass on information about approaching snow in time for schools, industry, and government agencies to decide whether or not to remain open or to close early.

Make contact with other agencies. Long before winter, meet with representatives of other public agencies to discuss means of cooperating in snow and ice removal. Take the initiative to let others know of your plans and to enlist their cooperation. Consider inviting these people to the pre-winter session: a representative of the top elected public official in your area, the local civil defense director, those in charge of bus transportation for school systems, police and fire officials, emergency road service managers of nearby clubs of the American Automobile Association (AAA), officers from local military units, and news media representatives.

Snowfighters are not miracle workers. They are dedicated, hardworking human beings who pit their will against the forces of nature – and usually win! The real record of their accomplishment is not the tons of snow removed or the miles of pavement kept clear or number of streets plowed. The achievement of open highways that allows business, industry, and government to function and people to travel safely and without undue delay is the testament of good Snowfighting.

According to a Marquette University study, road salting and plowing can reduce crash frequency by 88%. A one-day major snowstorm can cost a state \$300-700 million in both direct and indirect costs. \*

## Accident Rate Before and After Salt Spreading



# STORM RECORD



<b>Storm No:</b>			<b>Sec:</b>			<b>Div:</b>			<b>Date:</b>		
<b>1. Time</b>		<b>AM</b>	<b>PM</b>	<b>Day of Week</b>			<b>2. Location</b>			<b>Miles</b>	
Storm Started							From:				
Storm Ended							To:				
Road Cleared											

<b>3. Description</b>											
Dry Snow		Temp			Wind						
Wet Snow		Max:		Min:		Direction:		Velocity		MPH	
Sleet		Depth of Snow				Visibility					
Freezing Rain		Avg (in)		Drifts (ft)		Good:		Fair:		Poor:	

<b>4. Procedures</b>						<b>5. Results</b>							
		No of Apps		Time				Excellent		Good		Poor	
Salt				From: To:		Salt							
Plowing				From: To:		Plowing							
Abrasives				From: To:		Abrasives							

<b>6. Labor, Equipment &amp; Materials</b>											
Personnel		Reg Hrs.	O.T. Hrs.	Total	Equip. No.	Type	Hours	Material (TONS)			
								Salt			
Total											

**Comments:**

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Completed by: \_\_\_\_\_  
Name, Title

# SAFE AND SUSTAINABLE SNOWFIGHTING AWARD APPLICATION

The Salt Institute began promoting safe and sustainable snowfighting in 1972, when it began its Sensible Salting Program. Decades later, SI is still leading the way in advancing effective in snowfighting to ensure winter safety, mobility, and protection of the environment.

Partnering with leaders in winter maintenance, SI has expanded its long-standing “Excellence in Storage Award” to include safe and sustainable operations. In 2012, we presented the Salt Institute’s “Safe and Sustainable Snowfighting Award,” a program that recognizes agencies that demonstrate best practices in salt storage and snowfighting.

Clear winter roads protect lives and commerce. Road salting and effective plowing can reduce injury crashes by up to 88%. And a one-day major snowstorm that shuts down roads can cost a state between \$300 and \$700 million in direct and indirect costs. Snowfighting is often an underappreciated vocation, but at the Salt Institute we recognize snowfighters as heroes who protect lives and enable our winter economy.

To apply for the “Safe and Sustainable Snowfighting Award” the facility manager should complete the application form and checklist (found as an insert to this handbook, on [saltinstitute.org](http://saltinstitute.org), or on [safewinterroads.org](http://safewinterroads.org)), have it signed by an immediate supervisor and returned with all supporting documentation to the Salt Institute by June 1. Please answer all questions.

Applications will be judged by our evaluation committee and in some cases a Salt Institute representative will make an on-site facility visit.

Award recipients will receive a “Safe and Sustainable Snowfighting Award” certificate and will be recognized in a Salt Institute press release.



# Publications Available *from the* Salt Institute



*Refer to [saltinstitute.org](http://saltinstitute.org) for further details and other literature*

## *Salt Storage Handbook*

A guide for environmentally sensitive handling and storing deicing salt.

**ABOUT THE SALT INSTITUTE:** The Salt Institute is a North American based non-profit trade association dedicated to advancing the many benefits of salt, particularly to ensure winter roadway safety, quality water and healthy nutrition. See [saltinstitute.org](http://saltinstitute.org) or call 239.231.3305.

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**Massachusetts Turnpike located in Boston, MA responses to survey of toll facilities**

**Fort Worth, TX**

**HWY21FH005**

(65 pages)

# SURVEY OF TOLL FACILITIES

## General Operations:

1. Is the toll facility private or state regulated?  
I-90, Massachusetts Turnpike, State Regulated
2. When was the toll facility officially opened to traffic?  
1957
3. How many lane miles does the toll facility maintain?  
138 miles length, Appx. 336 lane miles, neglecting ramp systems (26 interchanges)
4. How many days did the toll facility respond to snow and ice removal events in each of the last 5 years?

	2016	2017	2018	2019	2020
Days with Snow and Ice Removal Events	24	35	34	37	25

## Snow and Ice Removal Pre-treatment Operations: Describe and/or provide documentation of the following:

5. All pre-treatment options and subsequent chemical applications currently used by the toll facility during snow and ice removal events.  
Pretreatment is 85% saturated NaCl solution, + 15% of 28% liq. magnesium chloride
  - 4a. How long each specific pre-treatment option and subsequent chemical applications are effective in treating the roadway after initial application. Pretreatment can be applied up to 3 days prior to event. It dries and waits for snow to fall.
  - 4b. Any formal criteria of when to use specific pre-treatment options and subsequent chemical applications. If the temperature of the road is expected to be frigid (below 20 deg. F), 28% liquid mag can be used solo (no NaCl brine).

## Snow and Ice Removal: Describe and/or provide documentation of the following.

6. An inventory (trucks, plows, front-end loaders, spreaders, etc.) including the number of covered salt storage facilities and quantities of salt that are dedicated to snow and ice removal events.

7. Methods/technologies to monitor moisture and ice formation on roadways, highway overpasses, or bridges.
  - 7a. If you use sensor detection systems, the systems, and procedures for their use.
  - 7b. If you do not use sensor detection systems, any future plans by the toll facility to utilize them or other technologies capable of monitoring moisture and ice formation on roadways, highway overpasses or bridges.
8. Procedures for snow and ice removal.
  - 8a. If you have formal procedures in place, provide a copy of the established procedures.
9. Training procedures for maintenance technicians who perform spot checks and inspections of road conditions during snow and ice removal events. Provide details on the training procedures necessary to become a spot checker (i.e., initial number of training days/hours, certification requirements, length of annual refresher courses, etc.)

**Documentation Checklist: Please provide the following if available.**

- ✓ Pre-treatment options, durations of effectiveness, and criteria for use
- ✓ Inventory of snow and ice equipment
- ✓ Systems/methods used to detect moisture and icy conditions
- ✓ Operational and training procedures for snow and ice removal
- ✓ Contract between toll authority and state, including snow and ice removal events



Dan Walsh NTSB Massachusetts Turnpike (I-90) Survey Responses to Questions 6-9

6. An inventory (trucks, plows, front-end loaders, spreaders, etc.); including the number of covered salt storage facilities and quantities of salt that are dedicated to snow and ice removal events.

**State-Owned Equipment Used on Massachusetts Turnpike**

<u>District</u>	<u>Spreaders</u>	<u>Loaders</u>	<u>Plows</u>	<u>Tankers</u>	<u>Other</u>
1	19	7	12	1	0
2	21	7	4	1	1
3	36	13	4	0	2
6	71	17	8	0	3
<b>SUM</b>	<b>147</b>	<b>44</b>	<b>28</b>	<b>2</b>	<b>6</b>

**Massachusetts Turnpike Salt Storage Capacities (2 Facilities per District)**

2 Salt Sheds per Facility (e.g., 2000+1500=3500)

<u>District</u>	<u>Tons</u>
1 (M1 & M2)	3,500
2 (M3 & M4)	4,000
3 (M5 & M6)	4,000
6 (M7 & M8)	4,500
<b>SUM</b>	<b>16,000</b>

**Salt Tons Used on Massachusetts Turnpike FYs 2016-2020**

<u>District</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
1	4,708	10,829	11,792	10,235	7,732
2	7,082	8,743	8,954	7,448	6,646
3	9,750	16,549	12,876	9,623	6,277
6	15,523	10,255	8,937	9,493	3,889
<b>SUM</b>	<b>37,063</b>	<b>46,376</b>	<b>42,559</b>	<b>36,799</b>	<b>24,544</b>

7. Methods/technologies to monitor moisture and ice formation on roadways, highway overpasses, or bridges. **Road Weather Information Systems (RWISs, provided by Vaisala) coupled with dedicated weather forecaster (DTN) who provides a Maintenance Decision Support System (MDSS, which is informed by Vaisala’s RWISs).**

7a. If you use sensor detection systems, the systems, and procedures for their use. **We have 45 fixed-location RWISs, with 4 of these trailer-based and relocatable. The sites use a mix of invasive (in-road) and non-invasive (i.e., infrared, spectroscopic) pole-mounted sensors. We also have about 2 dozen mobile RWIS units assigned to Area Supervisors, each of whom oversee 6 or 7 of MassDOT's maintenance depots (on average).**

7b. If you do not use sensor detection systems, any future plans by the toll facility to utilize them or other technologies capable of monitoring moisture and ice formation on roadways, highway overpasses or bridges. **N/A**

8. Procedures for snow and ice removal.

**Our written manual is undergoing updates. Snow and Ice staff that work for MassDOT include dedicated maintenance professionals (appx. 275) and Seasonal Support Staff, who work as engineers usually with other non-maintenance duties and report to duty at maintenance depots to assist with seasonal snow and ice events. There are approximately 500 such Seasonal Support Staffers. Our program has become more pro-active (anti-icing, pretreatment-oriented) over the last dozen or so years, using modern Best Management Practices (BMPs) such as pre-wetting of salt with magnesium chloride, and using closed loop controllers with Ground Speed Control, which makes salt distribution on Massachusetts' roadways consistent, regardless of the speed of the salt spreader. In other words, the quicker the salt spreader is traveling, the faster the conveyor within the salt spreader moves to deliver salt to the rear dispensation chute. If the spreader stops, the conveyor does too. Generally, we dictate that salt spreaders travel 25 MPH and slower, to lessen the bouncing and scattering of the salt crystals which can send salt off the roadway to the ditch where it does no good (performs no roadway treatment) prior to entering the environment as only a liability.**

9. Training procedures for maintenance technicians who perform spot checks and inspections of road conditions during snow and ice removal events. Provide details on the training procedures necessary to become a spot checker (i.e., initial number of training days/hours, certification requirements, length of annual refresher courses, etc.) **I have shared this year's online training module with NTSB's Dan Walsh earlier this season.**

# Winter Operations Working Efficiently



MassDOT Operations Training  
2021-2022



# Doing more with less!

- Changes in Operations have caused many challenges for MassDOT:
  - Less Personnel
  - Less Supervision
- This is not an excuse to go back to the old winter operations techniques!
- Better to work smarter not harder.

# Doing more with less!

- Changes in Operations have caused many challenges for MassDOT:
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# Cost Prevents us from Using Old, Wasteful Practices





# Three Essentials

- **Get Out Early**
  - Anti-ice when available/applicable
- **Calibrate Equipment**
  - Know how much material is being spread
- **Pre-Wet Material**
  - Especially the first load

# Tools Available Now!

- Anti-Icing Strategy
- Pre-Treating
  - (solid or liquid)
- Pre-Wetting
- Salt Brine
- Weather Forecasting Services



# Know Your Depot's Tools and How to Best Leverage Them

- Not all Depots have access to all materials and/or equipment.
- Each storm is different and may require a different response: (techniques/materials/staffing level)





# What is an “Anti-icing Strategy”?

The application of chemicals at the start of a precipitation event in an attempt to prevent or weaken the bond of ice to the pavement by reducing the freezing point of water.

# Why Anti-icing?


- Anti-icing is proactive
  - Apply chemicals before and/or during the early stages of a storm.
- This creates a brine layer on pavement surface.
- Prevents ice and snow from bonding to the pavement.

# Anti-icing Benefits

- Provides safer roads sooner than deicing
  - Produces black pavement right after storm
  - Less labor and fuel cost
- Uses less chemicals
  - Saves money
  - Less effect on environment
- Reduces wear on equipment, easier to remove snow and ice when not frozen on road surface.



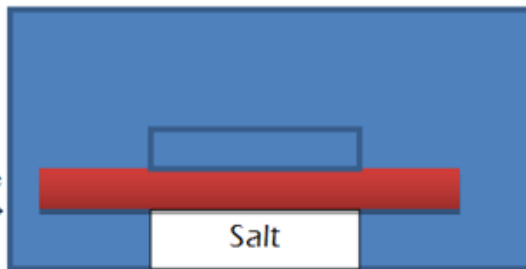
# What Are You Doing?

- Preventing the bond of the ice to the pavement
  - Plowing, not melting, removes 90% of the snow and ice
  - Spread patterns are critical
  - Must calibrate to ensure you're spreading what you want to spread
- 

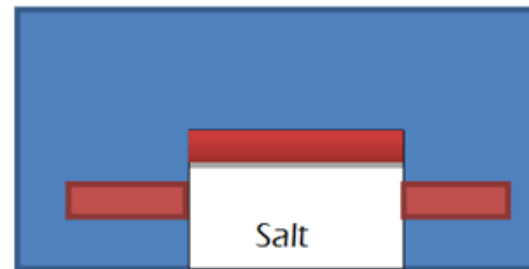
# Calibration Tape Marking

## MATERIAL SPREADER GATE MARKING MAINTENANCE REQUIREMENT

Proper Calibrated Gate  
Door Opening Height→



**Correct** (normally 2.5")



**Wasteful** (Gate open too high)

# Anti-Icing

- Applications will need to be more frequent at lower temperatures and higher snowfall rates.
- Dilution drives the application rate.
- More moisture:
  - More pounds per lane mile
  - More frequent applications



# De-icing

- A reactive approach
  - Chemicals are applied after the snow has accumulated on the road surface.
  - Sand and salt are spread on the top of packed snow and ice that has bonded to the road surface.

Cost up to 6X to melt snow and ice from the top down vs. from the bottom up. (CRRL)

# Policy Decisions

- Levels of Service (LOS)
  - During storm
  - After storm
- Which chemicals to use
- What amounts to use for various storms and conditions
- When to apply them for best results

- We Want to Place the  
Right Amount of the  
Right Materials on the  
Right Road at the Right  
Time.

# When to Apply Materials key to Success!

- Treatment decisions start with paying attention to details.
  - Foreman need to know:
    - Road Conditions
    - Expected Event Duration and Intensity
    - Pavement Temps
    - Traffic Volume & Timing
    - Equipment Available
- Communication with Area Supervisors.



# Why Pavement Temperature?

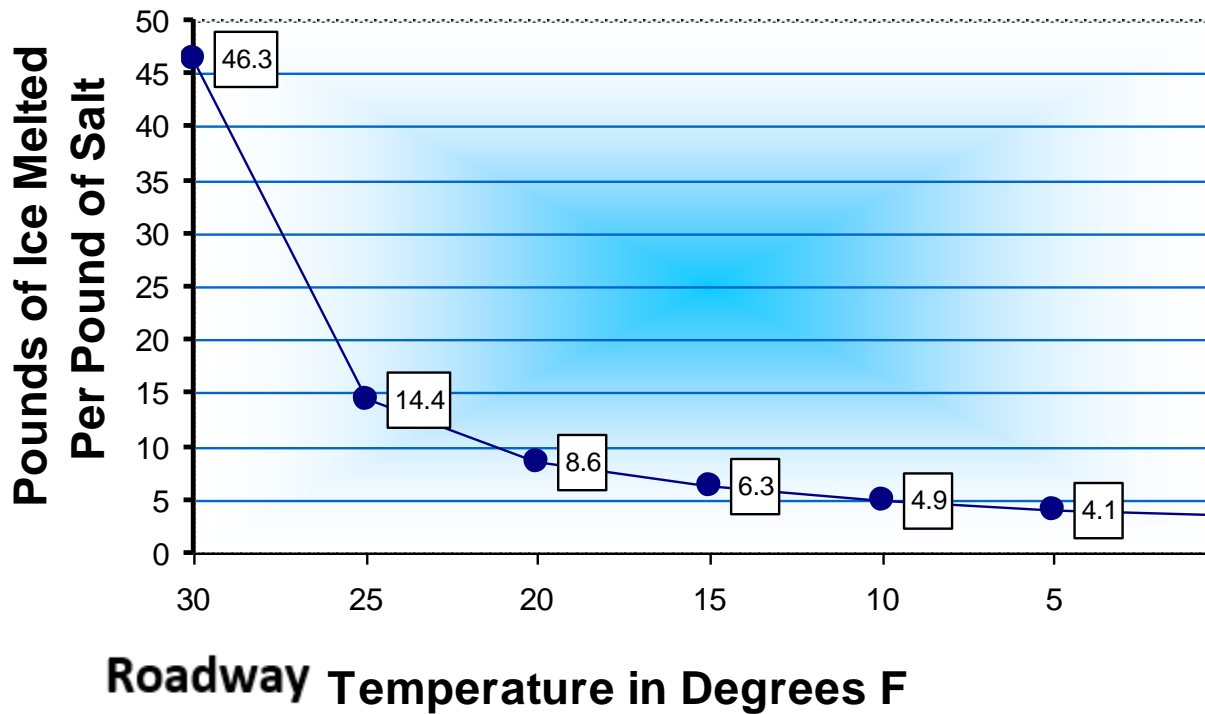
- What's the difference between Pavement Temperature and Air Temperature?
- Often times a LOT! Pavement temps lag air temps
- Think pavement temperature for
  - Chemical choice
  - Chemical form -- dry or prewet
  - Application rate

# Anti-icing Application Rates

- Pavement temperature -- range & trend
- Precipitation type and intensity
  - Light snow, rain, freezing rain, or sleet
  - Moderate snow, rain, freezing rain, or sleet
  - Heavy snow, wet snow, rain, freezing rain, or sleet
- Wheel path -- bare pavement, frost, thin ice, black ice, slush, loose snow, thick ice, packed snow

# Melting Rates

## Melting Rates-NaCl



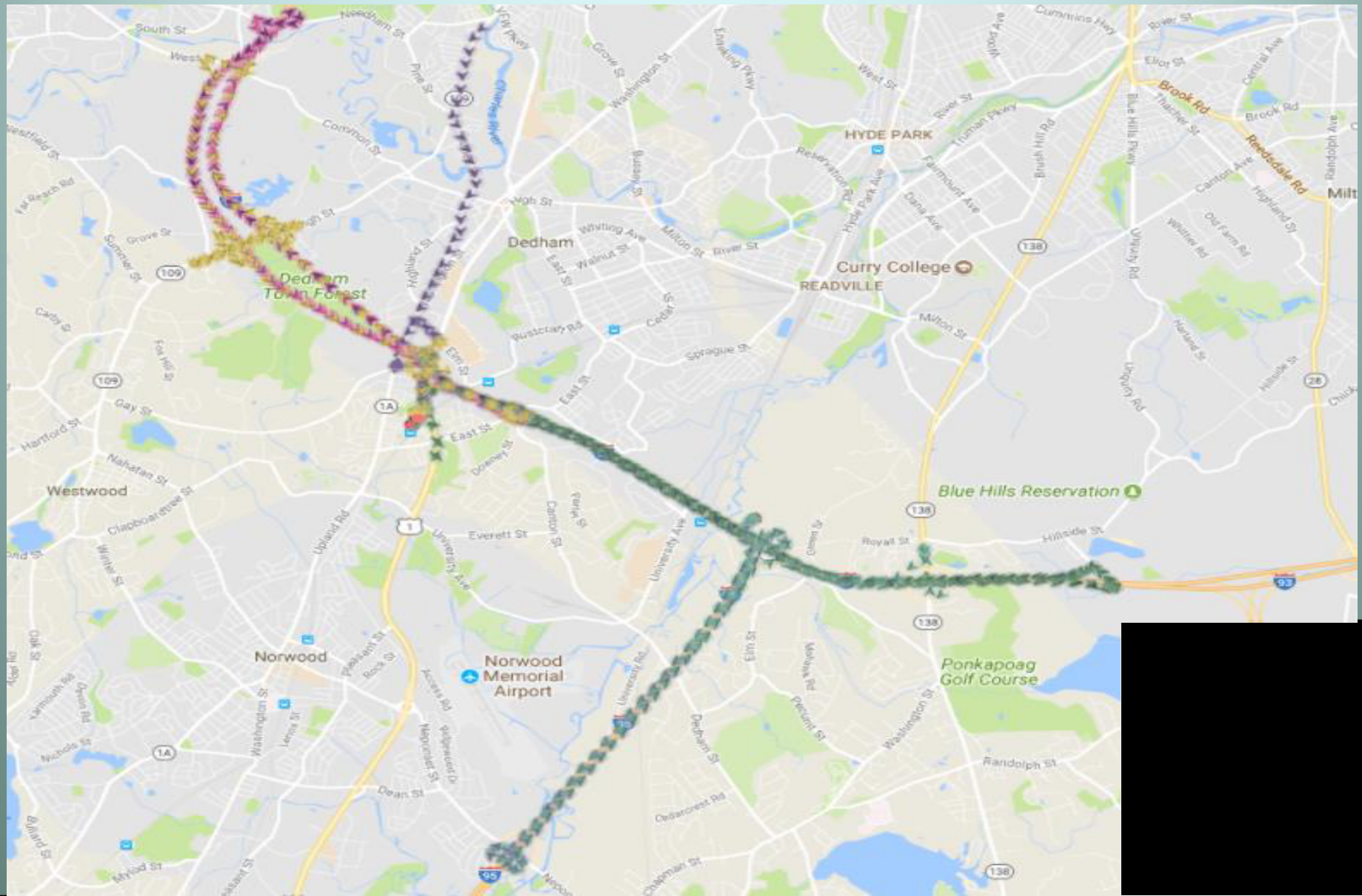
# Salt Application Guidelines

Applying higher applications rates is not the answer. Applying at the proper time is key.

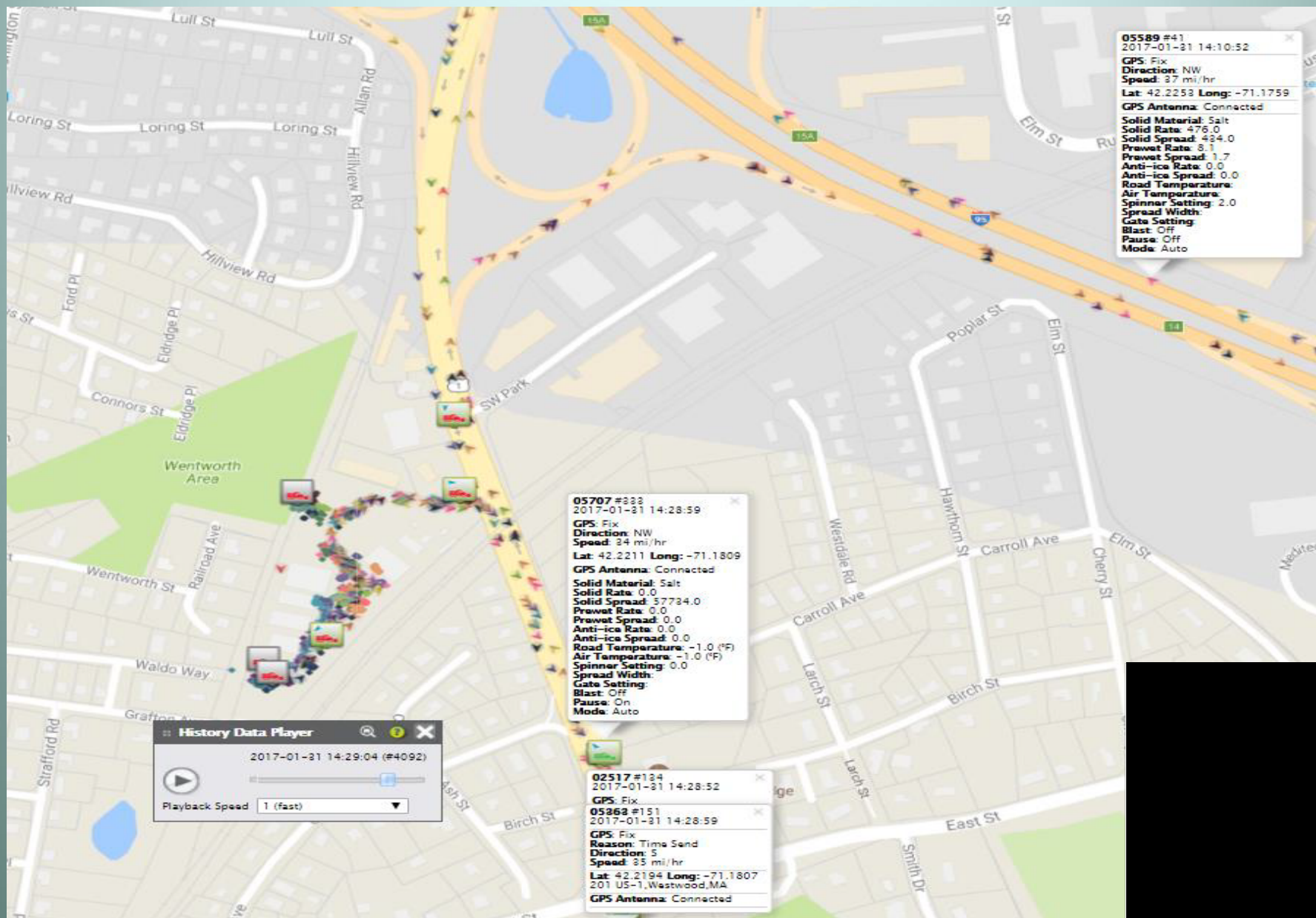
More is not better, when the truck behind plows the salt off, or it's too cold and salt works much slower.



# GPS Data Breadcrumbs



# Material & Equipment Distribution





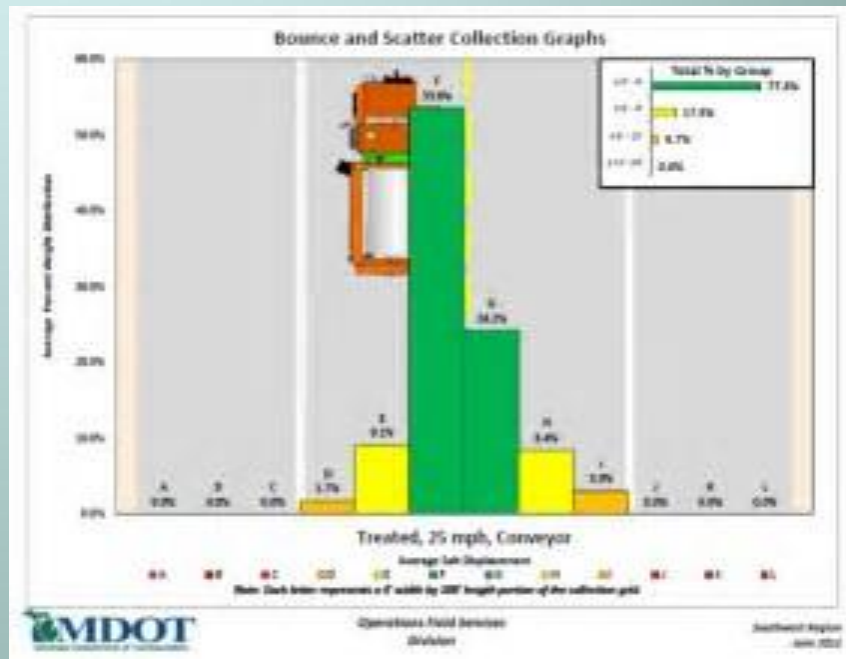
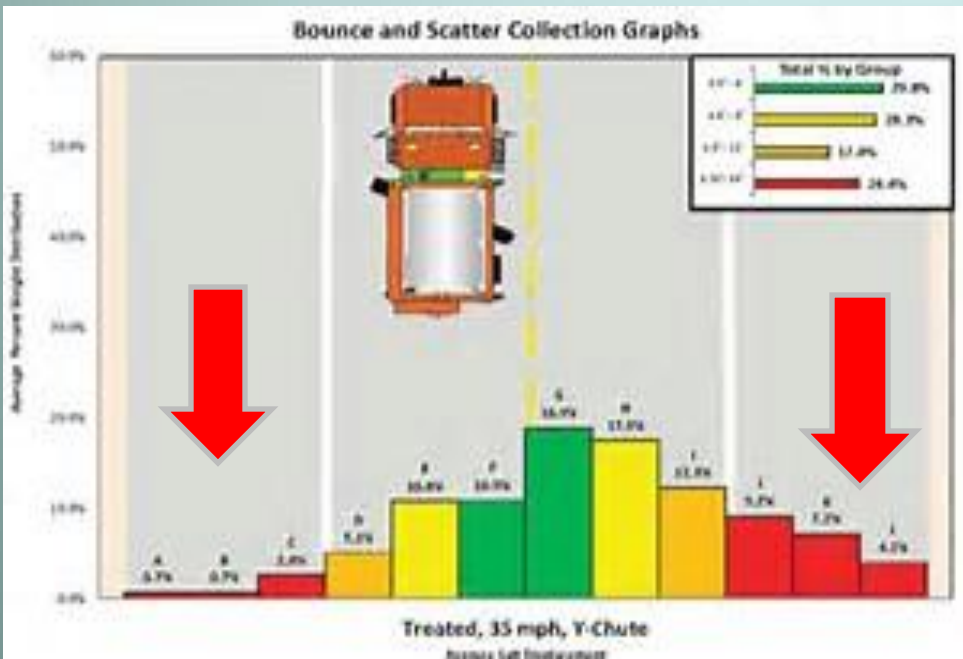


# Mandatory Pre-wetting Benefits

- Higher levels of service
  - Starts melting faster
  - Melt 10-25% more ice with less material
- Less bounce and scatter
- More environmentally responsible
- More cost effective



# Why we Need to Pre-Wet all of the time!



# Mandatory Pre-wetting

- Comparison of bounce and scatter, dry and prewetted salt

Percent remaining on the road after traffic

	<u>Dry</u> <u>Salt</u>	<u>Wetted</u> <u>Salt</u>
5 vehicles at 38 mph	30%	93%
100 vehicles at 38 mph	15%	80%

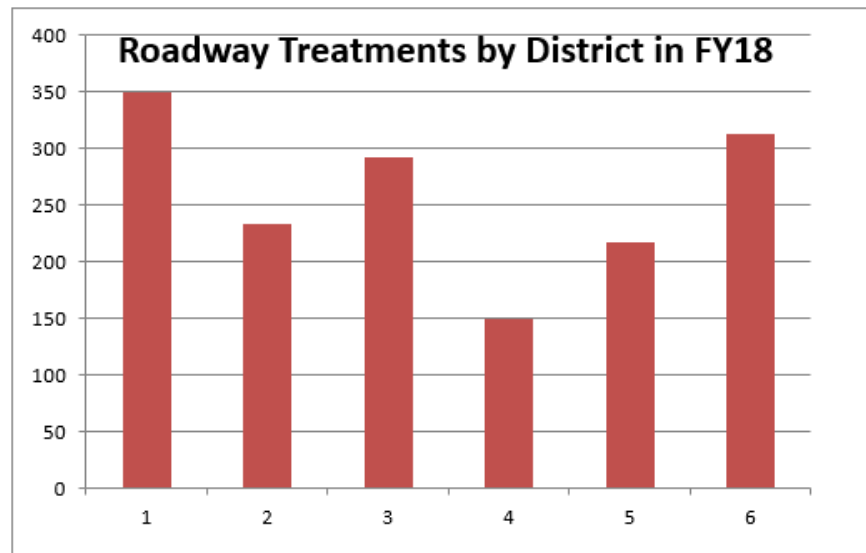
Source: Michigan DOT

# 8 gallons MgCl<sub>2</sub> per Ton of Salt

Liquid Mag Chloride Usage per District FY2019

District	Gallons MgCl <sub>2</sub>	Salt Tons	Gallons MgCl <sub>2</sub> /Ton Salt
1	197,238.78	54,149.12	3.642511273
2	195,306.46	61,699.80	3.165431006
3	539,774.21	91,373.40	5.907345135
4	458,776.24	52,103.51	8.805092785
5	270,008.07	86,573.73	3.118822188
6	56,357.55	45,926.77	1.22711764
<b>All</b>	<b>1,717,461.31</b>	<b>391,826.33</b>	<b>4.38322077</b>

# Pre-Wetting \$alt \$aves



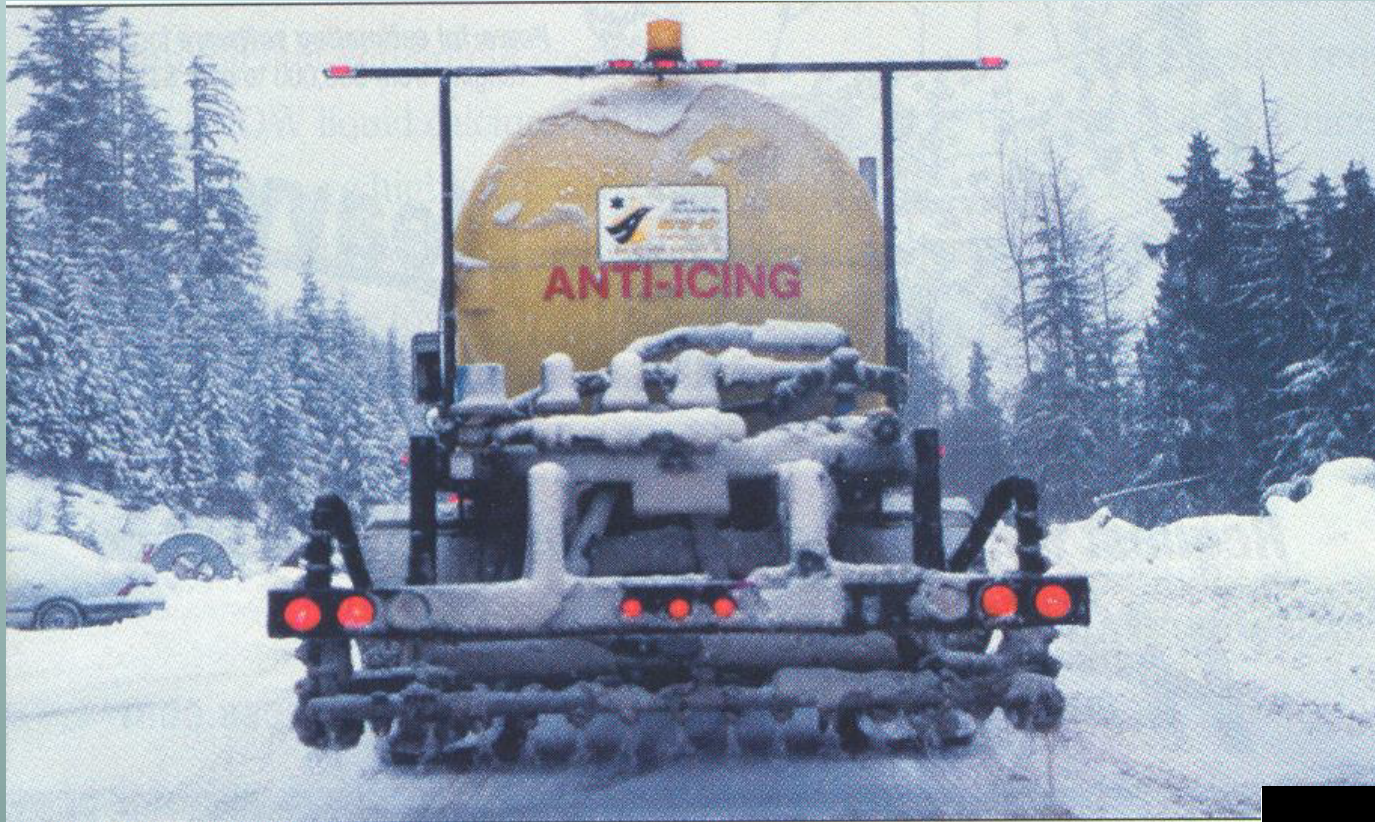
District	Tons/Lane-mi	Treatments in FY18
1	42	350
2	28	233.33
3	35	291.67
4	18	150
5	26	216.67
6	37.5	312.5



# Anti-Icing on Bare Pavement

- Chemical depresses the freeze point of water.
- If spread as solid, needs to dissolve
- Spread before event, forms film on road
- If film maintained, last plowing leaves a cleaner road

# Have to Know how Much!



# What's Happening?

1. Salt is spread on the ice or snow packed surface
2. Salt melts through the snow or ice forming a brine
3. Remaining snow or ice floats on the brine, breaking its bond with the road surface
4. Vehicular traffic breaks through the surface, reducing the snow/ice to plowable slush and moving it to the road side



# RWIS

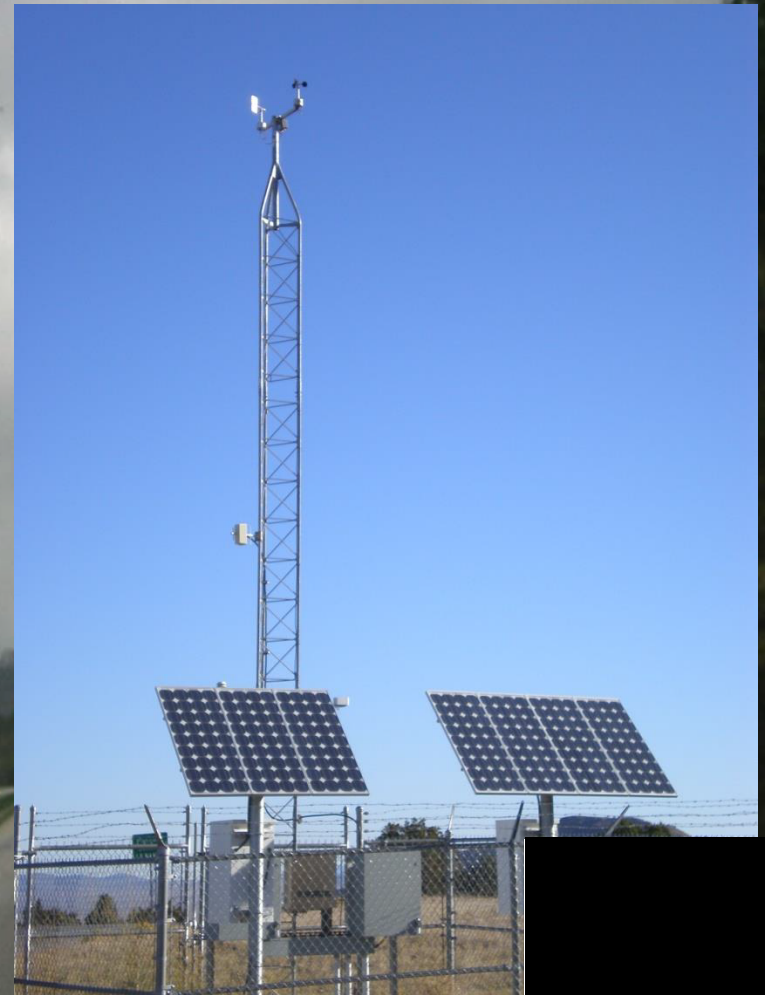
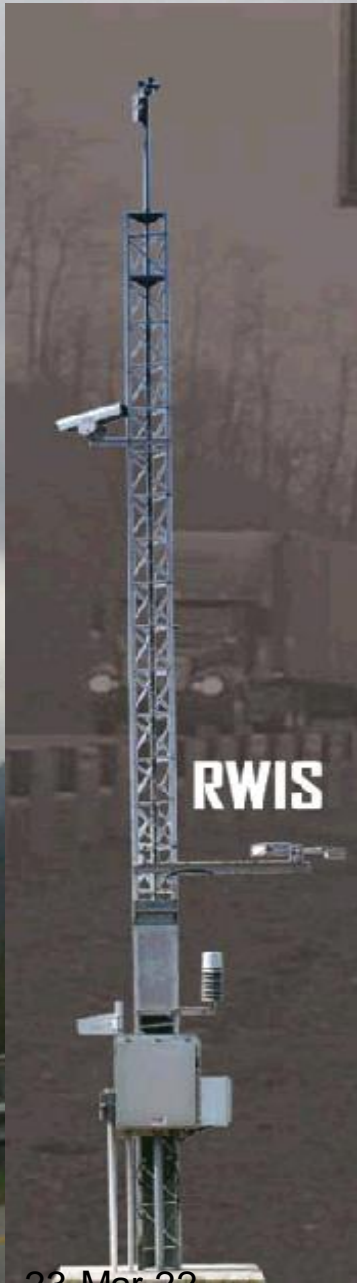
- Roadway Weather Information System
- What does that mean for you?
  - Shared information
  - Interstate sharing of Data
  - Better decisions



Pavement Temperature  
Pavement Moisture  
Frost & Ice Detection  
Chemical Concentration  
Freeze Point Temperature  
Moisture Depth



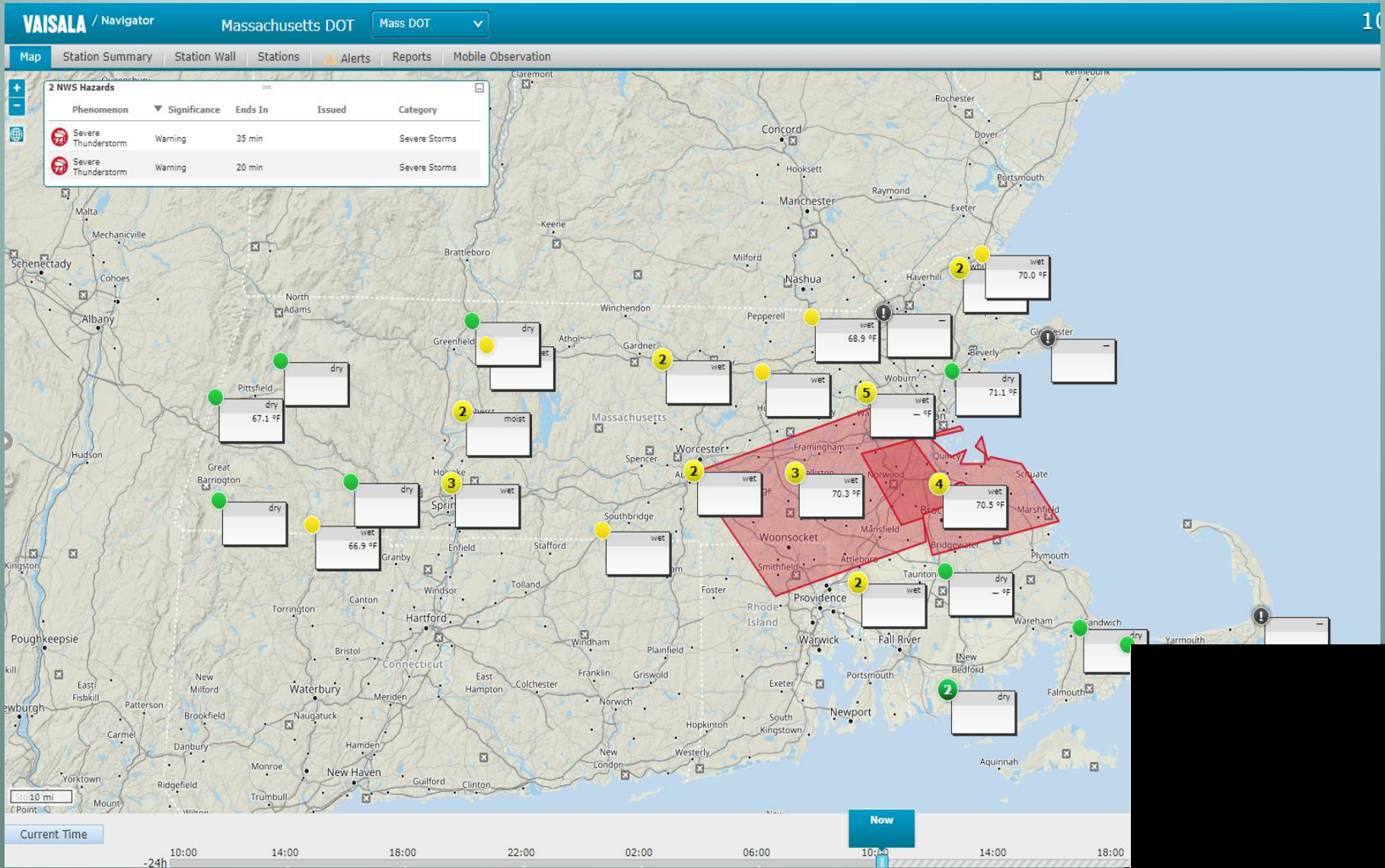
# ***RWIS Mounting Structures***



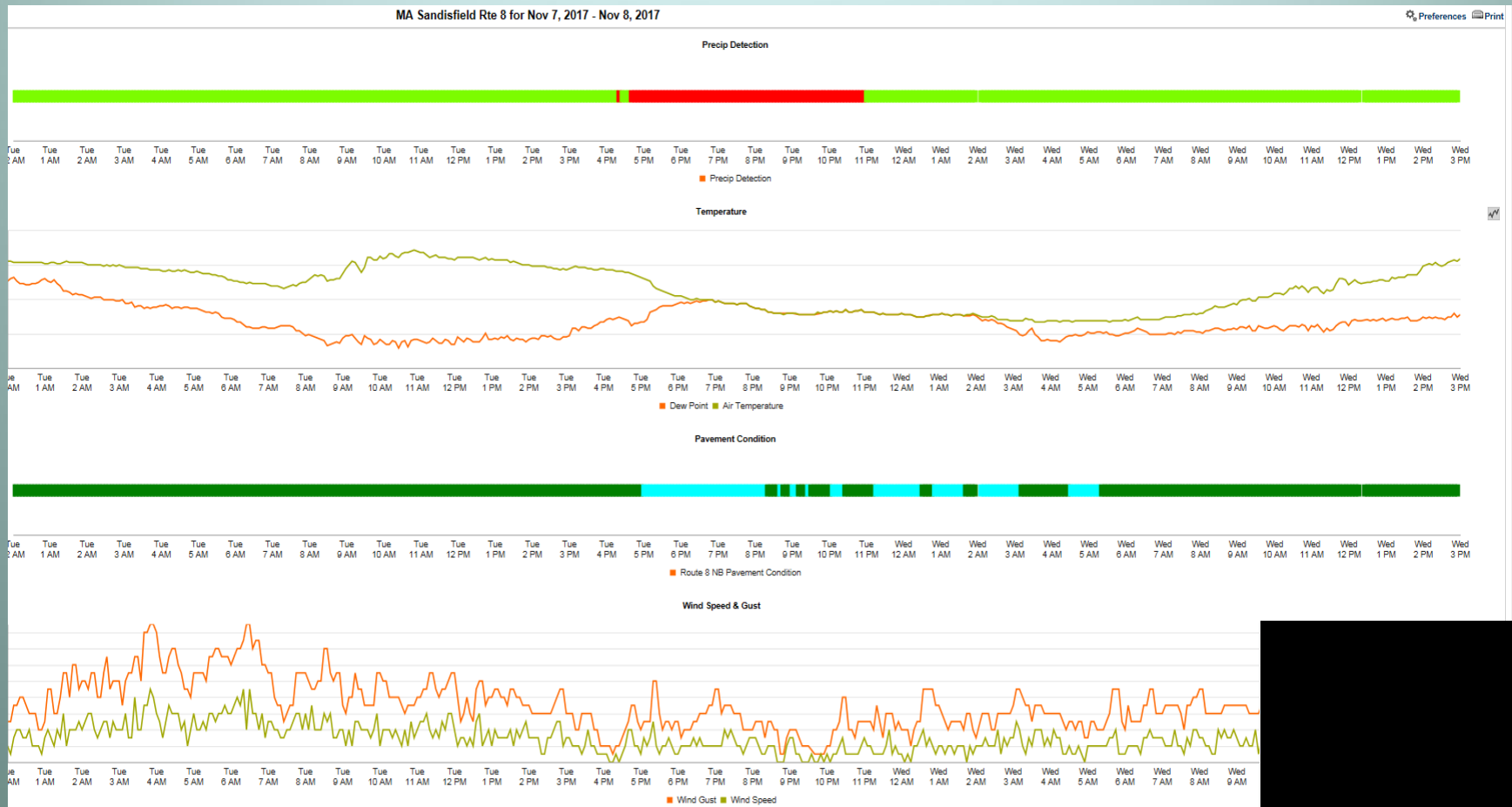
23-Mar-22



# RWIS Network



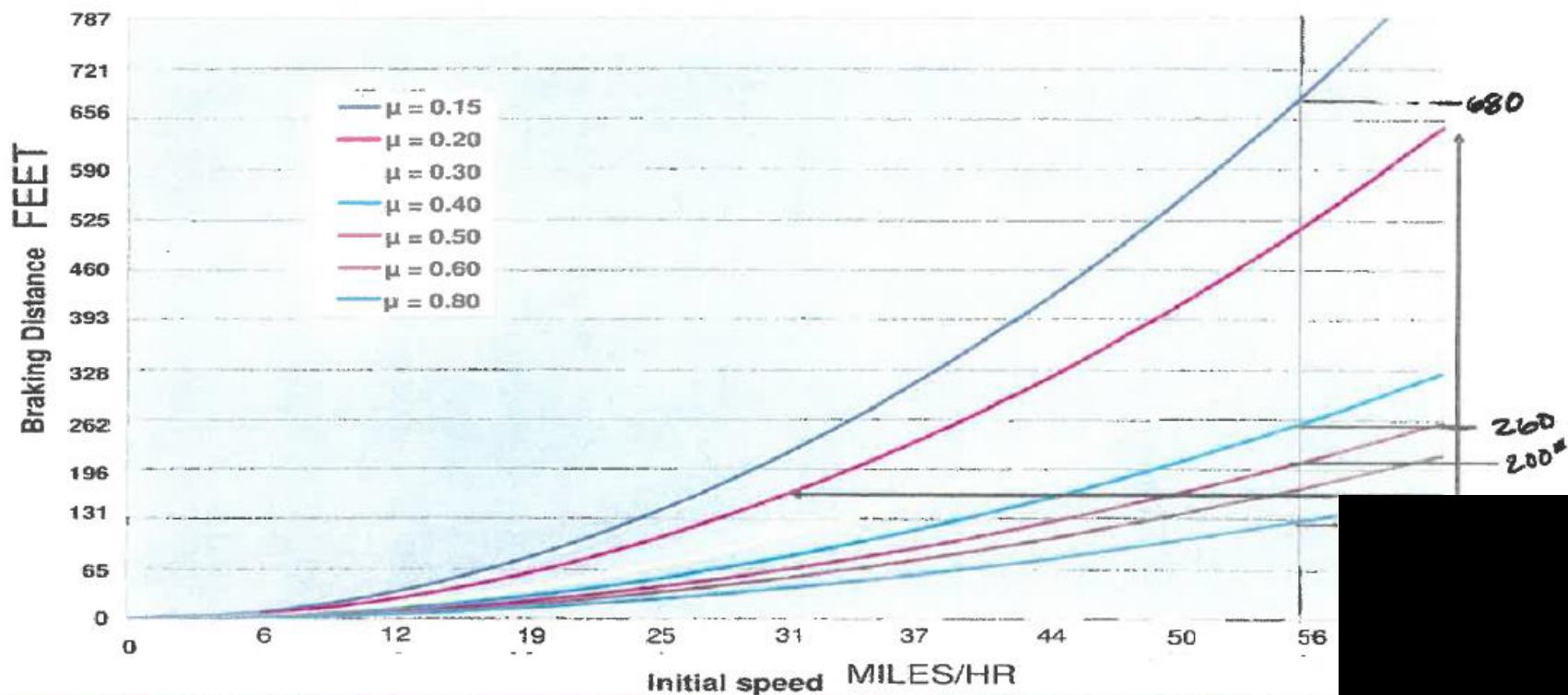
# RWIS Network: 41 Fixed, 4 Movable/Placeable and 25 Fully Mobile





# Grip is a KEY Physical Parameter

## Braking distance vs. initial speed and friction



# *Weather Forecast Center*

*24 Hour, Year-Round Staff of 24 Professional Meteorologists*



23-Mar-22



# Corrosion Issues



# Equipment Issues

- There may not be new equipment
  - Your responsibility is to keep it running
- Wash equipment after a storm
  - When weather permits
    - (32<sup>0</sup> and above)
- Follow MassDOT Procedures
- Use a Chloride neutralizer
- Do circle checks, regularly!



# The 3 Ts

- **Timing is everything!**
  - Be prepared
- **Trust Technology**
  - New Gadgets do work
- **Training is essential at all levels**
  - Train operators as well as consumers
- **And be open to new ideas**

# Teamwork and Professionalism



Rob Gronkowski #87 and Tom Brady #12 of the Tampa Bay Buccaneers celebrate after defeating the Kansas City Chiefs in Super Bowl LV at Raymond James Stadium on February 07, 2021 in Tampa, Florida.

*Mike Ehrmann | Getty Images*

Safety = Success!





# Social Distancing





# Environmental

An aerial photograph of a large dam and reservoir. The dam is a long, grey concrete structure stretching across the middle of the frame. To the left of the dam, a road curves along the edge of a smaller pond. In the foreground, there are several houses and a circular paved area. The background shows a large body of water with several small islands or peninsulas. The word "Environmental" is written in large, white, sans-serif font across the upper portion of the image.

*Laurene Poland, Salt Remediation Program Supervisor  
Cate Kenna, Program Coordinator  
Mike Pelletier, Program Engineer*

# Impacts of Snow & Ice Control

## Public Safety

- ★ Mobility
- ✗ Drinking water

## Economic

- ★ Commerce
- ✗ Material Costs
- ✗ Infrastructure / equipment

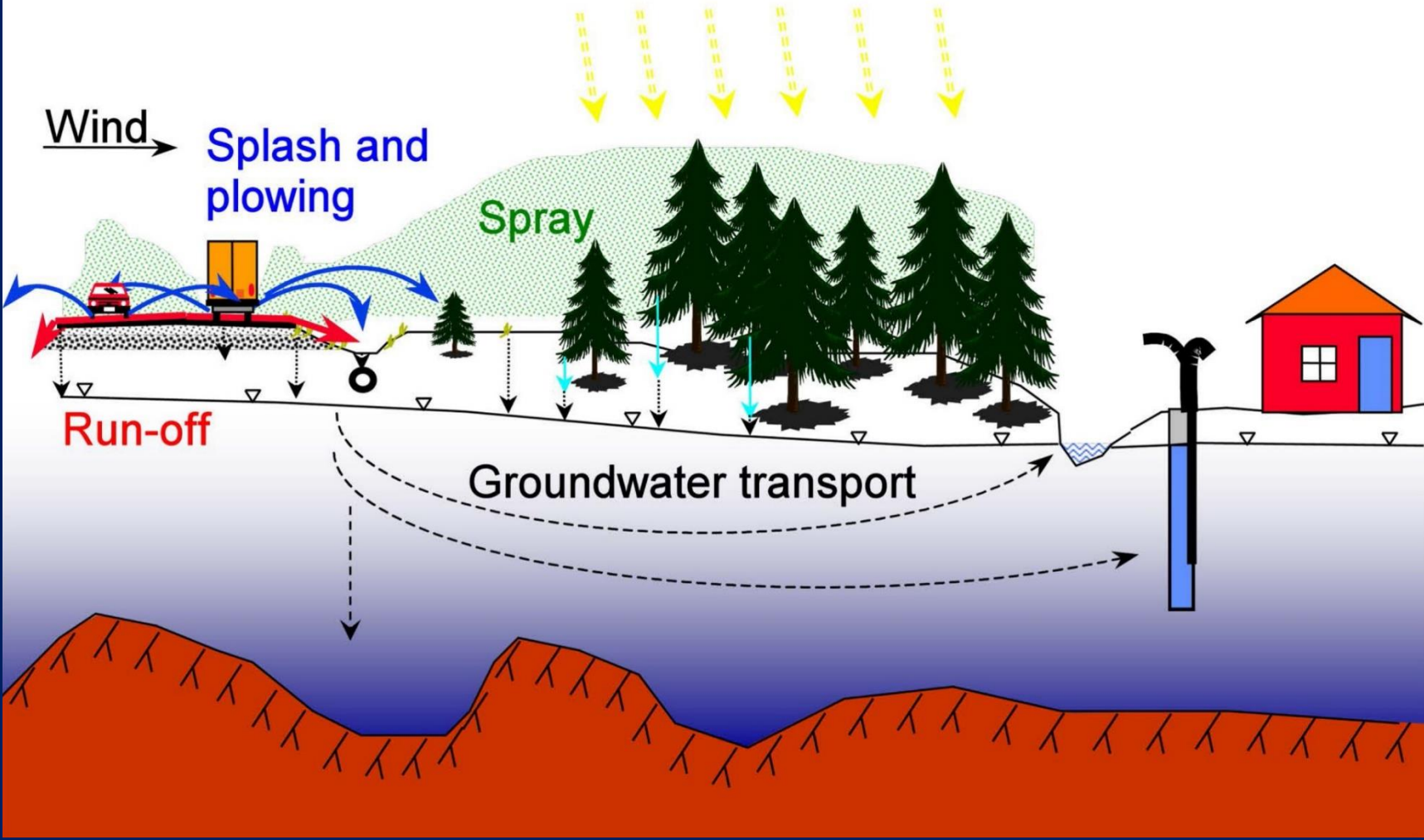
## Environmental

- ✗ Surface water, groundwater, drinking water, storm water, aquatic life, vegetation, soil, air





# Atmospheric deposition



# Salt Remediation Program

- ~ \$1.5 million per year investigating/remediating water supplies, not including millions spent on public water lines.
- Currently there are ~50 private well cases in various stages of the program
  - ~10-15 new complaints each year
- Frequent data requests!
- ESPR
  - Annual Report





# Complaint areas getting larger, more complex

Millions of dollars spent on connections to  
public water supplies!

2019 – Sturbridge: **\$330,000**

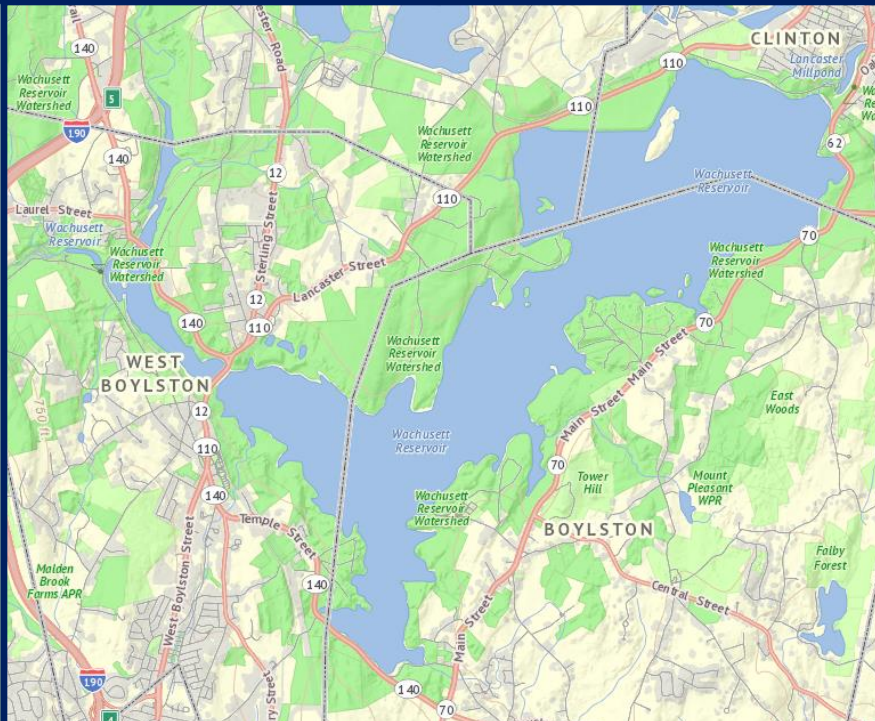
2020 – Wrentham: **\$3 Million**

TBD – Boxborough: 🍔😞

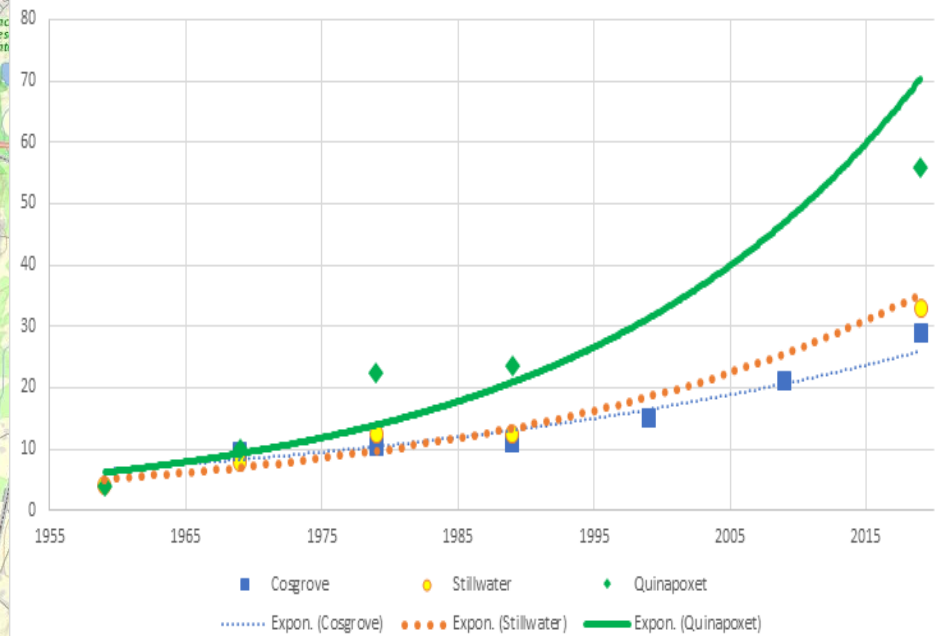


# Complaint areas getting larger, more complex

## Wachusett Reservoir



Sixty Years of Chlorides (mg/L)



*One 10-yard spreader load can contaminate up to 8 million gallons of water!*

=



x 12

*Think about the material and environmental savings we'd have if each spreader can only drop one load PER STORM!!!*



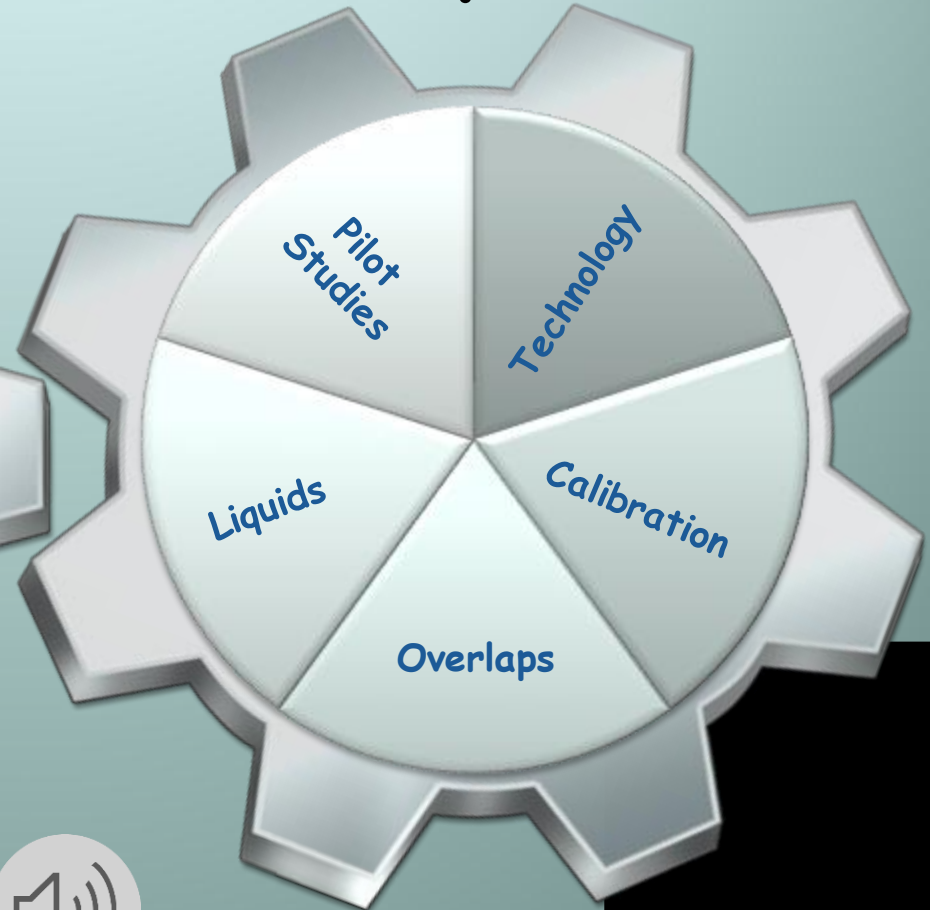
# BMPs / Operational Improvements

*How to get the most from our material...*

## BMPs



## Ops





# Best Management Practices

*How to get the most from our material...*



**Good Housekeeping**  
**No Overloading**  
**Spreaders**



**Check Gate Openings**  
**Reduced Salt Zones**  
**Training**



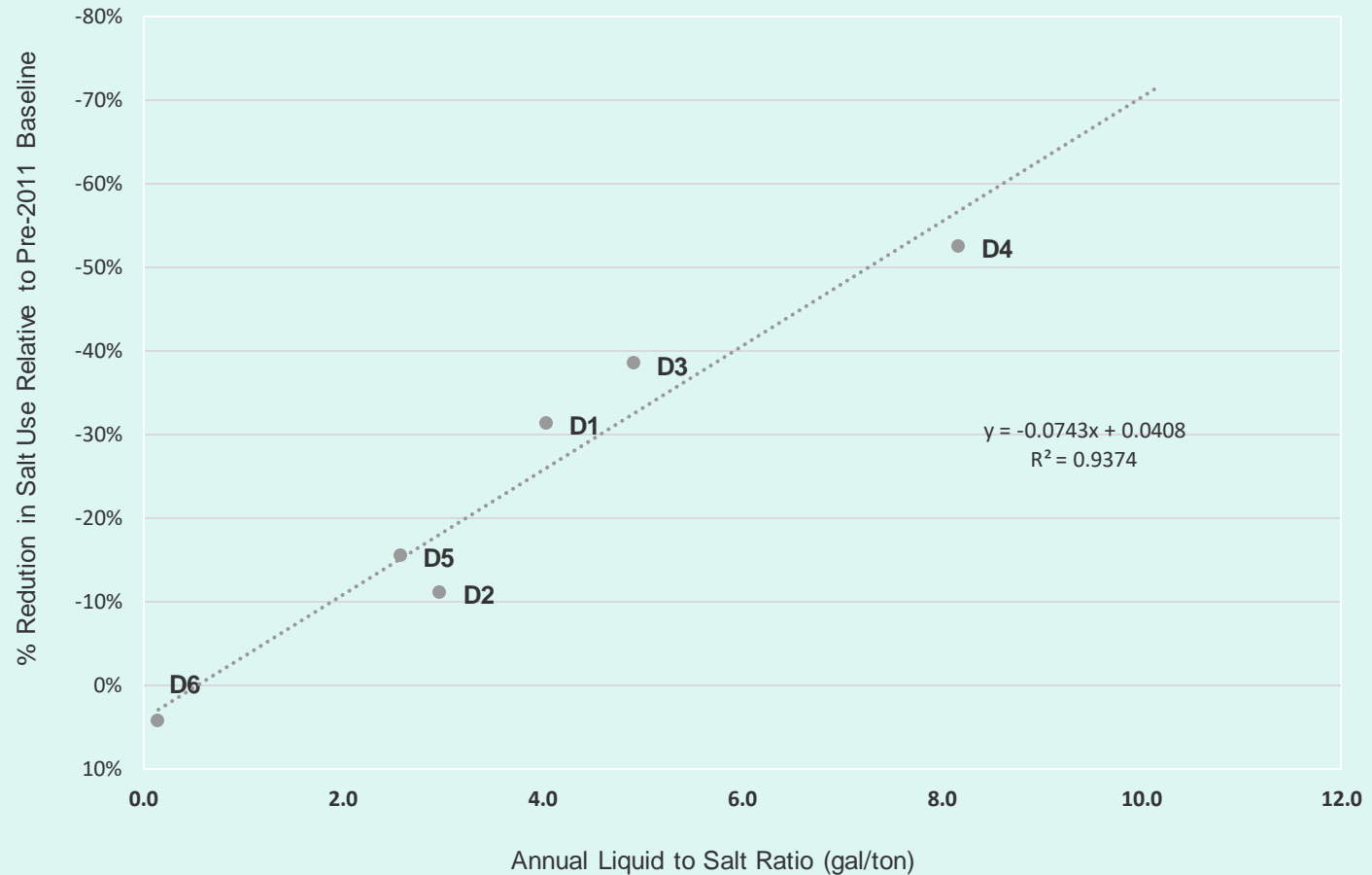
# Operational Improvements

*How to get the most from our material...*

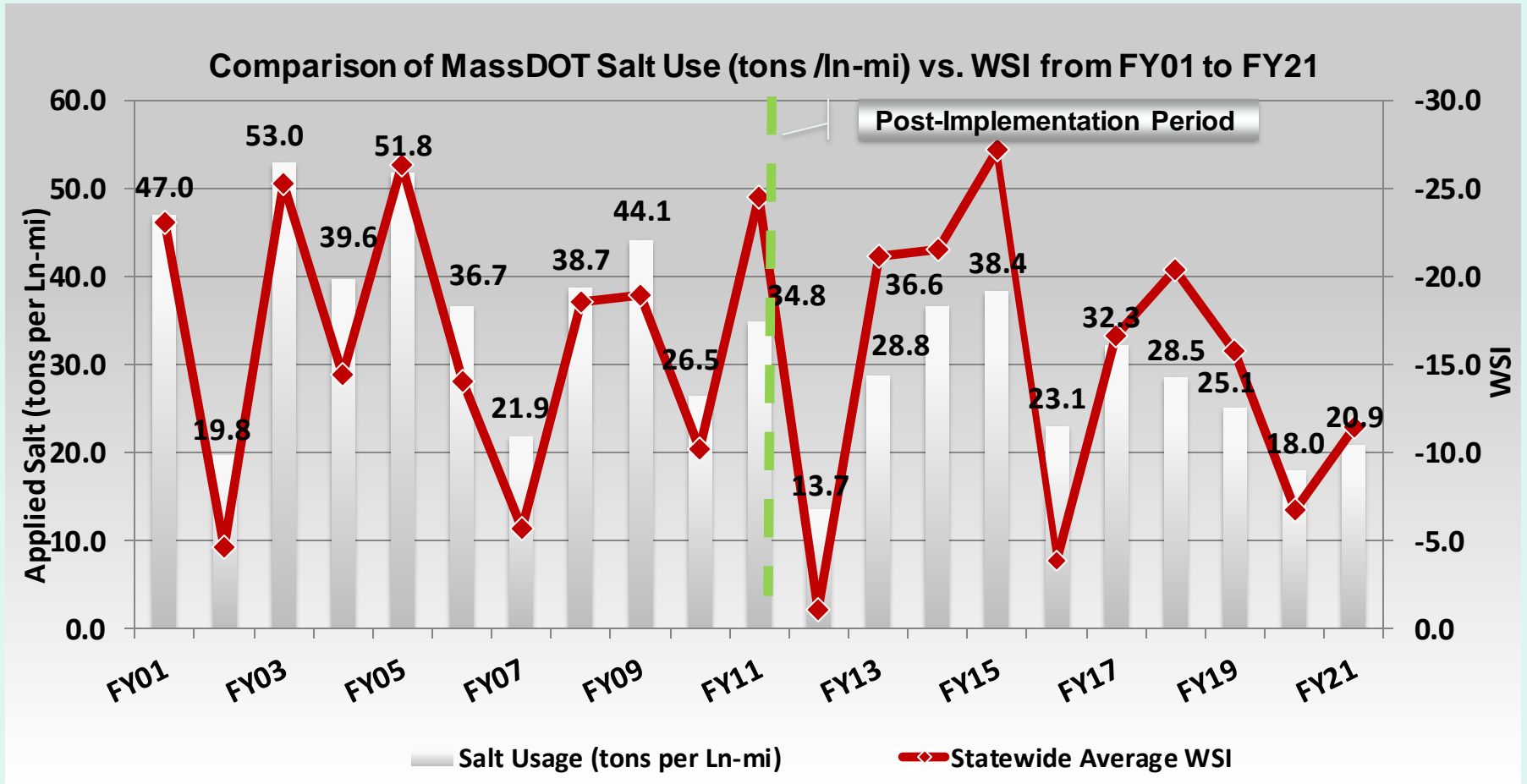


# Liquid Use and Salt Reduction

2021 Liquid / Salt Use Ratio vs % Reduction in Salt Use



# Winter Severity Index





# Something to Consider...

“Potentially the greatest long term environmental threat from road salt is to groundwater, largely because of the process of chloride sequestering, where some percentage of salt remains in the groundwater after a yearly cycle, and that percentage is gradually increasing each year. This means that in the long term (maybe very long term), the water in many aquifers near roads will become unfit for human consumption. **If salting of roads were to end today, vegetation would recover, corrosion would cease, but the salt already in groundwater will persist for decades or even centuries.**”

~Josh Katz, Former Maine DOT Geologist



# District-Specific Concerns

- Each District has its own unique salt sensitive areas which will be shared with each S&I Engineer
- Please reach out to your District S&I Engineer or Salt Remediation Program personnel for new & existing areas of concern for your depot.







**It Will Snow!**

**QUESTIONS?**



**North Texas Tollway Authority located in Plano, TX responses to survey of toll facilities**

**Fort Worth, TX**

**HWY21FH005**

(100 pages)



## SURVEY OF TOLL FACILITIES

The information provided below and attached are applicable to NTTA and may not have applicability to other roadways facilities.

### **General Operations:**

1. Is the toll facility private or state regulated?

NTTA is a political subdivision of the state of Texas, authorized to acquire, construct, maintain, repair and operate turnpike projects across the north Texas region. NTTA serves Collin, Dallas, Denton, Tarrant, Johnson, and Ellis counties and owns and operates the Dallas North Tollway, President George Bush Turnpike, Sam Rayburn Tollway, Addison Airport Toll Tunnel, Lewisville Lake Toll Bridge, Mountain Creek Lake Bridge, Chisholm Trail Parkway and 360 Tollway.

2. When was the toll facility officially opened to traffic?

- From 1968 to present - Dallas North Tollway (various phases)
- 1979- Mountain Creek Lake Bridge in Grand Prairie
- From 1998 to present - President George Bush Turnpike (various phases)
- From 2008 to present- Sam Rayburn Tollway (various phases)
- 2009- Lewisville Lake Toll Bridge
- 2014- Chisholm Trail Parkway
- 2018- 360 Tollway

3. How many lane miles does the toll facility maintain?

- Approximately 1100 lane miles

4. How many days did the toll facility respond to snow and ice removal events in each of the last 5 years?

	2016	2017	2018	2019	2020
Days with Snow and Ice Removal Events	1	1	7	5	0

**Snow and Ice Removal Pre-treatment Operations: Describe and/or provide documentation of the following:**

5. All pre-treatment options and subsequent chemical applications currently used by the toll facility during snow and ice removal events.

- Brine used as pre-treatment; each event is assessed independently for use.
- Material used during winter weather event:
  - Sand
  - Salt (Sodium chloride)
  - Magnesium chloride
  - Calcium chloride

5a. How long each specific pre-treatment option and subsequent chemical applications are effective in treating the roadway after initial application.

- There are many factors such as ambient temperature, pavement temperature, wind speed, type of precipitation that have direct affect in effectiveness of each chemical, due to this complexity. See below for general guidelines used.

5b. Any formal criteria of when to use specific pre-treatment options and subsequent chemical applications.

- Brine - each event is assessed independently but generally used in advance with little to no precipitation anticipated
- Salt (Sodium chloride) - each event is assessed independently but generally used during an event in mild temperatures ranging in 32-28 F
- Magnesium chloride - each event is assessed independently but generally used during an event in temperatures in ranging in 20s and 10s F
- Calcium chloride - each event is assessed independently but generally used in combination with Magnesium chloride during an event with extreme temperatures in 10s F and below range

**Snow and Ice Removal: Describe and/or provide documentation of the following.**

6. An inventory (trucks, plows, front-end loaders, spreaders, etc.) including the number of covered salt storage facilities and quantities of salt that are dedicated to snow and ice removal events.
  - 96 trucks of various sizes equipped with spreaders
  - 13 Plows
  - 14 front-end loaders
  - 14 stockpiles
  
7. Methods/technologies to monitor moisture and ice formation on roadways, highway overpasses, or bridges.
  - NTTA utilizes permanent pavement sensors, Road Weather Information System (RWIS), that can be monitored using an internet-based website at select location. In addition, NTTA staff patrols the roadways and monitors conditions.
  - 7a. If you use sensor detection systems, the systems, and procedures for their use.
    - NTTA utilizes Road Weather Information Systems (RWIS). There are currently sensors throughout NTTA's system. The sensors indicate surface temperature and surface state (dry, wet, or ice). The sensor information is monitored during events by the incident manager.
  
  - 7b. If you do not use sensor detection systems, any future plans by the toll facility to utilize them or other technologies capable of monitoring moisture and ice formation on roadways, highway overpasses or bridges.
    - NA

8. Procedures for snow and ice removal.

8a. If you have formal procedures in place, provide a copy of the established procedures.

- NTTA's Snow and Ice Plan is attached.

9. Training procedures for maintenance technicians who perform spot checks and inspections of road conditions during snow and ice removal events. Provide details on the training procedures necessary to become a spot checker (i.e., initial number of training days/hours, certification requirements, length of annual refresher courses, etc.)

- NTTA conducts in-house training to all employees who work in the snow and ice plan.
- Snow and Ice training material is attached.

**Documentation Checklist: Please provide the following if available.**

- ✓ Pre-treatment options, durations of effectiveness, and criteria for use
- ✓ Inventory of snow and ice equipment
- ✓ Systems/methods used to detect moisture and icy conditions
- ✓ Operational and training procedures for snow and ice removal

Contract between toll authority and state, including snow and ice removal events.

- NA. There is no contract between NTTA and State for snow & ice removal.





**NORTH TEXAS TOLLWAY AUTHORITY**

**ROADWAY MAINTENANCE DEPARTMENT**

# **SNOW AND ICE GUIDELINE**

## **2021 - 2022**

### *NTTA Mission*

---

***“To enhance mobility through responsible and innovative tolling solutions.”***

### *Maintenance Department Mission*

---

***“The NTTA Maintenance Organization will manage the resources and create the business processes to continuously develop and implement asset management practices that will enhance mobility through responsible and innovative tolling solutions.”***

### *Level of Service*

---

***“The goal of the NTTA Maintenance Department is to remove snow and or ice from our roadways as rapidly and practically as possible. This does not always mean pavement will be bare and dry, but it will be passable. While the severity of each winter storm is unpredictable, NTTA will continue to work within its resources to maintain the highest level of customer service possible while balancing efficiency in snow and ice control.”***

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## INTRODUCTION

Snow and ice sanding requires a swift and organized effort to preserve public safety and to sustain a smooth traffic flow on all roadways maintained by the North Texas Tollway Authority. The success of this operation will depend upon the availability and use of manpower, equipment, and material for a rapid response and plan execution.

Snow and ice conditions can represent the elements at their worst. To be able to combat these conditions rapidly and efficiently requires the best efforts of the Maintenance Department and its contractors. Examples of these efforts are as follows:

- Planning
- Preparation
- Informed, skilled, and physically fit crews
- Proper tools, clothing, and facilities for the crews
- Continuous improvement

This plan will apply to all types of winter road conditions that impede the traffic flow on the North Texas Tollway system. This plan will explain the color-coded system of Blue, Yellow, Orange, and Red used by the NTTA to determine a level of response for equipment and manpower. In the most extreme condition, the NTTA utilizes twelve hour shifts for all Maintenance Department employees and all normal day-to-day maintenance operations will be curtailed to emergency repairs only.

This plan will identify the available equipment, routes, employee shifts, Total Routine Maintenance Contractor (TRMC) responsibilities, and other information necessary to provide an organized response to extreme weather and driving conditions.

In October of each year, this plan will be reviewed and updated by the Roadway Maintenance Managers, recommended by the Assistant Directors, and approved by the Director of Maintenance.

Prior to the end of October each year, all affected employees, including the TRMC, will be trained on shift hours, equipment assignments, route assignments, condition types, and what will be expected of them when the plan is implemented.



## GENERAL PROCEDURES

All crew members will notify the Maintenance Emergency Operation Center (MEOC) by calling MEOC via radio phone at (214) 224-2174 if they are sick or unable to work a shift once an Alert has been posted or two hours prior to start of their shift. Failure to do so may result in disciplinary action. No alcoholic beverages will be consumed by a crew member for eight (8) hours prior to a shift start. Failure to comply may result in disciplinary action.

## SAFETY

Safety is the most important part of this plan. The employee shall complete a pre and post-operative check of the equipment to ensure the equipment is safe. All deficiencies will be reported to the mechanic on duty immediately upon discovery.

It is essential that all employees dress for extreme temperatures and wind chill. Dressing in layers is the preferred method. This will allow employees to regulate the amount of clothing necessary for driving, loading, and/or the possibility of flagging or directing traffic for an extended period of time. All crewmembers will wear a Reflective Winter Coat or a Traffic Safety Vest at all times while on their shift.

It is the employee's responsibility to check their assigned vehicle for safety items prior to starting a shift. These include:

- Working Flashlight
- Fire Extinguisher
- Shovels
- NTTA Assigned Handheld Radio (Working and Charged)
- Handheld Radio Charger
- Windshield Ice Scraper
- Vehicle Operations Book

All accidents and/or incidents will be reported immediately. A supervisor, or management equivalent, will travel to the area and handle any administrative procedures concerning the accident/incident. The QC/QA will be notified of any accident/incident immediately and Department guidelines will be used for the employee involved.

## PAVEMENT SURFACE SENSORS

The following locations have permanent pavement surface temperature sensors that can be monitored using an internet based site:

- PGBT at DNT
- PGBT at I-35
- PGBT at I-635
- SRT at DNT
- LLTB
- PGBT at IH30 (East)
- PGBT at IH20 (West)

- CTP at IH30
- CTP at IH 20

The Roadway Crews will rotate or flip all “Watch for Ice on Roadway” signs, to face traffic, on 1 October each year. Signs will be turned to hide from traffic on 15 April of each year.

## STOCKPILE LOCATIONS

Sand, Magnesium Chloride, Salt, and salt brine is used to combat winter road conditions. The deicing and anti-icing material will be procured by the warehouse during the month of September each year. The Roadway Maintenance Manager will be responsible for determining the quantity and/or amounts needed for this plan. This information will be forwarded to the Director of Maintenance for review and approval.

1. The current NTTA stockpiles as of October 2021 consist of the following locations:
  - DNT:
    - MEADERS: SB DNT between Meaders Road and Walnut Hill Lane
    - DNT/SRT: Under the DNT at SRT
    - STONEBROOK: Under DNT at BNSF Bridge
  - PGBT:
    - BRAND: Under PGBT at Brand Rd
    - ALMA: Under PGBT at Alma Road
    - DNT/PGBT: EB side of PGBT at the SW corner of the DNT and PGBT interchange
    - BELT LINE/LUNA: Under PGBT south of Beltline
    - OAKDALE: Under PGBT- WE at Oakdale
  - SRT:
    - EXCHANGE: Under the SRT at Exchange
    - I-35/SRT: Under SRT S/B SRT Frontage Rd just west of I-35
  - CTP:
    - CTP/North: Chisholm Trail Parkway and IH20, Access from CTP frontage roads
    - CTP/South: Chisholm Trail Parkway and SH 171
  - NTTA Facilities:
    - Plano POC: 1080 Ohio Dr., Plano
    - Frisco FOC: 11110 Research Rd, Frisco

2. When the material is purchased and received, it will be stockpiled at the pre-determined locations along with an equipment loader, in accordance with the following table. The following table indicates the capacity of the sand stockpiles. The Roadway Managers will be responsible for determining the appropriate mix of sand and

MGCL based on the pavement type and elevated structures. The Roadway Managers may consider using the larger stockpiles as storage areas to replenish smaller stockpiles between events.

**TABLE - SAND STOCKPILE LOCATIONS**

<b>STOCKPILE</b>	<b>LOCATION DESCRIPTION</b>	<b>CAPACITY</b>
ALMA	Alma under PGBT	1,650 tons
BELTLINE/LUNA	Under PGBT @ Belt Line Rd	2,350 tons
BRAND	PGBT & Brand Rd	1,700 tons
CTP/North	Under I-20 (Fort Worth)	5,500 tons
CTP/South	Under SH 171 (Fort Worth)	3,500 tons
DNT/PGBT	E/B PGBT, SW corner @ DNT	650 tons
DNT/SRT	Under DNT@ SRT	3,500 tons
Exchange	Under SRT @ Exchange	3,600 tons
I-35/SRT	S/B SRT Frontage Rd under SRT@I-35	4,500 tons
MCLB	MCLB compound	100 tons
MEADERS	DNT station 350	1,000 tons
MSC	1080 Ohio Dr.	120 tons
FOC	11110 Research Rd	120 tons
OAKDALE	Under PGBT WE @ Oakdale	4,500 tons
STONEBROOK	Under DNT/Stonebrook Bridge	1,825 tons

## ANTI-ICING AND DEICING MATERIAL

A variety of factors should be taken into account when deciding upon a course of action to treat roadways during snow and ice event. Product application combinations are chosen after Incident Managers have evaluated many factors including, but not limited to:

- air temperature
- pavement temperature
- humidity levels
- dew point temperatures
- cloud cover vs. sunshine
- type and rate of precipitation
- weather forecast
- weather radar data
- traffic conditions (volume, etc.).

Operational treatments are continuously evaluated by the Incident Managers before, during and after a winter storm. Road treatment and applications are modified through all phases of the event based on careful analysis of intensity, duration and type of precipitation.

Whereas anti-icing operations are conducted to prevent the formation or development of bonded snow and ice for easy removal, de-icing operations are performed to break the bond of already bonded snow and ice.

## Anti-icing Material and Applications (Pretreatment)

Anti-icing should be the first in a series of treatment strategies for winter storms. Anti-icing is a proactive approach and one of the most cost-effective and environmentally safe practices in winter road maintenance. Anti-icing, when performed correctly, prevents ice and snow from bonding to the pavement, thus achieving one of the most important goals of winter storm management. Once frozen precipitation has bonded to the pavement, the cost to break that bond in terms of materials, equipment, and labor increases substantially. The following is the anti-icing material that NTTA will be utilizing:

### Salt Brine

Brine is a solution of salt (Sodium Chloride-NaCl) in water. There are two primary sources of salt: solar salt and rock salt. Rock salt exists naturally across the world and is mined for use in numerous industries. Brine also occurs naturally across the world and is a by-product of many industrial processes, such as oil and gas exploration. Brine solutions range from about 3.5% (a typical concentration of seawater) up to about 26% (a typical saturated solution).

Brine can be used for anti-icing or de-icing, but its optimal use is in anti-icing operations. Brine produces similar results as other anti-icing chemicals, but at a fraction of the cost. Brine will be applied with brine distribution units. Brine is applied at rates ranging from 30-60 gallons per lane mile at a 23.3 percent solution. Brine is applied with stream nozzles similar to other liquid anti-icing chemicals.

## De-icing Material and Applications

NTTA primarily uses granular chemicals such as Magnesium Chloride and rock salt as de-icers. Timing of an initial dry solid chemical application for snowstorm events is critical. The application should be made as soon as possible after sufficient precipitation has fallen to prevent loss, but before ice bonds to the pavement.

For initial operations, de-icing granular will be effective when applied soon after sufficient precipitation has fallen, but before ice bonds to the pavement. For subsequent operations, granular chemical treatments will usually be effective when there is adequate moisture or accumulation of snow or ice during later periods of storms. There must also be sufficient traffic volume to keep the material mixed and allow it to go into a solution.

For either initial or subsequent operations, when there is not enough moisture or accumulation of snow or ice on the pavement there is likely to be loss of the chemical from the pavement. This may be caused by the blowing action of traffic, especially from high speed and commercial vehicles, or by particles bouncing off the pavement during spreading.

The following are the granular de-icing material stockpiled at NTTA facilities:

### Magnesium Chloride

is a multi-chloride granular deicer containing sodium, magnesium, calcium and potassium chlorides. These chlorides combined with extremely low insoluble, produce an active chloride level between 99.3% - 99.6%.

With its competitive price and low freezing point, magnesium chloride works well as both a de-icer and anti-icer. It contains a corrosion inhibitor making it less damaging to concrete and steel than other products and it is less harmful to the environment than calcium chloride and sodium chloride.



### Salt (Sodium Chloride, NaCl)

Sodium chloride has been used as an ice-control chemical on roads since early in the previous century. It is produced by three processes:

- rock salt is mined by conventional hard rock mining equipment and techniques
- solar salt is produced by the evaporation of sea water and may contain only a small amount of impurities
- evaporated, solution or vacuum salt is a very pure form made by drying under vacuum the solution resulting from injection of water into deep underground deposits.

### Calcium Chloride

Calcium Chloride is another granular de-icing product that the NTTA has in several stockpiles. Calcium Chloride aggressively melts snow and ice down to -49°F. It is approximately 85% less corrosive than rock salt and 5 times less corrosive than magnesium chloride. The application of Calcium Chloride is reserved for extremely low temperatures, when MgCl and other materials deem to be insufficient.

### Abrasives

The most economical materials used in snow and ice control are abrasives. However, abrasives on the road must be removed and sweeping adds expenses. Abrasives can also cause damage to windshields and auto paint. The addition of chemicals will assist in keeping ice slushy and will expedite melting as freezing temperatures end. The Incident Manager would direct the Pit Boss to use the Liquid Magnesium Chloride in conjunction with sand as necessary. At the NTTA, Grade 5 sand is stockpiled at stockpiles throughout the system. General recommendation of gradation for snow and ice control is as follows:

Sieve Size	Percent Passing
#4	100
#8	95 to 100
#16	65 to 80
#30	20 to 65
#50	0 to 25
#200	0 to 3

## CONDITIONS AND REPOSES

The NTTA uses a color system to designate the level of response, including manpower and equipment. The condition can be upgraded or downgraded as road conditions change. It is the responsibility of the Director of Maintenance, or his designee, to establish these conditions. The Assistant Directors and the Maintenance Managers will provide input as necessary. The conditions levels are:

- **Blue** –Weather forecast indicates freezing temperatures no predicted rain chance
- **Yellow** – Weather forecast indicates freezing temperatures with a small chance of rain, or freezing conditions exist on a portion of the roadway system
- **Orange** – Ice/Snow exists on a portion of the roadway system, or the forecast of freezing weather and rain is forecasted on a portion of the system.
- **Red** – It is predicted (or conditions exist) that 95% of the system has snow/ice on the roadway

### CONDITION BLUE

Blue conditions are called when the forecast indicates a freezing temperature with no rain predicted. This action requires close watch of pending weather conditions. The full emergency management system will not be activated at Blue. The on-call Maintenance personnel will be responsible for responding in the event a trouble spot is identified by the NTTA Safety Operation Center (SOC).

Prior to the end of their regular shift, the Fleet Division will identify a truck and spreader already loaded and ready to respond. The truck number and key will be provided to the on-call maintenance personnel. The TRM Contractor will also have a spreader loaded and ready to respond if called by the SOC. The on-call maintenance staff will notify a supervisor if conditions begin to deteriorate beyond the original weather predictions.

### CONDITION YELLOW

Yellow conditions are called when freezing temperatures are predicted and a slight chance of rain exists. The conditions will warrant a standby crew stationed at each maintenance center. However, the full Maintenance Emergency Management system will not be activated at Yellow.

The Fleet Division will prepare trucks and spreaders based on the number of members of the standby crew. At a minimum the standby crew will consist of 3 maintenance techs and at least 1 supervisor, crew lead or senior technician for a total of four members each roadway. However, the Roadway Manager could increase the number of members on the standby crew at their discretion.

The TRM Contractor will have spreaders loaded and ready to respond as well.

The standby crew will patrol the roadways on routes designated by the Roadway Manager. The SOC will be provided a contact name and PTT number for the standby crew for each maintenance center. The standby crew will treat any areas they discover and/or respond to areas reported by the SOC. The crew will notify a supervisor if conditions begin to deteriorate beyond the original weather predictions.

## **CONDITION ORANGE**

Orange conditions are called when snow and/or ice exist on a portion of the system, or if there is a high chance of freezing weather and precipitation in the forecast for a portion of the system. The conditions will not warrant the Maintenance Department Emergency Management system to be activated. However, the Maintenance Department will have a twelve hour shift. At this condition level it is expected the conditions will not exceed the first twelve hour shift.

The Fleet Division will prepare trucks and spreaders based on the number of members of the standby crew. At a minimum crew will consist of 6 maintenance technicians and at least 1 supervisor, crew lead or senior technician for a total of four members each roadway. However, the Roadway Manager could increase the number of members on the crew at their discretion.

The crew will patrol the roadways on routes designated by the Roadway Manager. The SOC will be provided the name a contact information of the senior member of each crew for each maintenance center. The crews will treat any areas they discover and/or respond to areas reported by the SOC. The crews will keep a sanding log for each event.

The crew will notify a supervisor if conditions begin to deteriorate beyond the original weather predictions.

The TRM Contractor shall provide the full capacity of subcontractors for snow and ice response, or a number as determined by the Roadway Manager.

The crew will notify a supervisor if conditions begin to deteriorate beyond the original weather predictions.

## **CONDITION RED**

Red conditions are called when the system has, or is forecasted to have, 95% coverage of freezing conditions and precipitation. This condition will exist as long as freezing rain, sleet, moderate to heavy snow, icy or packed snow exist on the system. The Red condition will require all Department employees to work 12 hour shift. All normal day-to-day maintenance operations will be curtailed to emergency repairs only while in this alert. The Maintenance Department Emergency Management system will be activated as described below.

The Incident Manager will notify all Managers and Supervisors of the condition and provide instructions as to what time the plan will become active. The Incident Manager will notify the SOC of the condition and provide the contact information for the Maintenance Emergency Operation Center.

The Fleet Division will provide a list of trucks and spreaders available for use to the Incident Manager. In addition, the Managers and Supervisors will provide a list of available personnel to the Incident Manager.

The initial assignments for each sand stockpile are included in this plan. However, the Incident Manager will review the vehicle and employee availability information and modify the route assignments as necessary. The changes will be made prior to the Pit Boss shift change and a list of employees with route assignments will be provided to each Pit Boss as they start.

The TRM Contractor shall provide the full capacity of subcontractors for snow and ice response, including the onsite supervisor to assist in the Maintenance Emergency Operations Center.

## CREW REPORTING

Upon notification, first shift crew personnel will report to the Plano Operation Center (POC)/Frisco Operation Center (FOC) at least one hour prior to the start of their shift. All personnel will clock-in when they arrive and clock-out when they leave from work. Crews will be given road condition, safety briefings, equipment checks, and administrative requirements. The drivers will then go to their assigned stockpile locations for material loading and begin the routes.

All subsequent crews will first report to the POC or FOC depending on their assigned route. They will be transported from the POC or FOC to the stockpile where they will make the shift change. The replacement crews will perform a maintenance check on their vehicle prior to beginning their routes. Both the incoming and outgoing driver will insure the Vehicle Operations Book is up-dated and all forms are completed at the beginning and the end of each shift. It is extremely important these forms be maintained correctly and in a timely manner. Managers, Supervisors, and Crew Leaders will spot check the Vehicle Operations Book throughout the operation. Each driver will be responsible for the book during their shift. This includes:

- Route Map familiarity and stockpile locations
- Special driver instructions
- Crew Shift personnel
- Maintenance of the Sanding Log
- Maintenance of the Special Time Sheet
- Maintenance of the Pre/Post Vehicle Operational Check-List

No crewmember will leave their assigned route without supervisory approval. Reloading their vehicle is the only exception. When fuel gauges drop below half a tank, crewmembers will notify a Crew Leader or Supervisor that fuel is needed. Unit fuel cards will be issued to each truck. The supervisors need to be informed of where the unit is going for refueling. Refueling activity is recorded on Fuel card statement. See the “Refueling Plan” section for the refueling procedure.

All crew members will notify the Maintenance Emergency Operation Center (MEOC) by calling MEOC via Radio or phone at (214) 224-2174 if they are sick or unable to work a shift two hours prior to start of their shift. Failure to do so may result in disciplinary action.

## PUBLIC INFORMATION AND MEDIA RELATIONS

Regular reporting from Maintenance Department to SOC (TIM Department) and Communications Department has become a normal procedure during Snow and Ice events. A typical report includes detailed information from Maintenance Department that can be used to answer public complaints and requests for information during the event. This information is also used to update board members and executive management.

### What to Include

The information that should be included in a report from a Maintenance Department to Communications are:

- The time that the snow and ice fighting operations began and the time operations ended



- What type of response has been activated? For example are the crews applying de-ice materials? Are the crews plowing snow? Are the crews plowing snow and applying ice control materials?
- The depth of accumulated snow on the roadway surface and general roadway conditions.
- Information needs may increase during longer periods of winter weather such as anticipated manpower or equipment needs.
- Challenges the crews are facing, or areas that still requires additional attention and manpower.

### **End of Event Report**

At the end of every event the Incident Manager on duty will provide the Director Maintenance Department with a report with the following information:

- The time event was call on, the time event was called off, days in the event, average low temperature during the event,
- Total manpower, number of truck and equipment utilized,
- Total quantities of material used,

## **RESPONSIBILITIES UNDER THE EMERGENCY MANAGEMENT SYSTEM**

### **Incident Manager**

- Has the authority to call the start and end of the Event
- Manages all operations for the Event and the execution of all operations
- Maintains close contact with subordinate positions
- Ensures safe operations
- Provides periodic predictions on Event potential
- Reports any significant change in Event status
- Maintains close communication with Pit Bosses
- Maintains close communication with Fleet Liaison
- Directs time of application of Magnesium Chloride, Salt, Brine, and liquid de-icer and other material
- Reassigns personnel as needed during the Event
- Establishes specialized data collection systems as necessary (e.g. weather forecasts, pavement sensors, etc.)
- Collects and manages all Event relevant operational data
- Supervises preparation of the Snow & Ice Plan
- Conducts and facilitates planning and/or training meetings

### **Logistics Manager**

- Keeps an active log of
  - all calls received from SOC,
  - time of application of MD20, Brine, and Calcium Chloride
  - screen shots of temperature sensors
  - problem areas
  - shift changes
  - truck or route reassignments
  - decisions made during the Incident Manager shift that the oncoming shift needs to be aware of

- Acts as the point of contact for the Public Affairs Department. Proactively provides Event status information to Media Relations Officer for website update.
- Updates material (MD20, Sand, etc.) inventory using the information provided by Pit boss

### **QA/QC**

- Ensures all operations are in compliance with the plan
- Ensures adequacy of methods and materials
- Reports to the Incident Manager on areas of need
- When an NTTA employee is involved in an accident, respond to the scene of accident. Coordinate with Nova for drug testing or transport the employee to Nova. Fill out all necessary forms and documentation.

### **Fleet Liaison**

- Informs the Incident Manager when a repair is complete and the truck is ready to go back on route, also turn the keys to the Incident Manager to assign the truck as necessary.
- Updates the list of “Vehicles Available Not on Route” and “Truck/Equipment Down List” throughout the event.
- Keep an active log of trucks returning to MSC for repair, include the operators name, truck ID, mechanical diagnosis, time truck entered the Service Center, time the truck was repaired
- Ensures that serviced trucks are parked in the designated area and have the correct indicators (Red Tag for non-functioning, Green Tag for serviced and available) displayed on the windshield.
- Coordinate delivery of fuel to sand stockpiles for loaders, possibly using the staff waiting on the equipment to be repaired
- Coordinate repair of the loader at sand stockpile as needed.

### **Pit Boss**

- The supervisor or lead assigned a dually truck with a spreader responsible for the section of roadway covered by their assigned sand stockpile
- Transport of truck drivers between the Operation Center (POC or FOC) and stockpile locations.
- Sand and/or MD-20 spreading at trouble spots, thus allowing dump trucks to remain on assigned routes
- Any other immediate needs or emergencies during an icing event
- Communicate with Incident Manager the location of trucks when they are off the route for any reason (i.e. refuel, reload, breaks, etc.)
- Keep an Activity Shift Log with details such as crew break times, personnel reassignment, truck reassignment, etc,
- Transfer the Activity Shift Log to the oncoming Pit Boss at end of his/her shift.
- Reports any accident involving a Maintenance employee and have the employee transported to Care Now by Liaison Manager
- Coordinating of service to ensure timely effective coverage
- 

### **Snow Plow Operators**

- The snowplow are responsible for maintaining a positive work environment to enhance the teamwork concept;
- Provide a timely, effective service for their designated routes;
- Maintain vehicles, plows and spreaders in safe working order; and

- Serve as good-will ambassadors for NTTA.

### **Administrative and Support Services:**

- FOC Warehouse would only operate during daytime shifts. MSC Warehouse will be open 24 hours during the event to support Fleet.
- Two designated warehouse personnel will be assigned to each shift to provide logistical support and issue necessary supplies for the operation.
- One designated electrician will be assigned to each shift to handle any electrical emergencies that may occur.
- Two designated mechanics will be assigned to each shift to handle any mechanical problems that may occur. During the event MSC Fleet shop will be open, FOC Fleet will be closed.

### **Buildings & Facilities**

#### **Gleneagles**

- Two designated Facility persons will be assigned by the Facilities Manager to clear ice and dispense (spread) deicing material (Magnesium Chloride or equivalent) to sidewalks and walkways at GE.
- The Maintenance Emergency Operation Center (MEOC) will dispatch a truck to spread sand on the parking lot. If upon arrival the designated Facility persons find the parking lots are treacherous, they should contact the MEOC to request deicing.
- These personnel will assume their regular support duties once the grounds have been adequately deiced.
- These personnel will also serve as back-up drivers and will be available for assignment when necessary.
- After the event, these persons will be responsible for clearing and disposing of deicing materials from the sidewalks and walkways at GE.
- The third Facility person typically scheduled for day shift at GE, will begin working a night shift to support the snow and ice effort.

#### **MSC, FOC and Plazas**

- Two designated Facility persons will be assigned by the Facilities Manager to clear ice and dispense (spread) deicing material (Magnesium chloride or equivalent) to sidewalks and walkways at the MSC, the FOC, the Main Lane Plazas, and Toll Tag Stores.
- The Incident Manager will dispatch a truck to spread sand on parking lots. If upon arrival the designated Facility persons find the parking lots are treacherous, they should contact the MEOC to request deicing.
- At the MSC, these personnel will assume their regular support duties once the grounds have been adequately deiced.
- When visiting the FOC and Main Lane Plazas, after deicing the sidewalks and walkways, the secondary assignment will be to mop up any standing liquids, empty trash containers, restock paper dispensers and quickly clean any restroom equipment, (sinks, toilets, urinals) needing immediate attention.
- These personnel will also serve as back-up drivers and will be available for assignment when necessary.
- After the event, these persons will be responsible for clearing and disposing of deicing materials from the sidewalks and walkways at the MSC and the FOC.
- The remaining Facility team members typically scheduled for day shift on the System will begin working their assigned Snow and Ice Event schedule.

### **Electrical Division**

- Electricians will be working on 12 hour shifts.
- Electrical Division will be responsible for turning the lights at the stockpiles when the event is called.
- Electricians will be assigned to duties such as helping at Fleet Mechanic shop, driving a fuel truck to stock piles, etc at the direction of Incident Manager on duty.
- The Incident Manager will dispatch the electricians on duty when an electrical emergency arises such as down light pole, need for generators, etc.
- These personnel will assume their regular support duties once the emergency situation has been handled.

### **Safety Officer**

- Monitors incident operations and advises the Incident Manager on all matters related to operational safety
- Has authority to stop and/or prevent unsafe acts
- Coordinates safety management functions with other departments and agencies

### **Maintenance Emergency Operations Center**

During an event the conference room at the Maintenance Service Center is called the Maintenance Emergency Operation Center (MEOC). Incident Manager, Logistics Manager and the Liaison Managers will be working from this location. MEOC is equipped with a magnetic white board. At the beginning of each event, equipment number and name of all employees are displayed on the board. At the end of each shift, the name of the employee would be replaced with the oncoming employee on the assigned route. It's the Pit Boss's responsibility to notify Incident Manager that the shift change for each route has happened.

Anytime during the event, if equipment (spreader or truck) needs to return back to fleet to be serviced, the Pit Boss will notify the Incident Manager and provide the truck number that will be arriving at the fleet. The Incident Manager or Liaison Manager will make necessary changes on the white board based on the communication received from Pit Bosses and Fleet Liaison on duty.

### **Material on Hand**

During the event Pit Bosses will notify the Incident Manager of how much material has been used. The Operations Manager will keep an approximate quantity of material on hand. Each bin at stockpile is outfitted with color tabs on the wall; the colors designate Full, Three Quarter Full, Half Full, and Quarter Full. When the Incident Manager has called the Pit Boss for inventory count, the Pit Boss will respond with the Bin Number, what color tab, and an approximate height of the material in the bin.



## EMERGENCY MANAGEMENT CHAIN OF COMMAND

## **OUTSOURCED EQUIPMENT AND LABOR**

The TRMC is responsible for providing 24 hour coverage of all TRM assigned routes.

### **PGBT and MCLB**

#### **Contract Overview**

The Total Routine Maintenance Contractor (TRMC), will provide (32) dump trucks equipped with snow and ice spreaders and drivers, (7) dually trucks equipped with snow and ice spreaders and drivers, and (4) snow plows and drivers during the months of November through April for Snow & Ice events in an effort to increase our efficiency and manpower. The TRMC will also provide front end loaders at seven (7) locations identified on the drawings for the contractor to use in response to a snow and Ice event. These vehicles and equipment will be incorporated into the existing driver routes and schedules. Outsourced drivers are expected to act in accordance with the route plans and procedures.

The TRMC will provide a manager for the Snow and Ice program that has a minimum of five (5) years experience in managing and directing Snow and Ice mitigation programs.

TRMC Managers and Supervisors will initially report to the NTTA Maintenance Center, located at 1080 Ohio Drive in Plano, Texas for standby events. TRMC Managers and Supervisors will report to 4001 PGBT in Plano, TX for live events. Upon arrival, they will be supplied with necessary equipment and instructions. Drivers will be required to work during snow and ice events until released by the NTTA. In the case of a forecasted event, the schedule will be set in advance, if possible. In this case, contract drivers and trucks shall report one hour prior to the scheduled beginning of the event. In the case of an event that is not forecasted, the Contractor shall furnish (43) drivers for the (32) Tandem dump trucks, (7) dually, and (4) snow plows, and (7) operators for the (7) front end loaders within 2 hours of notification. All other drivers and trucks shall report within 4 hours.

#### **Contract Conditions**

The TRMC will be responsible for providing fuel for the trucks, loaders and sand spreading self contained equipment.

The TRMC will provide maintenance personnel during a snow and ice event to respond to maintenance issues of TRMC snow and ice equipment.

Vehicular Damage and Mechanical Failure – In the event of a mechanical failure of a non-NTTA truck, the contractor will be responsible for a replacement unit with spreader within three (3) hours.

#### **Operations and Procedures**

Training – Instructions on using sand spreaders and specific route procedures will be supplied at the beginning of the contract period. Additional refresher training will be provided as needed and prior to each event if necessary. The TRMC Project Manager and Snow & Ice Event Supervisor shall attend the annual Snow & Ice Rodeo.

Radio Communication – Contract drivers will be assigned a radio provided by the NTTA. Radios will allow communication with other NTTA drivers and NTTA supervisors. The radios are to remain inside the driver’s vehicle throughout the entire event and are to be returned at the end of each event.

## **Chisolm Trail Parkway**

### **Contract Overview**

The Total Routine Maintenance Contractor (TRMC), will provide (13) dump trucks equipped with snow and ice spreaders and drivers, (2) dually trucks equipped with snow and ice spreaders, plows and drivers and (4) dump trucks with snow plows and drivers. Three (3) additional dump trucks (without spreaders or plows) are required to accommodate 1,000 gallon tanks capable of dispensing anti-icing and deicing chemicals during the months of November through April for Snow & Ice events in an effort to increase our efficiency and manpower. The TRMC will also provide front end loaders at two (2) sand stockpile locations for the contractor to use in response to a snow and Ice event. These vehicles and equipment will be incorporated into the existing driver routes and schedules. Outsourced drivers are expected to act in accordance with the route plans and procedures.

The TRMC will provide a supervisor for the Snow and Ice program that has experience in managing and directing Snow and Ice control programs on duty for all winter weather events. The supervisor shall perform as the NTTA's point of contact and maintain the ability to communicate with the NTTA and TRMC field personnel at all times.

TRMC Manager will initially report to their contract Manager on duty. Drivers will be required to work during snow and ice events until released by the NTTA. In the case of a forecasted event, the schedule will be set in advance, if possible. In this case, contract drivers and trucks shall report one hour prior to the scheduled beginning of the event. In the case of an event that is not forecasted, the Contractor shall furnish (19) drivers for the (13) Tandem dump trucks, (2) dually, and (4) snow plows, and (2) operators for the (2) front end loaders within 2 hours of notification.

### **Contract Conditions**

The TRMC will be responsible for providing fuel for the trucks, loaders and sand spreading self-contained equipment. The TRMC shall provide Automatic Vehicle Location (AVL) with Global Positioning Satellite (GPS) devices for all vehicle/piece of equipment to be used on the roadway. The AVL system shall be internet based and the NTTA shall have access to view all AVL systems, including features showing at least location, speed, engine status, and other information deemed necessary to allow the NTTA to determine the vehicles are actively performing now and ice event duties.

The TRMC will provide maintenance personnel during a snow and ice event to respond to maintenance issues of TRMC snow and ice equipment. Personnel will be limited to work a maximum of twelve (12) hours of operation during any twenty-four (24) hour time period. The TRMC shall furnish backup/replacement personnel as needed or as directed by the NTTA. The TRMC shall coordinate shift changes so that not all of the trucks are off of the road at the same time

The TRMC shall take an active role in assisting the NTTA to determine when the TRMC will be required to mobilize all snow and ice personnel, vehicles and equipment by continually evaluating the roadway conditions, forecasts, and other available information.



Vehicular Damage and Mechanical Failure – In the event of a mechanical failure of a non-NTTA truck, the contractor will be responsible for a replacement unit with spreader within three (3) hours.

### **Operations and Procedures**

Training – Instructions on using sand spreaders and specific route procedures will be supplied at the beginning of the contract period. Additional refresher training will be provided as needed and prior to each event if necessary. The TRMC Project Manager and Snow & Ice Event Supervisor shall attend the annual Snow & Ice Rodeo.

TRMC will be required to pre-treat elevated structure, bridges, ramps, direct connects, and other known areas that are subject to freezing first, prior to the beginning of the winter weather event. TRMC is responsible for continually monitoring weather conditions and making additional effectiveness of mobilized equipment, determining if additional equipment or personnel are needed, and mobilizing additional equipment and personnel as necessary until the risk of accumulation of ice, snow or hazardous conditions has dissipated and the roads are free and clear of ice and snow.

TRMC is to monitor and inventory all materials at a minimum of every eight (8) hours and provide updates to NTTA. Within two (2) hours of completion of the winter weather event, de-icing materials at the stockpile locations shall be inventoried and provided to the NTTA.

## **POST EVENT ACTIVITIES**

The cleanup will begin immediately after the Snow and Ice Alert is terminated. The on-duty crew will empty and clean all trucks and equipment as directed. The trucks used as attenuator trucks will have their spreaders removed immediately after the event. The other trucks will have spreaders removed as necessary and when the immediate clean up is complete.

At the conclusion of each event, the on-duty Pit Boss will report the material used at each stockpile and the remaining material at each stockpile to the Incident Manager. The information will be used to determine if material from one stockpile needs to be moved to another and the amount of material to be ordered. The Incident Manager will provide the amount to be ordered to the Warehouse/Purchasing Manager.

The Maintenance Department goal is to remove all materials used for the snow and ice event within seven days of the event ending. To accomplish this, the Roadway Maintenance Manager will establish hours of operation, crew configuration and priority for sweeping operations. The sweeping operations will continue until all sand and materials have been removed from the roadway.

In order to continually improve operations a post event debriefing will be scheduled within 10 days of each event. The debriefing will include discussions about any issues reported or observed, crew suggestions for improvements, and any other issue related to the past snow and ice event. The debriefing will include roadway supervisors, representatives from the TRMC, and representatives from the Command Center. The Roadway Project Engineer will prepare an executive summary of the debriefing and assign actions to a responsible person for follow up.

## **AFTER OPERATIONS CLEAN-UP PROCEDURES**

1. After operations clean-up will begin immediately after the Snow & Ice Alert is terminated.
2. Each driver should be prepared to tell the pit boss what material is on their truck and how much. Also the condition of the spreader (Operating or Not).
3. Depending on the time schedule, drivers will be informed to empty their trucks in the correct pile at a specific sand stockpile or return to the Yard.
4. If drivers are told to empty their truck, they will work together to make sure the truck is completely emptied before bringing it in to be washed.
5. If the truck is turned over to someone else to wash, make sure the pre/post, sanding logs, keys and supply box is left inside the truck.
6. A Supervisor, Crew Leader or Senior Tech will be in charge of the cleanup operation. They will direct crew members to hook up water hose and where to park vehicles. They will also delegated specific duties to various crew members.

7. Job Duties may include:
  - a. Emptying trucks as needed
  - b. Basic spreader washing
  - c. Detail truck washing, cab, windows, mirrors etc.
  - d. Lubricate spreader according to Fleet Supervisor instructions for storage
  - e. Removing Snow & Ice box and keys from trucks after washing and turn into the Pit Boss
8. Identify trucks to be used in case of a stand-by status.
9. Staging of truck after an event.
  - a. Replenishment (restock) of truck boxes
  - b. Replenishment of binders

## **WORK ORDER PROCESSING**

Immediately following each event, a cost summary report will be issued to the Director of Maintenance. All work order processing will be electronically entered into NTTA's Hansen v7 Asset Management Software. A complete reference on the Hansen interface and order entry process is found in the "03 Response Maintenance (R3)" document within the Maintenance Department. One comprehensive work order will be created for each snow and ice event. This includes the following three general categories of activities or task.

1. Preparation – notification of NTTA personnel, dispatch of initial drivers, and loading of materials
2. Removal – labor, material consumption, equipment/vehicle usage, and contract labor
3. Cleanup – roadway sweeping, cleaning and storage of all vehicles/equipment, and inventory of vehicles/equipment

## **Work Order Setup**

Immediately following each event, a cost summary report will be issued to the Director of Maintenance. All work order processing will be electronically entered into NTTA's AssetWORKS Asset Management Software. A complete reference on the AssetWORKS interface and order entry process is found in the "14 Snow & Ice AssetWORKS Response" document within the Maintenance Department. One comprehensive project in AssetWORKS will be created for each snow and ice event and work orders created by the supervisors will be attached to this project by the CMMS Application Administrator. This includes the following three general categories of activities or task.

4. Preparation – notification of NTTA personnel, dispatch of initial drivers, and loading of materials
5. Removal – labor, material consumption, equipment/vehicle usage, and contract labor

6. Cleanup – roadway sweeping, cleaning and storage of all vehicles/equipment, and inventory of vehicles/equipment

### **Work Order Setup**

THE FOLLOWING MINIMUM FIELD VALUES ARE REQUIRED TO SETUP A NEW ASSETWORKS WORK ORDER FOR SNOW AND ICE EVENTS.

- Work Order # – Created by Supervisors
- Asset – Roadway and Buildings found using the asset selector on work orders under the “SI” filter
- Task – “900” Series (Roadway Snow and Ice Removal) as task group.

### **Tracking Items and Costs**

WHEN ENTERING COST INFORMATION, IT IS NECESSARY TO IDENTIFY THE TASK BEING PERFORMED AS EITHER “900-SNPREP” (PREPARATION), “900-SNRMVL” (REMOVAL), OR “900-SNCLNP” (CLEANUP). LISTED BELOW ARE THE PRIMARY ITEMS AND COSTS TO BE TRACKED WITHIN ASSETWORKS WORK ORDERS.

- Vehicles – mileage and dates used
- Equipment – total hours and dates used
- Labor – hours for all NTTA personnel on duty (crews, managers, and supervisors)
- Materials – amounts extracted from inventory; includes sand, MD-20, (salt)
- Contractor fees – labor and equipment are grouped together
- Vehicle fuel costs are included under the vehicle usage tab

Any documents related to the event must be attached to the AssetWORKS project.

### **AssetWORKS Software Work Order Interface**

The Work Orders for the Snow and Ice season will be created by each supervisor. The Work Order that each supervisor creates will be attached to the AssetWORKS snow and ice project after the work order is created. A repair reason of “Snow and Ice 2016-2017” must be assigned to each work order.



## EMERGENCY CONTACT INFORMATION

**TABLE – EMERGENCY CONTACT INFORMATION**

NAME	AGENCY	POSITION	OFFICE PHONE	CELL PHONE	AFTER HOURS
<i>CareNow</i>			<i>214-350-9800</i>		214-280-0101

## AVAILABLE EQUIPMENT

Fleet Division updates and provides the list of available and operational equipment to be used for Snow and Ice when the event is announced.

The following tables list all NTTA vehicles to be used for snow and ice sanding operations.

## **REFUELING PLAN**

All re-fueling operations will be done using a NTTA Fuel Card. When fuel gauges drop below half a tank, crewmembers will notify a Crew Leader or Supervisor that fuel is needed. The supervisors need to be informed of where the unit is going for refueling. Refueling activity is recorded on Fuel card statement and Driver Log. All receipts will be turned in at the end of each Driver's shift. All of the listed service stations accept the NTTA Fuel Card.

## **EMPLOYEE PHONE LIST**

Before each event managers and supervisor shall use the most recent phone list and assign crew accordingly.



## **EMPLOYEES SHIFTS AND RESPONSIBILITIES**

Before each event managers and supervisor shall update the [REDACTED] with available staff.



## ROUTE MAPS

INSERT [Route Maps](#)

# SNOW AND ICE TIME CARD

Name \_\_\_\_\_  
 No. \_\_\_\_\_ Pay Period Ending \_\_\_\_\_

EXTRA TIME		REGULAR TIME		
1st DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
2nd DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
3rd DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
4th DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
5th DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
6th DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
7th DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
<b>TOTAL</b>		<b>TOTAL</b>		

REGULAR HRS. \_\_\_\_\_ Rate \_\_\_\_\_ Total \_\_\_\_\_  
 EXTRA HRS. \_\_\_\_\_ Rate \_\_\_\_\_ Total \_\_\_\_\_  
 F.I.C.A. \_\_\_\_\_ Total \_\_\_\_\_  
 FED. WITH. TAX \_\_\_\_\_  
 STATE WITH. TAX \_\_\_\_\_  
 STATE DIS. BEN. \_\_\_\_\_  
 STATE UNEMP. \_\_\_\_\_  
 CITY W.T. \_\_\_\_\_  
 OTHER \_\_\_\_\_ NET WAGES \_\_\_\_\_

SIGNATURE \_\_\_\_\_  
 Office printer \_\_\_\_\_

Name \_\_\_\_\_  
 No. \_\_\_\_\_ Pay Period Ending \_\_\_\_\_

EXTRA TIME		REGULAR TIME		
1st DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
2nd DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
3rd DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
4th DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
5th DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
6th DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
7th DAY	A.M.	IN	OUT	
	NOON	IN	OUT	
	P.M.	IN	OUT	
<b>TOTAL</b>		<b>TOTAL</b>		

REGULAR HRS. \_\_\_\_\_ Rate \_\_\_\_\_ Total \_\_\_\_\_  
 EXTRA HRS. \_\_\_\_\_ Rate \_\_\_\_\_ Total \_\_\_\_\_  
 F.I.C.A. \_\_\_\_\_ Total \_\_\_\_\_  
 FED. WITH. TAX \_\_\_\_\_  
 STATE WITH. TAX \_\_\_\_\_  
 STATE DIS. BEN. \_\_\_\_\_  
 STATE UNEMP. \_\_\_\_\_  
 CITY W.T. \_\_\_\_\_  
 OTHER \_\_\_\_\_ NET WAGES \_\_\_\_\_

SIGNATURE \_\_\_\_\_  
 Office printer \_\_\_\_\_

## SNOW AND ICE TRAINING

All Roadway Maintenance employees will participate at the Snow and Ice training as outlined here. After the classroom training, each employee will participate in a hands-on training, which include tarp roll off, spreader settings and getting familiar with the routes they are assigned. Employees who are assigned to operate a front-end loader at the sand stockpiles will receive hands-on training for operating loaders.

### Training Outline for All Employees

Proper and thorough training of our employees is crucial to our success during any operation, but it is vitally important during snow and icy conditions. Through training we seek to improve the skills, capabilities, and knowledge of our work force resulting in a safer and productive employee. The training process will consist of the following:

#### Reporting:

1. Shift assignment
2. Telephone number 214-224-2174
3. Call outs (start of event/end of events)
4. Reporting to work (where to go/what to do)
5. Calling in sick or reporting an injury
6. Time keeping (time clock)
7. Radios fully charged and operational

#### Routes and Responsibilities:

1. Review route maps / drive routes / become knowledgeable of routes \*
2. Priority 1 routes \*
3. Reporting hazards, road / bridge conditions, or delays to Pit boss
4. Vehicle Operations
  - a. Safety lights (clear of dirt or slush)
  - b. Equipment (tires, spreader, etc.)
  - c. Air brake checks (during shift)
  - d. Supplies (flashlight, phone charger, small trash bags, rags, etc.)
5. Stranded motorist
  - a. Calling for assistance
  - b. When to give aid or cover
6. Driver logs
7. Pre / Post trip logs
8. Fueling stations / Gas cards
9. Break times (when-where)
10. Job box item (who replenish /when)
11. Non-CDL driver's responsibility

Material and Material Application:

1. When / where to apply
2. Traveling speeds when applying
3. Rates for MD20 versus Sand versus ASALT
4. Liquids (Brine, Magnesium Chloride) – Rates \*
5. Proper recording - load times, amount loaded, time emptied
6. Tarp operations (closing and opening) \*

Loader Operations:

1. Preoperational / post operational checks
2. Equipment operation / functions / loader log\*
3. Fueling procedure
4. Reporting deficiencies
5. Maintenance of loader after each event

\*Hands on training multiple times before actual event.



## **Pit boss Training Outline**

All supervisors, leads, and any other employee who has been assigned to perform the duties of a pit boss will participate in the training outlined below.

### Reporting:

1. Shift assignment / Shift Change (times and process)
2. Telephone number 214-224-2174
3. Call outs (start of event/end of events)
  - a. Notify all personnel of start of event
  - b. Each non-exempt person has timecard
  - c. Time promptly and correctly entered
  - d. All shifts notified of end of shift, and begin of clean-up

### Routes and Responsibilities:

1. Have maps of all routes assigned out of your sand stockpile
2. All issues with trucks reported to fleet for resolution
3. Solid communication skills – able to:
  - a. Accurately relay information to Maintenance Emergency Operations Center, on disposition of personnel, vehicles, road condition, material and traffic.
  - b. Communicate efficiently with personnel as well as other Pit Bosses on transfer of information.
  - c. Be knowledgeable of all Priority 1 routes \* in your area of responsibility
4. Driver and road checks
5. Be familiar with operations in the Maintenance Emergency Operations Center (MEOC).
  - a. Incident Manager
  - b. Liaison Manager
  - c. Logistic Manager
  - d. Event board
6. Be knowledgeable of S&I Logs
  - a. Pit Boss log
  - b. Loader log \*

- c. Driver log \*

\*submit to the Maintenance Emergency Operations Center daily.

#### 7. Sand Stock Pile

- a. Job Box – ensure that they are in place before event, stocked and secured.
  - i. Jumper cables, rags, windshield wiper cleaner, wiper blades, WD40 etc.
- b. Ladders – are at sand pile prior to event and removed afterwards.
  - i. Warehouse ladders to be kept at each sand stock pile to be use when one needs to gain entry to the top of the spreader.

#### Material:

- 1. Accurately report material levels to the Maintenance Emergency Operations Center of:
  - a. Magnesium Chloride
  - b. Sand
  - c. Brine
  - d. Salt
  - e. Calcium Chloride







## VEHICLE PRE AND POST OPERATION CHECK LIST

### PRE/POST OPERATIONAL CHECK LIST

Pre Operational Check List: The following checks will be made at the beginning of the shift:

Vehicle Number: \_\_\_\_\_ Beginning Mileage: \_\_\_\_\_

- Headlights     Tail Lights     Brake Lights     Turn Signal     Emergency Flashers/Lights  
 Wipers     Brakes     Gauges     Spreader Check     Horn  
 Shovel     Flashlight     Gloves     Radio Charger     Vest  
 Oil     Fuel     De-Icier     Spreader Light     PTO  
 Drain Air Brake Tank

NOTES:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

In Coming Driver:	Date:	Time:
-------------------	-------	-------

Post Operational Check List: The following checks will be made at the beginning of the shift:

Vehicle Number: \_\_\_\_\_ Beginning Mileage: \_\_\_\_\_

- Headlights     Tail Lights     Brake Lights     Turn Signal     Emergency Flashers/Lights  
 Wipers     Brakes     Gauges     Spreader Check     Horn  
 Shovel     Flashlight     Gloves     Radio Charger     Vest  
 Oil     Fuel     De-Icier     Spreader Light     PTO  
 Drain Air Brake Tank

NOTES:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Out Going Driver:	Date:	Time:
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## LOADER PRE AND POST OPERATION CHECK LIST

### FRONT END LOADER PRE/POST INSPECTION

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Driver: \_\_\_\_\_ ID#: \_\_\_\_\_ Date: \_\_\_\_\_ Unit#: \_\_\_\_\_  
 Beginnings Hours: \_\_\_\_\_ Ending Hours: \_\_\_\_\_ Oil Level: \_\_\_\_\_ Tires: \_\_\_\_\_  
 Hydraulic Fluid: \_\_\_\_\_ Fuel: \_\_\_\_\_ Coolant: \_\_\_\_\_ Window Wipers: \_\_\_\_\_  
 Wiper Fluid: \_\_\_\_\_ Brakes: \_\_\_\_\_ Horn: \_\_\_\_\_ Lights: \_\_\_\_\_ Gauges: \_\_\_\_\_  
 Bucket Operation: \_\_\_\_\_ Forward: \_\_\_\_\_ Reverse: \_\_\_\_\_  
 Fittings Greased: Date: \_\_\_\_\_ Time: \_\_\_\_\_ Number of fittings greased: \_\_\_\_\_

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Driver: \_\_\_\_\_ ID#: \_\_\_\_\_ Date: \_\_\_\_\_ Unit#: \_\_\_\_\_  
 Beginnings Hours: \_\_\_\_\_ Ending Hours: \_\_\_\_\_ Oil Level: \_\_\_\_\_ Tires: \_\_\_\_\_  
 Hydraulic Fluid: \_\_\_\_\_ Fuel: \_\_\_\_\_ Coolant: \_\_\_\_\_ Window Wipers: \_\_\_\_\_  
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 Bucket Operation: \_\_\_\_\_ Forward: \_\_\_\_\_ Reverse: \_\_\_\_\_  
 Fittings Greased: Date: \_\_\_\_\_ Time: \_\_\_\_\_ Number of fittings greased: \_\_\_\_\_

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

# ACCIDENT REPORTING



## STEPS TO FOLLOW

- Step 1:** Check to see if anyone is injured. If injured, please call 9-1-1.
- Step 2:** Move cars to shoulder if possible.
- Step 3:** Call the NTTA Command Center (214.224.2203) and your Supervisor.
- Step 4:** Fill out ALL of the information for the other driver. DO NOT discuss the accident with anyone except the police (this includes other driver(s)). DO NOT ADMIT FAULT TO ANYONE.
- Step 5:** Give your complete information to the other driver(s).
- Step 6:** Please get attending police officer's business card with report number if applicable.
- Step 7:** Contact Supervisor for further information and instructions.
- Step 8:** Contact Insurance Coordinator (214.224.2312) to give details and turn in completed form.

## OTHER DRIVER INFORMATION

Accident Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 Location: \_\_\_\_\_

*Make sure that the address is correct on the Driver's License*

Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Driver's License #: \_\_\_\_\_ State: \_\_\_\_\_  
 Telephone #: \_\_\_\_\_  
 Vehicle Type: \_\_\_\_\_  
 License Plate #: \_\_\_\_\_ Year: \_\_\_\_\_ Color: \_\_\_\_\_  
 Make: \_\_\_\_\_ Number of Passengers: \_\_\_\_\_  
 List: \_\_\_\_\_

**Attending Officer Information**

Attending Officer: \_\_\_\_\_  
 Badge #: \_\_\_\_\_ Agency: \_\_\_\_\_  
 Telephone #: \_\_\_\_\_ Report #: \_\_\_\_\_

**Insurance Information**

Insurance Carrier: \_\_\_\_\_  
 Policy #: \_\_\_\_\_  
 Expiration Date: \_\_\_\_\_  
 Address & Telephone #: \_\_\_\_\_

## NTTA INFORMATION

Accident Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 Location: \_\_\_\_\_

Name: \_\_\_\_\_  
 Address: NTTA P.O. Box 260729, Plano, TX 75026

Driver's License #: \_\_\_\_\_

**Insurance Information**

Carrier: Texas Municipal League, Intergovernmental Risk Pool  
 Policy #: 4524  
 Expiration Date: \_\_\_\_\_  
 Address: Texas Municipal League, Intergovernmental Risk Pool  
 1821 Rutherford Lane, First Floor  
 Austin, TX 78754  
 Telephone: 800.537.6655

NTTA Vehicle Type: \_\_\_\_\_  
 License Plate #: \_\_\_\_\_ Unit #: \_\_\_\_\_  
 Year: \_\_\_\_\_ Color: \_\_\_\_\_ Make: \_\_\_\_\_  
 Number of Passengers: \_\_\_\_\_

**Attending Officer Information**

Attending Officer: \_\_\_\_\_  
 Badge #: \_\_\_\_\_ Agency: \_\_\_\_\_  
 Telephone #: \_\_\_\_\_ Report #: \_\_\_\_\_

NTTA contact information on reverse side







(PLEASE USE WITH ALL SUBMISSIONS  
TO EXPEDITE HANDLING)

### EMPLOYEE'S REPORT OF INJURY

Dear Claimant:

We have received a report that you were injured in the course of your employment. In order for us to process your claim efficiently, please fill in the lines completely and print legibly. Attach additional sheets if necessary.

1. Name: \_\_\_\_\_ Social Security: \_\_\_\_\_  
LAST FIRST MI MAIDEN

2. Give your current home address: \_\_\_\_\_

3. By whom are you employed? \_\_\_\_\_

4. What is your job title / description? \_\_\_\_\_

5. What are your monthly wages? \_\_\_\_\_ 6. How many days per week do you work? \_\_\_\_\_

7. On what date were you injured? \_\_\_\_\_

8. What was the exact location of the accident (street address if possible)? \_\_\_\_\_

9. How did the accident happen? \_\_\_\_\_

10. What part of your body was injured? \_\_\_\_\_

11. When did you report the incident? \_\_\_\_\_

12. To whom did you make your incident report? \_\_\_\_\_

13. List name(s), address(es), and telephone number (s) of witness or witnesses: \_\_\_\_\_

14. Name, address, and telephone number of physician who provided treatment: \_\_\_\_\_

15. When did you first receive treatment? \_\_\_\_\_

16. When did you stop working as a result of your accident? \_\_\_\_\_

17. Name, address, and telephone number of doctor presently treating you: \_\_\_\_\_

18. When were you last treated? \_\_\_\_\_

19. Have you returned to work? \_\_\_\_\_ If so, when? \_\_\_\_\_

20. Have you lost any wages on account of your accident? \_\_\_\_\_

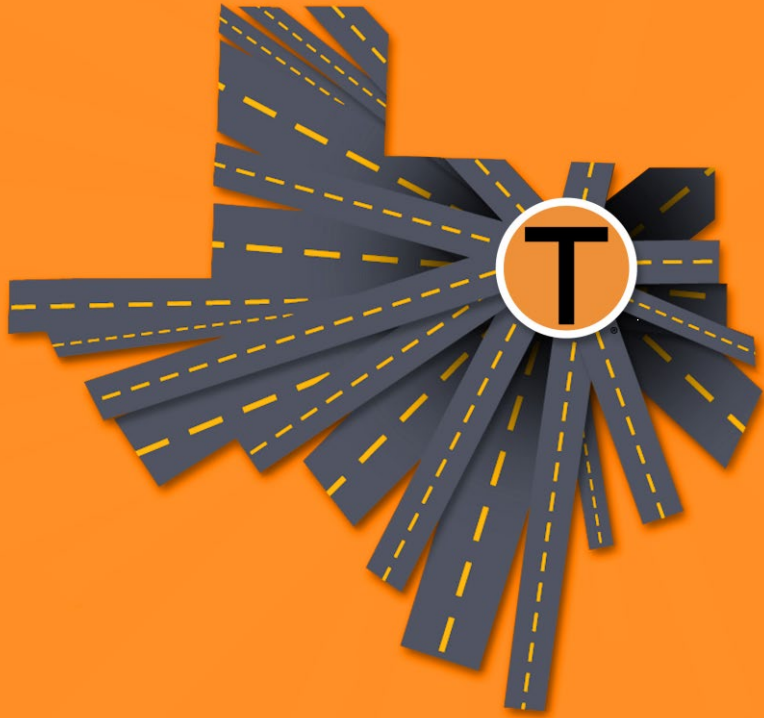
21. Have you ever had a previous injury claim? \_\_\_\_\_ If so, describe: \_\_\_\_\_

(dated) \_\_\_\_\_ (signed) \_\_\_\_\_

Form No. WCD-29 Rev. 9-95.

## SAFETY DATA SHEET FOR MAGNESIUM CHLORIDE

Insert Data Sheet



# BRINE APPLICATION TRAINING

Roadway Supervisors:



# Brine Application

Brine is a solution of Salt (Sodium Chloride) and water that can be applied to road surfaces ahead of an impending weather event. Brine prevents bonding of ice and snow to the road surface.







## BRINE

- Brine can lay dormant on the road surface for several days before an event and still perform when snow does arrive.
- By applying brine as an anti-icing agent, we are working on prevention instead of reaction.

One of the factors that we would look at before making the decision to apply brine would be, the forecast, is it going to rain ahead of icing or snow which would result in washing the brine off before it could react.



When we do make the decision to apply brine it will be a 23% solution applied at around a rate of 30-50 gallons per lane mile of roadway.



Depending on the amount of time ahead of the event we would normally begin applying brine to our priority areas first, these areas consist of our flyovers, bridge overpasses, and bridges.





All elevated roadways would be amongst our priority areas as they will freeze first due to the open exposure under them.



If time permits and depending on the severity of the approaching storm we may also elect to treat all main lanes and service roads.

The equipment used to apply the brine solution varies from a 300 gallon homemade unit that slides into the bed of a dually, to a trailer mounted tank that has an electric pump, to a 550 gallon self-contained tank that slides into our small dump truck, to our larger 1000 gallon hydraulic driven sprayers.







This last larger sprayer can spray 1-3 lanes in one pass although because of traffic we usually only spray one lane at a time.



All of the sprayers will be shadowed by a TMA whenever brine is being applied.

The travel speed when applying brine will depend on which type of unit is being used, but it normally is between 20-30 MPH.



# Questions

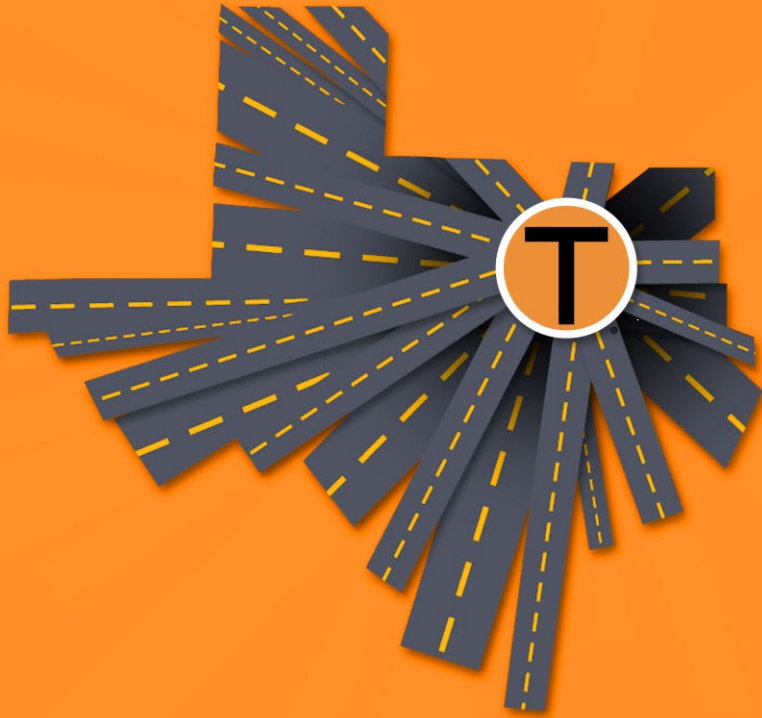




# North Texas Tollway Authority

## Our Mission

**Provide** a safe and reliable toll road system **Increase** value and mobility options for customers **Operate** the Authority in a businesslike manner **Protect** our bondholders **Partner** to meet our region's growing need for transportation infrastructure



# LOADER TRAINING

Roadway Supervisors:



# Agenda Slide



1

**Photos of Different Types of Skid Loaders**

2

**Loader/Skid Steer Pre and Post**

3

**Pre/Post (actual sheet)**

4

**From the Ground**

5

**Loader and Skid Steer operation and Responsibilities**

6

**Front End Loader/Skid Steer Do's and Don'ts**

7

**Hands on Training with a Subject Matter Expert**

# LOADERS AND SKID STEERS

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# LOADERS AND SKID STEERS

# LOADERS AND SKID STEERS

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# LOADERS AND SKID STEERS

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# Loader and Skid Steer Pre and Post

- Check all hoses, belts, and fluid levels
- Check inside engine compartment for any loose belts or anything out of place

## **Inside Cab:**

- Check seat belt, horn, back-up alarm, lights, parking brake, accelerator, and brake pedals
- Check mirrors, windshield, heater, wipers, and overall cab interior



# From The Ground...

- Check loader / skid steer bucket. Make sure cutting edge is intact and not worn even with the bucket
- Check underneath loader for loose items such as dangling belts, hoses, or other parts out of place
- Check steps, handrails, lights, grease fittings (grease if needed), frame, leaks and overall machine for any dents, dings, or body damage

# Loader / Skid Steer Operation and Responsibilities

- Operates straight or articulated front loader, skid steer, skid steer rubber tire or track unit with front mounted hydraulically assisted front bucket; to scoop lift and transport Md-20, salt, and/or sand if needed for the application of a snow and ice event.
- This can be for the purpose of loading salt spreader truck for roadway application or at various sites in the making of brine solution.
- Start engine, shift gears, press pedals, turning steering to load and unload material either onto spreaders or bring making tanks.
- Move levers to tilt bucket, so as to dump or scoop into waiting trucks or brine tanks
- Perform routine duties, such as cleaning, fueling and refilling DEF tanks as needed

# Loader / Skid Steer Do's and Don'ts

- **Do** be careful loading
- **Do** be careful backing
- **Do** be careful all the time
- **Do** use the horn when backing (if equipped)
- **Do** break up any material in down time, and always be ready to load
  
- **Don't** get in a hurry, but work at a steady pace
- **Don't** assume clearance, get out and look if needed
- **Don't** be careless (you have the most important job during a snow and ice event)

# Hands On Training with a Subject Matter Expert

- Hands on training will be held at each individual sand pile and or service centers
- This will give the operators a chance to see multiple different configurations and obstacles at each sand pile location
- Loader / skid steer operators will learn how to and practice loading materials such as Md-20, salt, and sand
- Your full attention will be required and expected for this training: For some of you this might be a refresher but for others this will be a first-time experience. Experienced operators- Please feel free to share knowledge and experiences with the non-experienced operators.





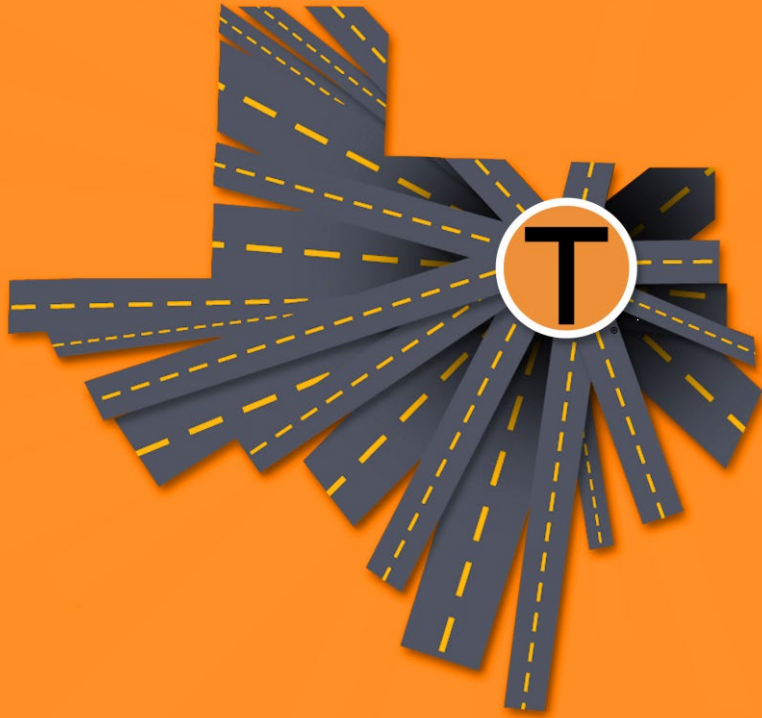
# Questions



# North Texas Tollway Authority

## Our Mission

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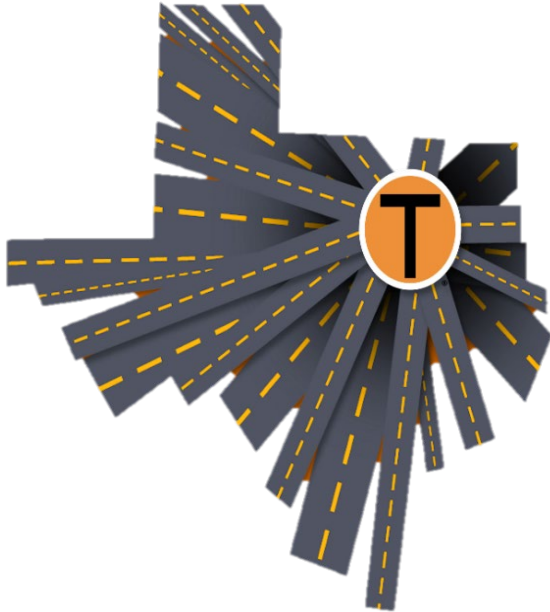


# SNOW PLOW TRAINING

Roadway Supervisors:



# Agenda Slide



1

**Types of Snow Plows Used by NTTA**

2

**Types of Blades and Parts of a Snow Plow**

3

**Snow Plow Pre/Post Inspection**

4

**Snow Plow Operation**

5

**Snow Plow Processes (Do's & Don'ts)**

6

**Hands on Training with a Subject Matter Expert**



# Types of Snow Plows used by NTTA



10' Henke Snow Plow



10' Boss Snow Plow

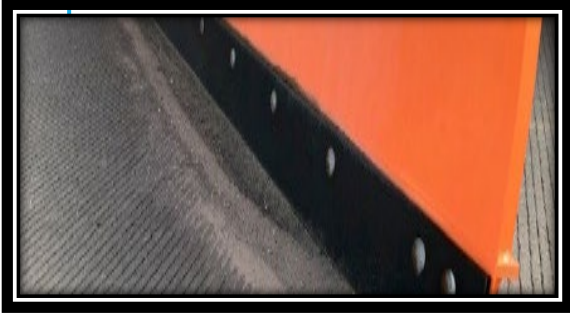


10' Snow Dogg Snow Plow



8' Boss Snow Plow

# TYPES OF BLADES AND PARTS OF A SNOW PLOW



Steel Plow Blade



3 Piece Carbide Plow Blade



Rubber Plow Blade



Snow Plow Shoes



Plow Mow Board



Plow Handheld Controller

# Snow Plow Pre/Post Inspection

- Check all hoses and connections before and after operation of the plow
- Check condition of the blade that is attached to the plow before and after operation (Check to make sure the blade is not worn down to within a ½” of the mow board, make sure that the blade is not wearing on one side more than the other).
- Check the condition of the plow shoes to make sure they are not worn down enough to which they are not keeping the snow plow slightly about the road surface.
- Check the plow lights (if equipped) to make sure both are working as when the plow is raised the truck headlights become obstructed.
- Make sure the plow is fully operational from the handheld controller (up/down, tilt left/right, angle left/right).

# Snow Plow Operation Procedure

- Always travel with the snow plow at an angled position when not in use ( The plow is wider than the width of the truck and becomes a hazard to passing motorists while traveling).
- When plowing only skim the road surface. **DO NOT** lower the plow all the way down in a manner that raises the front of the truck up.
- The goal is to remove the snow from the travel path. For example if you are plowing in the right lane, angle the plow to the right to push the snow onto the right shoulder or up against the wall.
- Always be aware of the surrounding traffic and do not spray passing motorists with snow while plowing.



# Snow Plow Procedure (Do's & Don'ts)

- **Do Not** pile snow up against attenuators or guardrail (this will cause the attenuator and/or guardrail not to function properly if impacted) Angle the snow plow to the straight position until the plow is past the attenuator or guardrail then angle plow back to the right position.
- **Do Not** plow over bridge expansion joints or armor joints with the plow in the straight position. Always glide over these joints with the plow at an angled position.
- **Do Not** plow over bridges in a manner in which snow is being thrown (rooster tail) over the bridge rail on to traffic down below the bridge (Slow down to approximately 20 mph when plowing over bridges to eliminate this from happening)
- **Do Not** plow at a speed over 30 mph.
- If the snow plow folds over due to excess weight being pushed (or any other reason), **Do Not** slam on the brakes. Slow down and slightly raise the plow to disperse some of the weight so the plow will raise back up.

# Hands On Training with a Subject Matter Expert

- Hands on training will be held at the Oak Lawn Yard on the south end of DNT.
- Plow operators will learn how and practice plowing using hardwood mulch through traffic cones that are spaced out to a standard 11' lane.
- Plow operators will also be driving the truck with plow on the road with a Subject Matter Expert to get familiar with traveling the roadway with a plow attached.
- Your full attention will be required and expected during this training: For some of you this might be a refresher but for others this will be a first time experience. Experienced operators- Please feel free to share knowledge and experiences with the non-experienced operators.



# Questions

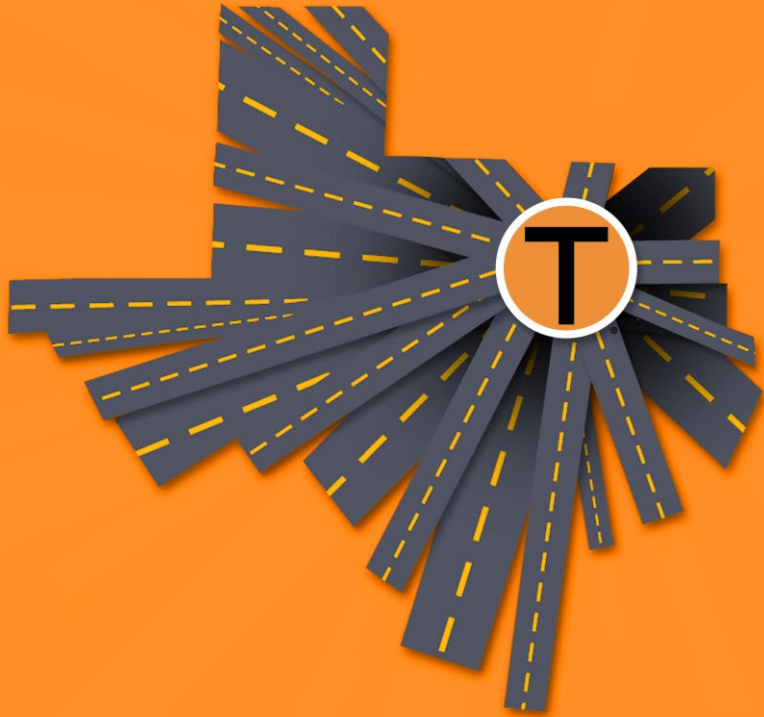


# North Texas Tollway Authority

## Our Mission

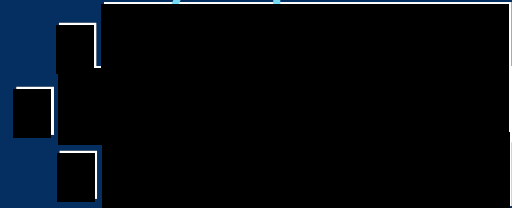
**Provide** a safe and reliable toll road system **Increase** value and mobility options for customers **Operate** the Authority in a businesslike manner **Protect** our bondholders **Partner** to meet our region's growing need for transportation infrastructure





# SNOW & ICE SPREADER TRAINING

▶ Roadway Supervisors:



# Agenda Slide



1

Types of Snow & Ice Spreaders used by NTTA

2

Parts of a Snow & Ice Spreader

3

Spreader Settings & Deicing Material used by NTTA

4

Loading/Unloading Spreaders

5

Spreader Operation

6

Hands on Training with a Subject Matter Expert

# Types of Snow & Ice Spreaders used by NTTA



8' Electric Salt Dogg Spreader



14' Electric Salt Dogg Spreader

# Types of Snow & Ice Spreaders used by NTTA (Cont.)



12' Hydraulic Spreader



# Parts of a Snow & Ice Spreader



Handle for Adjusting  
Spreader Setting

Spreader Setting



Spinner

Adjustable Flaps  
(For Throw Pattern)



# Parts of a Snow & Ice Spreader (Cont.)



Tarp Handle

Spreader Tarp



PTO Engage  
(On/Off)

Spinner & Auger  
Setting (Speed)

# Parts of a Snow & Ice Spreader (Cont.)

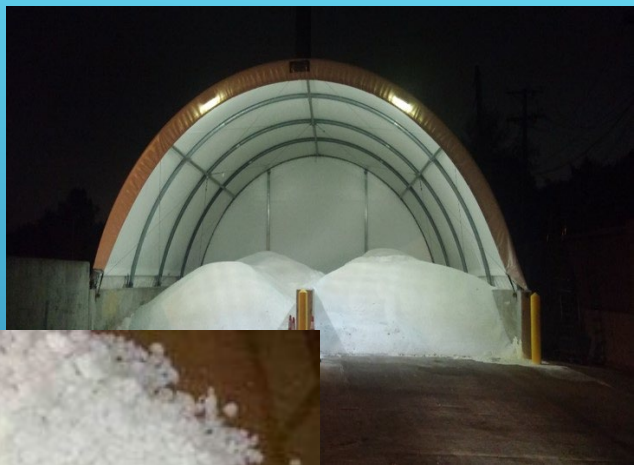


Control Panel for Salt Dogg  
Electric Spreader

# Spreader Settings and Deicing Material used by NTTA



Meltdown  
20 (MD 20)  
Spreader  
Chute  
Setting- 2



Rock Salt  
Spreader  
Chute  
Setting- 2





# Loading/Unloading Spreaders

- Loading and unloading large spreaders consists of using a 4 person team (2 to guide chains and attach spreader to arm, 1 loader operator, and 1 spotter)
- Hardhats and all PPE are required by everyone involved when loading or unloading spreaders
- Always use the ladder with the 4' overhang when attaching/unattaching chains to the large (tandem) spreaders. **DO NOT CLIMB ON TOP OF SPREADER**
- The large (tandem) spreaders are secured to the truck with 4 binders and 4 chains (2 on each side- front and back)
- Once the spreader is loaded, all hoses and connections will be attached to ensure all aspects of the spreader and lights are working.



# Loading/Unloading Spreaders (Cont.)

- Loading and unloading 8' (dually) spreaders consist of using a 3 person team (1 forklift operator and 2 spotters)
- Hardhats and all PPE are required by everyone involved when loading 8' spreaders.
- The 8' (dually) spreaders are secured to the truck with 4 ratchet straps (2 on each side- front and back)
- Always use the ladder when needed to secure or remove the ratchet straps from the spreader. **DO NOT CLIMB ON TOP OF SPREADER**
- Once the spreader is loaded, all hoses and connections will be attached to ensure all aspects of the spreader and lights are working.





# Spreader Operation

- Always conduct a thorough Pre/Post Inspection of the spreader before operation (Check all hoses and connections, positioning of chute flaps, spinner condition, spreader settings, tarp and handle condition, operation of spreader (including lights), and all chains, binders or straps are tight.
- Pit Bosses will inform driver's of which material is to be loaded into the spreaders when deemed necessary.
- All material will be loaded from the sand pile (by the loader operator) in which the driver is assigned, unless informed to load from an alternate location.
- It is the driver's responsibility to roll back the tarp and spot the loader operator during the loading operation (always make sure the front end loader bucket does not come in contact with the wire grate on top of the spreader by using the ladder at the sand piles. **DO NOT CLIMB ON THE SPREADER OR SIDE OF THE TRUCK**



# Spreader Operation (Cont.)

- Always make sure the tarp is rolled back in to the closed position and the handle is secure before leaving the sand pile.
- All instructions about when and where to spread material will come from the Pit Bosses when necessary.
- Each driver will get familiar with the truck and spreader they will be operating during the hands on training. Not all trucks/spreaders will operate in the same manner.
- Always be aware of surrounding vehicles when spreading material and be aware of how your spreader is operating at all times.
- If a problem occurs with the truck or spreader while driving the roadway contact your Pit Boss and drive the truck to the sand pile (if possible) to inspect. **DO NOT** stop on the road to inspect the truck or spreader.



# Questions



# North Texas Tollway Authority

## Our Mission

**Provide** a safe and reliable toll road system  
**Increase** value and mobility options for  
customers **Operate** the Authority in a  
businesslike manner **Protect** our bondholders  
**Partner** to meet our region's growing need for  
transportation infrastructure



# Conclusion

BE SAFE, REMEMBER SAFETY BEGINS WITH YOU  
AND DON'T FORGET THAT WHAT YOU DO  
SAVES LIVES!



**Northwest Parkway located in Broomfield, CO responses to survey of toll facilities**

**Fort Worth, TX**

**HWY21FH005**

(35 pages)

# SURVEY OF TOLL FACILITIES

## **General Operations:**

1. Is the toll facility private or state regulated?  
[Privately owned](#)
2. When was the toll facility officially opened to traffic?  
[November 2002](#)
3. How many lane miles does the toll facility maintain?  
[44.6 lane miles](#)
4. How many days did the toll facility respond to snow and ice removal events in each of the last 5 years?

	2016	2017	2018	2019	2020
Days with Snow and Ice Removal Events	2 5	2 9	1 7	3 8	2 3

## **Snow and Ice Removal Pre-treatment Operations: Describe and/or provide documentation of the following:**

5. All pre-treatment options and subsequent chemical applications currently used by the toll facility during snow and ice removal events.
  - 4a. How long each specific pre-treatment option and subsequent chemical applications are effective in treating the roadway after initial application.
  - 4b. Any formal criteria of when to use specific pre-treatment options and subsequent chemical applications.

## **Snow and Ice Removal: Describe and/or provide documentation of the following.**

6. An inventory (trucks, plows, front-end loaders, spreaders, etc.) including the number of covered salt storage facilities and quantities of salt that are dedicated to snow and ice removal events.

7. Methods/technologies to monitor moisture and ice formation on roadways, highway overpasses, or bridges.
  - 6a. If you use sensor detection systems, the systems, and procedures for their use.
  - 6b. If you do not use sensor detection systems, any future plans by the toll facility to utilize them or other technologies capable of monitoring moisture and ice formation on roadways, highway overpasses or bridges.
8. Procedures for snow and ice removal.
  - 7a. If you have formal procedures in place, provide a copy of the established procedures.
9. Training procedures for maintenance technicians who perform spot checks and inspections of road conditions during snow and ice removal events. Provide details on the training procedures necessary to become a spot checker (i.e., initial number of training days/hours, certification requirements, length of annual refresher courses, etc.)

**Documentation Checklist: Please provide the following if available.**

- ✓ Pre-treatment options, durations of effectiveness, and criteria for use
- ✓ Inventory of snow and ice equipment
- ✓ Systems/methods used to detect moisture and icy conditions
- ✓ Operational and training procedures for snow and ice removal
- ✓ Contract between toll authority and state, including snow and ice removal events

# Northwest Parkway, Broomfield Colorado

## Snow and Ice Procedures for 2021 / 2022 Snow Season

### **Snow and Ice Removal Pre-treatment Operations: Describe and/or provide documentation of the following:**

5. All pre-treatment options and subsequent chemical applications currently used by the toll facility during snow and ice removal events.

NWP uses Ice Slicer granular and Apex liquid supplied by Envirotech.

4a. How long each specific pre-treatment option and subsequent chemical applications are effective in treating the roadway after initial application.

The NWP does not have conclusive data, depends on weather and snow conditions.

4b. Any formal criteria of when to use specific pre-treatment options and subsequent chemical applications.

Application: The effectiveness of any plan for snow and ice control depends on the choice of materials to be used, along with the close monitoring of weather and procedures as outlined. The results of the selected methods to be followed should be closely monitored to determine their efficiency.

Applications of Ice Slicer will be placed using the "Broadcast Method". Precautions must be taken to ensure that material is broadcast the full width of the pavement and not thrown off onto the shoulder. Application of Magnesium Chloride will be placed using the spray bar on the unit. Precautions must be taken to ensure that material is applied to the travel lanes and not applied to shoulder areas.

The procedure to be followed in combating any storm will depend on the temperature, the condition of the pavement, the nature of the precipitation, and the storm forecast.

It is not the intent to completely detail all methods to be employed by Contractor forces, since snow and ice removal is an extremely dynamic process. There are three basic conditions, which will exist at the start or in the early stages of the storm. The procedures to be followed under these three conditions are as follows:

#### **Condition 1:**

Air temperature: 25 F to 34 F and rising.

Pavement: Wet

Precipitation: Snow, sleet, or freezing rain.

This condition may prevail until the temperature rises through the critical zone (28 F to 34 F) in which case the precipitation will gradually turn to rain and the chance of packing or icing will diminish as the storm progresses. The temperature may, however, level off at a temperature within the critical range in which case packing or icing will take place. Actual temperatures and



precipitation will be checked hourly. The initial treatment should be the application of Ice Slicer at the rates approved by the Project Manager.

If the temperature moves at a rapid rate through the critical range, one application may be sufficient for the duration of the storm, but if the temperature rises slowly or levels off in the critical range, further applications may be necessary in storms of long duration. If the temperature levels off below the critical range and the storm continues in the form of snow and packing is imminent, it may be necessary to commence plowing and to retreat the potential pack areas with de-icing chemicals in spray pattern. If pack exists, de-icing with liquid shall be applied with a pressure stream pattern.

**Condition 2:**

Air temperature: 20 F to 32 F

Pavement: Wet or icing

Precipitation: Rain, snow, sleet, or freezing rain.

Under this condition, ice is likely to form on the pavement. There is a distinct possibility that the precipitation will turn to snow even though it may start as rain. The initial treatment is the application of Ice Slicer at the rates approved by the Project Manager prior to treatment. If this treatment is effective, the pavement will remain wet or be covered with slush according to the degree to which the temperature has fallen. If slush develops, it should be removed and/or chemical treated before it is hardened by freezing and the packing action of traffic. Subsequent treatment when required should consist of another application of Ice Slicer, Magnesium Chloride or plowing whichever is indicated.

**Condition 3:**

Air temperature: Below 25 F

Pavement: Dry

Precipitation: Snow

This condition calls for plowing when sufficient accumulation occurs, followed by a chemical treatment when snow begins to adhere to pavement surfaces in the wheel paths. Plowing should continue for the duration of the storm and until pavement is clear. If temperature rises through the critical range (28 F to 34 F) the application of de-icing liquid at the spray rate prescribed by the tables and precipitation forecast shall be applied.

The application of the de-icing materials shall commence when the snow can be seen packing in the traveled lanes. When the precipitation is in the form of freezing rain or sleet, the initiation of applications will be determined by observing the condition of the roadway surface for bond braking and the ambient temperature and the forecasted accumulations. Priority consideration will be given to those areas most prone to icing. We identify these areas as “Cold Spots and will be among the first inspected.

Re-application: Re-application of de-icing materials will be determined by the monitoring of field conditions by checking the roadway by means of observing surface conditions. Physical examination of the pavement through touch or the use of a Thermometer can also provide a valuable indication of icing.

It should be recognized that “Cold Spots” would require more frequent applications of de-icing materials than the adjacent stretches of road. These areas shall be effectively confined during re-application so as not to unnecessarily treat the entire roadway segment. During plow operations, precautions must be taken to ensure that de-icing material applications are placed following plow methods and not before.

De-icing material applications shall continue as long as the danger of the existence of re-freeze exists. The level of service to be obtained guides our de-icing applications.

Response to icing incidents: The Assistant Project Manager or Snow Supervisor will respond to the area where the icing incident was reported and personally inspect the site to determine if the level of response is adequate or needed. The Project Manager or Assistant Project Manager will notify the snow driver(s) on duty of the icing incident and direct the activity of personnel as required by the situation. A reported, confined incident should require a minimum dispatch of a snow driver or drivers to load and operate the spreading equipment. If the Assistant Project Manager or Snow Supervisor determines that no response is needed then all personnel and equipment dispatched shall be canceled.

**Snow and Ice Removal: Describe and/or provide documentation of the following.**

**6. An inventory (trucks, plows, front-end loaders, spreaders, etc.) including the number of covered salt storage facilities and quantities of salt that are dedicated to snow and ice removal events.**

Equipment disposition: There will be a total of five tandem plow trucks and one 4x4 pick-up plow trucks on site. There will be three tandem plow trucks with v-box sander units, and two tandem plow trucks with liquid spray units. All plow trucks will be equipped with clearance lights that comply with DOT FMVSS 108 and current CDOT practice. There will be one front end loader with a 2.75 yard bucket on-site during for winter operations from October 15<sup>th</sup> through May 15<sup>th</sup> at the Northwest Parkway Maintenance Facility.

The Northwest Parkway owns one salt storage dome that is dedicated solely to the roadway. Adequate quantities are maintained in the dome of Ice Slicer to cover any impending storm. Typical quantities on hand in the winter are at or above 600 tons. Two tanks are dedicated full time to the storage of Magnesium Chloride with capacity over 6000 gallons.

**7. Methods/technologies to monitor moisture and ice formation on roadways, highway overpasses, or bridges.**

**PLANS FOR ROUTING AND SPECIFIC DETAILS:** Scheduling of snow drivers and mechanics will be the responsibility of Contractor. The Project Manager will be responsible in seeing that his Assistant Project Manager, Snow Supervisors and snow drivers will be available for future storms. The Project Manager will work with his staff to ensure that all areas are properly evaluated and covered. If coverage cannot be maintained, the Project Manager will work with his upper management to replace personnel as required with the Northwest Parkway being notified as well. Snow drivers in each area will work together but will be assigned to a specific area. Traveling conditions in both east and west on Northwest Parkway will be addressed at all times. Since conditions can vary from one section of highway to the next, snow drivers may move from their assigned area to assist in other areas with more severe conditions. High priority areas will include bridges, all ramps and the Toll Plaza area. Each plow truck will be equipped with a cell phone to communicate with each other as well as the Assistant Project Manager, Snow Supervisor and the Project Manager. Plowing will be the traditional right and left off of the pavement except when the wind is blowing, in which plowing will be done with the wind. The driving lanes are the highest priority during the storm event. Once driving lanes and ramps are free of snow and ice, **ALL**

**PAVEMENT** will be a concern until clear from shoulder to shoulder. Snow accumulating against concrete barriers or metal guardrails will be removed shortly following the storm. Snow melting during the daylight hours can run back onto the highway and then proceed to freeze in the evening causing an icing problem on the highway. Great efforts will be taken to minimize this problem, including hand shoveling when necessary.

#### **APPLICATION AND PROCEDURES:**

Snow shall be considered to be at a plow able depth when it meets the following criteria: When snow reaches a depth or consistency that cannot be removed by a controlled application of Ice Slicer or liquid deicers.

The progression for the various levels of plowing response is based on the following scenarios:

##### Level 1 plowing:

Ramp area accumulation Greater than one half inch.

Mainline accumulation Trace accumulation.

Traffic is assisting in maintaining mainline accumulations by enhancing the deicers by means of tire traction. During this time the plows can turn some focus on the Toll Plaza and ramps.

##### Level 2 plowing:

Passing lanes accumulation Greater than one half inch.

Shoulder accumulation Greater than one inch.

Right lane accumulation Visible skip marks.

Traffic is working the de-icing material and displacing the chemically treated snow on those lanes that are more heavily traveled. Plowing will turn its focus to the clearing of high speed traveling lanes first.

##### Level 3 plowing:

Mainline accumulation Greater than one inch full width.

Full width plowing is commenced when accumulation in all remaining lanes exceeds one inch. The build-up of snow will now continue and repeated applications of de-icing materials without physical removal of snow will result in excessive and needless amounts of material being applied. De-icing materials should be applied to help keep the bond between the snow and pavement surfaces loose about every three plowing passes. The chance of packing occurring is now greater if the existing snow is not removed.

All plowing equipment should have their plows flush against the pavement and there should be no tension left in the chains or devices.

Drifted snow should not be treated with de-icing materials, but instead be pushed back and plowed off. Application of de-icing materials will allow a wet spot and pack conditions to develop. The area should be pushed back in the hopes that any residue will dry and avoid further sticking.

The Toll Plaza parking lots shall receive an application of de-icing liquids, which is approximately double that of the de-icing amount specified for mainline usage.

Granular material (Ice Slicer) will be dispensed by calibration at 200 lb. /lane mile. It is the intent of TCA to use the optimum amount of material. Spreader trucks will travel no faster than 45 M.P.H. on the mainline and 30 M.P.H. by the Ramp Toll Buildings. Spreader trucks will maintain a speed that

provides for proper functioning of the spreader unit. Individual truck speed shall be adjusted to meet snow, wind, and highway and traffic conditions.

Application: The effectiveness of any plan for snow and ice control depends on the choice of materials to be used, along with the close monitoring of weather and procedures as outlined. The results of the selected methods to be followed should be closely monitored to determine their efficiency.

Applications of Ice Slicer will be placed using the “Broadcast Method”. Precautions must be taken to ensure that material is broadcast the full width of the pavement and not thrown off onto the shoulder.

Application of Magnesium Chloride will be placed using the spray bar on the unit. Precautions must be taken to ensure that material is applied to the travel lanes and not applied to shoulder areas.

The procedure to be followed in combating any storm will depend on the temperature, the condition of the pavement, the nature of the precipitation, and the storm forecast.

#### 6a. If you use sensor detection systems, the systems, and procedures for their use.

No roadway sensors are used at this time.

#### 6b. If you do not use sensor detection systems, any future plans by the toll facility to utilize them or other technologies capable of monitoring moisture and ice formation on roadways, highway overpasses or bridges.

Northwest Parkway is considering a test trial of new roadway sensors to monitor temperatures of the pavement at specific locations. Nothing is in place at this time.

### 8. Procedures for snow and ice removal.

#### 7a. If you have formal procedures in place, provide a copy of the established procedures.

#### **PATROL SIZE AND LEVEL OF SERVICE**

Patrol size will be determined by the severity of the storm. Snow drivers will be on site and ready to commence work within sixty minutes of a call by the Project Manager or Assistant Project Manager. If trucks are taken out of service, an analysis will be made by the Project Manager, Assistant Project Manager or Snow Supervisor as to the anticipate time required to make the repairs. Storm timing, intensity and localization will be considered by the Project Manager to determine whether reassigning trucks to other areas or routes is warranted.

Contractor will keep all driving lanes and ramps clear of snow and ice. If the storm does not allow keeping lanes and ramps clear, efforts will be concentrated in keeping driving lanes open at all times. If Contractor is unable to keep up with the storm or the forecast is calling for heavy snow for several hours, additional equipment will be deployed per the Project Manager’s directive (with the NWP staff being notified as well). This will include loaders, and additional plow trucks.

## **CALL OUT PROCEDURE**

When a storm is predicted, the Assistant Project Manager, Snow Supervisors and snow drivers will be notified and will be required to be immediately available when called. When conditions warrant snow drivers to be dispatched, the Project Manager will mobilize snow drivers appropriately and then proceed to the highway. The Snow Supervisor may be exclusively dispatched at the beginning of a storm to check and evaluate the highway and spot treat where necessary.

Snow drivers will typically run a twelve-hour shift on the toll way. The standard shift changes are 12:00 a.m. and 12:00 p.m. This schedule allows for consistency and advance planning for snow staff. Advance planning and forethought on the part of Contractor is key in maintaining a high level of service.

If the Project Manager is absent or on vacation, the Assistant Project Manager or Snow Supervisor will be in charge. In the event of planned absence, the Project Manager will notify NWP prior to his leaving.

**PARTIAL DEPLOYMENT:** During periods of light snow or pre-treatment of the highway, partial deployment may be called. The number and routing of trucks is to be determined by the Project Manager or Assistant Project Manager.

**STAND-BY:** Recognizing the bare pavement policy, standby drivers are necessary to ensure timely response to the beginning of an event. The snow driver(s) on stand-by will remain on site. During stand-by Contractor will be paid at a stand-by rate. Personnel at the site shall ensure that the equipment is ready to be mobilized at any given time. At the beginning of a major storm and during minor events, the entire plow fleet may be mobilized. During partial deployment the trucks in service will be assigned to several routes.

**CALIBRATION:** Contractor's mechanic will give training on all snow related equipment before the beginning of the snow season. There will be on-going training as needed to ensure that a quality application of products occurs at all times and plowing techniques are followed properly. The Project Manager, Assistant Project Manager and Contractor's mechanic will all be part of material and equipment calibrations. Recalibrating will be continually checked and adjusted as needed.

**9. Training procedures for maintenance technicians who perform spot checks and inspections of road conditions during snow and ice removal events. Provide details on the training procedures necessary to become a spot checker (i.e., initial number of training days/hours, certification requirements, length of annual refresher courses, etc.)**

The Assistant Project Manager and Snow Supervisor will be sure that each snow driver is completely trained for their specific area.

**SAFETY:** Safety is of the utmost importance on this project. All snow drivers will be trained in snow removal driving techniques and safety. Contract specifications and CDOT standards will be followed with regards to lighting, beacons, travel speed and plowing techniques. Contractor has been involved for many years of snow plowing on toll roads and we continue to strive to effectively perform these duties based on our experience and expertise.



**TRAINING:** Training will consist of the following for all snow drivers:

Contractor's mechanic will conduct training on how to operate the snow unit's controls, sander unit and liquid unit. All training for operating sanders and liquid units will be finished by October.

Contractor will conduct internal training on snow and icy conditions, explain driving techniques, loading of materials, and when to apply which materials and their proper rates.

Dry runs will occur in early to late October so that all drivers know their area and any special concerns of that area of highway and become familiar with the trucks they will be driving. All snow drivers will be trained and be able to change material rates but will not do so unless directed by the Project Manager, Assistant Project Manager or Snow Supervisor. Additional training will be conducted during stand-by periods with the Project Manager, Assistant Project Manager or Snow Supervisor on duty.

After each storm event a short debriefing meeting will occur with each shift. This meeting will provide a way for everyone to have input so service can continue to improve.

The Project Manager, Assistant Project Manager and Snow Supervisors will stay abreast of new technology through education.

All snow drivers returning from previous seasons will meet for a refresher course and go over proper paperwork.

Snow drivers that become employed during the season will be trained throughout. This will require at least four hours of ride along time with an experienced snow driver. TCA will not charge time for new drivers in training.

**Documentation Checklist: Please provide the following if available.**

- ✓ Pre-treatment options, durations of effectiveness, and criteria for use
- ✓ Inventory of snow and ice equipment
- ✓ Systems/methods used to detect moisture and icy conditions
- ✓ Operational and training procedures for snow and ice removal
- ✓ Contract between toll authority and state, including snow and ice removal events



# **2017-2018**

# **Snow Orientation**

Welcome

# Course Objective and Agenda

- General Facility and Shift Procedures
- Operations Safety
- Snow & Ice Control Material
- Removal Techniques
- Outside:
  - Hands-on - Pre-trip and Post-trip
  - Mechanical operations
  - Front-end Loader
  - Driving

# Facility and Shift Procedures

- 12 Hour Shifts (Hours may differ from project to project)
  - 12 AM to 12 PM
  - 12 PM to 12 AM
  - Storm Dependent Shift
- Shift Supervisors
  - Driver Contact & Shift Organization
  - Weather Monitoring
  - Training
  - Supervision

# Facility and Shift Procedures

- Driver Contact and Confirmation
  - Seasonal Driver Rotation
  - Good Phone Numbers
  - Driver Availability
  - Driver History and Reputation
- Weather Forecasts
  - Self Monitoring
  - Resource Requirement Evaluation
  - Pre-Storm Weather (start)



# Facility and Shift Procedures

- Stand-by Status and Start WX Dependent
  - Home Based Stand-by
    - Snow probability low or minimal
    - Supervisor will contact requesting stand-by
    - One hour or less response time
  - Facility Based Stand-by
    - Snow imminent
    - Supervisor will contact advising of start time
  - Pre-determined Start Time

# Pre-Storm Weather

- Forecast Sources
  - Local News (TV, Radio)
  - Internet Web Sites
    - Accuweather.com
    - National Oceanic & Atmospheric Administration (NOAA.gov)
    - Weather.com (The Weather Channel)
    - Clarus-system.com (RWIS)
  - Historical Consistency
  - Similarities

# Mid-Storm Weather

- Road Surface Temperatures & **Current Conditions**
  - Snow & Ice accumulation
  - Material Selection & **Use**
  - Traction and Vehicle Control
- Precipitation
  - Snow Intensity
  - Radar (Path & Predictive)
- Air Temperatures & Wind
  - Increasing or Decreasing
    - Wind Intensity & Direction

## Post Storm Weather (Clean-up)

- Road Surface Conditions
- Air Temperatures
- Wind Conditions
- Sun & Cloud Cover
- 24 Hour Forecast



# **Driver Documentation**



**SNOW DRIVERS REPORT**

DRIVER NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

JOB NAME / CITY NAME: \_\_\_\_\_

\*SHIFT START TIME: \_\_\_\_\_ AM/PM      SHIFT END TIME: \_\_\_\_\_ AM/PM

STAND BY START TIME: \_\_\_\_\_ AM/PM      STAND BY END TIME: \_\_\_\_\_ AM/PM

\*\*DEPLOYMENT TIME START: \_\_\_\_\_ AM/PM      DEPLOYMENT END: \_\_\_\_\_ AM/PM

TOTAL SHIFT/DRIVER HRS: \_\_\_\_\_ TOTAL TRUCK DEPLOYMENT HRS: \_\_\_\_\_

GPS TIME START: \_\_\_\_\_ AM/PM      END \_\_\_\_\_ AM/PM

\*\*\*Supervisor to complete GPS time      GPS HRS\*: \_\_\_\_\_

\*\*\*\*TRUCK / EQUIPMENT NUMBER: \_\_\_\_\_

HOUR METER		END		MILES		END
START				START		
TOTAL			TOTAL			

CUBIC YARDS OF MATERIAL			
Circle Type:	Ice Slicer	Salt	Sand Salt
Start Cu. Yd./Buckets in Truck			
Loaded Cu. Yd./Buckets (+)			
Loaded Cu. Yd./Buckets (+)			
Loaded Cu. Yd./Buckets (+)			
Loaded Cu. Yd./Buckets (+)			
Loaded Cu. Yd./Buckets (+)			
End Cu. Yd./Buckets in Truck (-)			
Total Used			

GALLONS OF LIQUID / APEX			
Circle Type:	Apex	Salt Brine	Mag Chloride
Start Gal. in Truck			
Loaded Gal. (+)			
Loaded Gal. (+)			
Loaded Gal. (+)			
Loaded Gal. (+)			
Loaded Gal. (+)			
End Gal. in Truck (-)			
Total Material Used			

ROUTES PLOWED: \_\_\_\_\_

ADDITIONAL COMMENTS:  
(Plowing or Equipment Remarks)

I HAVE INSPECTED VEHICLE AND NOTED CONCERNS AND MADE CORRECTIONS WHEN POSSIBLE

DRIVER SIGNATURE: \_\_\_\_\_

\*Shift time - reflects time sheet hours for payroll  
\*\*Deployment starts when truck departs and ends when it arrives at end of shift

\*\*\* GPS Hours and Time will be filled in by Supervisor  
\*\*\*\* When Switching Trucks Please use a New Sheet

**TRUCK / EQUIPMENT INSPECTION**  
**CHECK ANY DEFECTIVE ITEM AND GIVE DETAILS UNDER ADDITIONAL COMMENTS**

√ = NO REPAIRS NEEDED      N/A=NOT APPLICABLE      X=REQUIRES REPAIR

<u>INSIDE CAB</u>	Pre Trip	Post Trip
REGISTRATION/INSURANCE/		
DOT ANNUAL/GAS CARD		
CAB LIGHT		
FIRE EXTINGUISHER		
TRIANGLES		
SNOW BRUSH/SCRAPER		
INSIDE CAB (CLEAN/DIRTY)		
DASH CONTROLS CONDITIONS		
WINDOWS AND WINDSHIELD-GLASS		
MIRRORS-ALL SIDES		
SEAT & SEAT BELTS		
STEERING WHEEL & MECHANISM		
GAUGES-ALL		
BRAKES-SERVICE & PARKING		
CLUTCH		
GEAR SHIFT HANDLE		
OVERDRIVE SWITCH (AUTOMATIC)		
HYDRAULIC CONTROLS		
SNOW MATERIALS CONTROL BOX		
HEATER/DEFROSTER		
FUEL LEVEL		
HORN (s)		
BACK ALARM		
WINDSHIELD WIPERS CONTROL		
POWER DIVIDER (IN OFF POSITON)		
PTO CONTROL SWITCH		
<b><u>SNOW PLOW</u></b>		
PLOW CONDITIONS-CRACKS		
PLOW EDGE AND CURB SHOES		
(EDGE A LEAST 1" FROM FRAME)		
PLOW PINS & BOLTS		
HYDRAULIC HOSES & CYLINDERS		
HYDRAULIC FITINGS		
PLOW MARKERS		

<u>OUTSIDE</u>	Pre Trip	Post Trip
VISIBLE LEAKS		
RUNNING LIGHTS		
HEADLIGHTS		
SIGNAL LIGHTS		
HAZZARD LIGHTS		
STOP LIGHTS		
PLOW LIGHTS		
BEACONS		
SANDER LIGHT		
BODY / DENTS		
STEPS / HAND RAILS		
FRAME / CHASIS		
EXHAUST SYSTEM		
DRIVE SHAFT		
HYDRAULIC OIL LEVEL		
HOSES CONDITIONS-AIR AND OIL		
QUICK COPLINGS		
GREASE FITTINGS-ALL		
SUSPENSION / SPRINGS		
TIRES / RIMS / LOG NUTS		
<b><u>SANDER</u></b>		
SANDER CONDITIONS-CRACKS		
SECURE TIE DOWN TO TRUCK		
CONVEYOR		
SPINNER		
SPRAYERS (if Tanker)		
GATE HIGHT & MECHANISM		
GREASE FITTINGS		
LOAD IN BOX		
OVERLOADED		
<b><u>PERSONAL ITEMS</u></b>		
SOMETHING TO DRINK		
SOMETHING TO EAT		
ROUTE BOOK		
GPS UNIT # (Centennial)		

**Standard Procedures**

- 1) DO NOT EXCEED 25 MPH WHILE PLOWING
- 2) Watch for low branches Don't get too close and risk breaking off beacons.
- 3) DO NOT push snow on sidewalks. Violators will be issued shovels.
- 4) Stay away from pedestrians and homeowners cleaning their walks or driveways.
- 5) Drive at or below the speed limit pending snow conditions and traffic.
- 6) Expect impatient drivers to takes risks to go around you and get to the next light in front of you.
- 7) Time your fuel stops, material pickup and breaks with traffic patterns in mind.
- 8) Check edges, plows, and lights at beginning, end and top of the hour for wear. Verify with your supervisor.
- 9) Call your local, friendly supervisor with any problems, questions, or resident complaints.
- 10) Avoid confrontations with homeowners. Pass the buck to your supervisor

# Documentation

- Accuracy & Accountability
- Pre-Trip & Post-Trip Inspections
- Hours of Operation
- Material Use
  - Total Material Quantity
  - Regular Calculations
    - Pounds / Miles = pounds per mile
    - 11000 lbs.. (2 buckets) / 65 Miles = 169 lbs. per mile
    - Goal during “normal” storm = 150-175 lbs. per mile

# Documentation

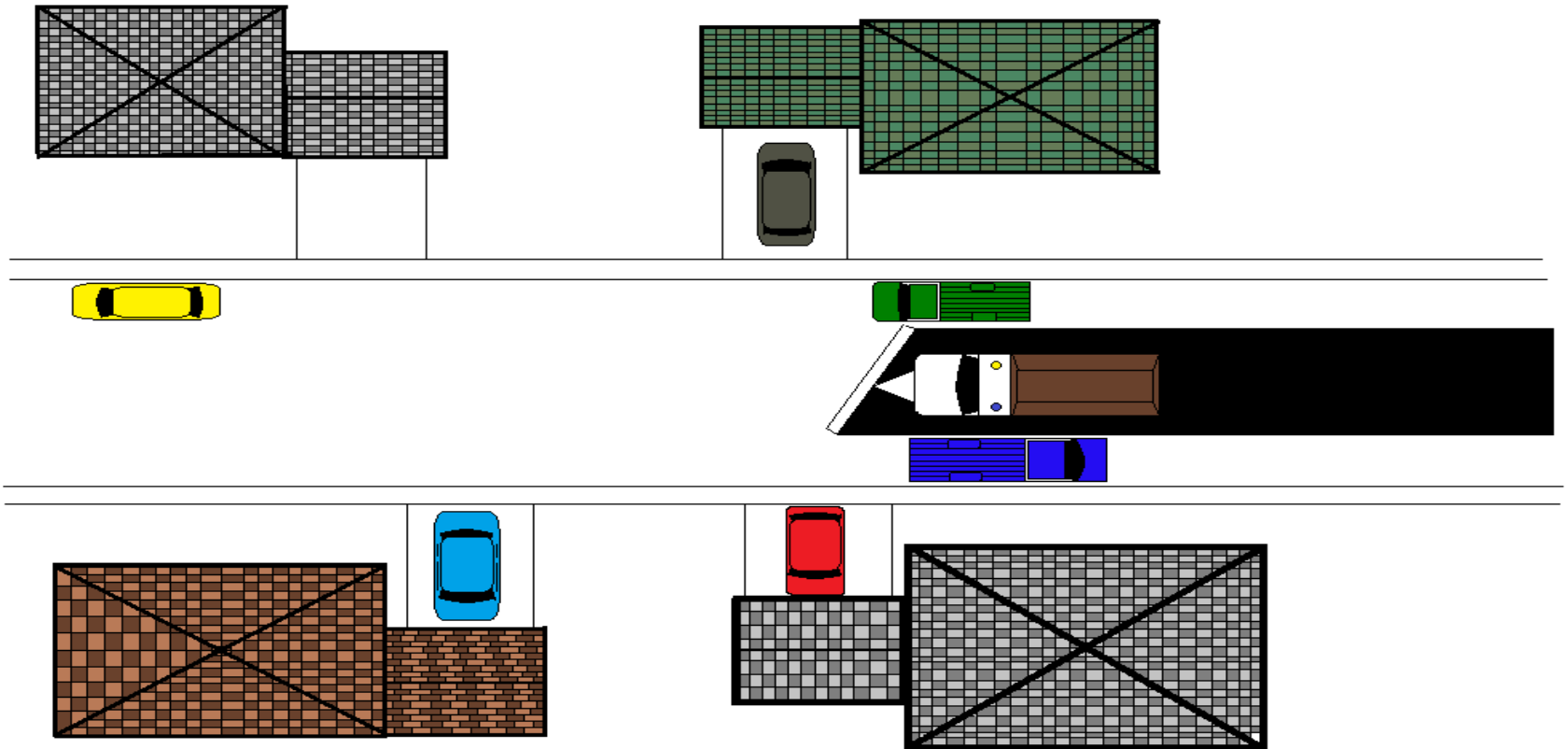
- End of Shift Document Review by Snow Shift Supervisor
  - Do not leave until Snow Shift Supervisor approves and signs your paperwork
- Equipment Repairs
  - **Notify Shift Supervisor During Shift is Required**
  - Document Problems @ End of Shift in addition to Supervisor Notification
  - Equipment Issues / Problems are the Current Drivers Responsibility – Assumed Current Driver Created Problem.

# Snow Plowing Techniques

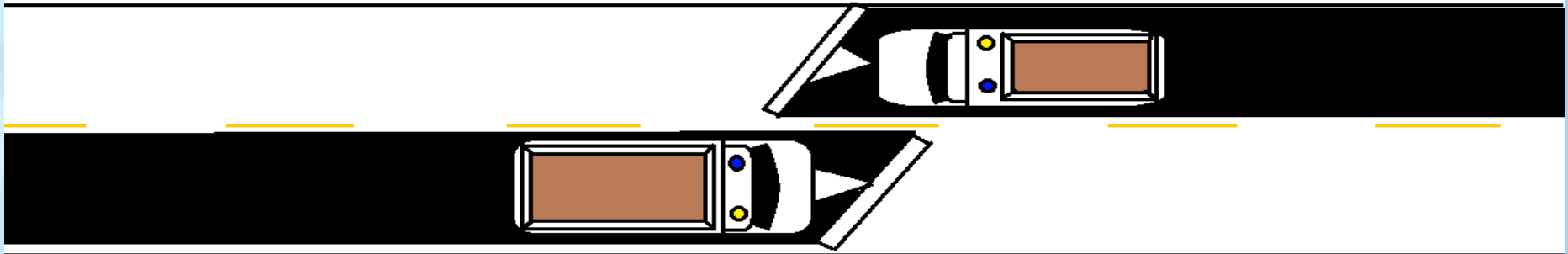
- Residential Street
- Two Way Street
- Echelon Plowing



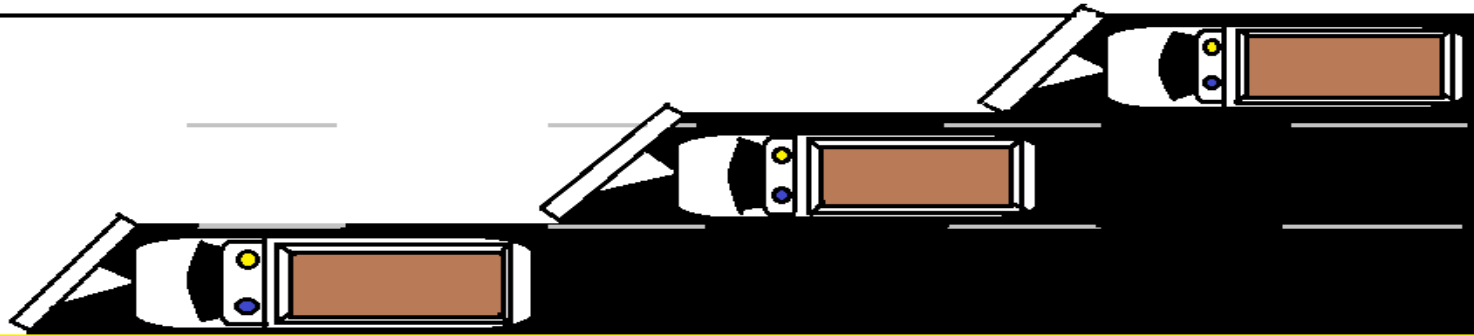
# Residential Street Plowing



# Two Way Street Plowing



# Echelon Plowing





# **Difference between Anti-Icing and De-Icing**

# ANTI-ICING

- ▣ Anti-icing occurs before the snow begins to fall and is used to prevent ice from bonding to the roadway surface.
- ▣ Anti-icing applications should be between 35 & 40 gallons per lane mile before the road has turned wet.
- ▣ It is essential that the pavement be cleared of snow or loose ice before applying liquid chemicals to reduce the dilution that would result.



# DE-ICING

- ▣ DE-ICING is a snow and ice control strategy in which chemicals are applied to the top of an accumulation of snow, ice, or frost that is already bonded to the pavement surface.

# Early Fall Applications

Be careful of road surface contaminants when there has not been moisture for extended periods of time.

They can cause the surface to become slick with minimum application rates of de-icers.

- Anti-freeze
- Motor oil
- Diesel fuel
- Gasoline
- Rubber



# Cold Temperature Mag-Chloride

- ▣ Apex – 25 gal/lane mile above 16°
- ▣ Mag– 40 gal/lane mile
- ▣ Requires constant monitoring of precipitation rate and temperature





# Only use what is needed





**Only apply to driving lanes**





**Do not over apply at the end  
of the storm**





**Pocahontas Parkway located in Richmond, VA responses to survey of toll facilities**

**Fort Worth, TX**

**HWY21FH005**

(21 pages)

## SURVEY OF TOLL FACILITIES

### **General Operations:**

1. Is the toll facility private or state regulated?

*The Pocahontas Parkway is state regulated through a Concession Agreement with the Virginia Department of Transportation.*

2. When was the toll facility officially opened to traffic?

*The Pocahontas Parkway opened to traffic in May of 2002.*

3. How many lane miles does the toll facility maintain?

*The Pocahontas Parkway consists of approximately 38 lane miles.*

4. How many days did the toll facility respond to snow and ice removal events in each of the last 5 years?

	2016	2017	2018	2019	2020
Days with Snow and Ice Removal Events	7	6	5	2	6

### **Snow and Ice Removal Pre-treatment Operations: Describe and/or provide documentation of the following:**

5. All pre-treatment options and subsequent chemical applications currently used by the toll facility during snow and ice removal events.

See attached “*Pocahontas Parkway Winter Maintenance Plan*”

- 4a. How long each specific pre-treatment option and subsequent chemical applications are effective in treating the roadway after initial application.

*Anti-icing measures take place before snow begins to fall and ice forms on the roadway. Among several benefits:*

*Lowers the freezing temperature of water to about 18 degrees.  
Prevents snow and ice from bonding with the road's surface.*

*Keeps snow from being compacted by traffic, which can turn it into ice. More effective and coats roadways better than plain salt or sand. Gives crews more time, since brining can occur up to 48 hours before a storm.*

*These benefits are generally short-lived and should not be expected to last over a long period. Subsequent chemical applications should be made as soon as conditions begin to deteriorate. Pre-treatments can be thought of as "buying time" in the early stages of a storm until subsequent chemical applications are made and become effective.*

- 4b. Any formal criteria of when to use specific pre-treatment options and subsequent chemical applications.

*Anti-icing measures should not be applied if rain is expected before the snow begins.*

*Crews can use salt and sand to help clear roads when after a storm hits. After plows clear as much snow as possible, a mixture is spread on roadway, with special attention given to parkway ramps. Salt helps to melt the remaining snow and ice. Sand helps break up the ice and adds extra traction for vehicles.*

**Snow and Ice Removal: Describe and/or provide documentation of the following.**

6. An inventory (trucks, plows, front-end loaders, spreaders, etc.) including the number of covered salt storage facilities and quantities of salt that are dedicated to snow and ice removal events.

See attached "Pocahontas Parkway Winter Maintenance Plan"

7. Methods/technologies to monitor moisture and ice formation on roadways, highway overpasses, or bridges.

*Our Pocahontas Parkway team checks the weather forecast daily using weather mobile applications and nearby weather stations.*

7a. If you use sensor detection systems, the systems, and procedures for their use.

*Our supervisor's and maintenance technicians have access to handheld laser temperature gauges. The gauges are used to monitor the temperature of the road asphalt and concrete bridge decks throughout the parkway.*

7b. If you do not use sensor detection systems, any future plans by the toll facility to utilize them or other technologies capable of monitoring moisture and ice formation on roadways, highway overpasses or bridges.

*Not applicable.*

8. Procedures for snow and ice removal.

8a. If you have formal procedures in place, provide a copy of the established procedures.

See attached "*Pocahontas Parkway Winter Maintenance Plan*"

9. Training procedures for maintenance technicians who perform spot checks and inspections of road conditions during snow and ice removal events. Provide details on the training procedures necessary to become a spot checker (i.e., initial number of training days/hours, certification requirements, length of annual refresher courses, etc.)

*Our highway maintenance technicians are only allowed to check the temperature of the roadway and bridge decks with our handheld laser temperature gauges. The Maintenance Manager or the subcontractor supervisor will be the only person to make decisions concerning pre-storm applications, spreading salt or sand, and when to plow snow. Both the Maintenance Manager and the subcontractor supervisor have over two decades of snow removal and winter storm response experience here in central Virginia.*



**Documentation Checklist: Please provide the following if available.**

- ✓ Pre-treatment options, durations of effectiveness, and criteria for use  
See attached "*Pocahontas Parkway Winter Maintenance Plan*"
- ✓ Inventory of snow and ice equipment  
See attached "*Pocahontas Parkway Winter Maintenance Plan*"
- ✓ Systems/methods used to detect moisture and icy conditions  
See attached "*Pocahontas Parkway Winter Maintenance Plan*"
- ✓ Operational and training procedures for snow and ice removal  
See attached "*Pocahontas Parkway Winter Maintenance Plan*"
- ✓ Contract between toll authority and state, including snow and ice removal events  
*ARCA agreement with the Virginia Department of Transportation*



Rt. 895 – Pocahontas Parkway  
Winter Maintenance Plan 2021 – 2022

Globalvia Operations USA, LLC

501 Pocahontas Parkway

Richmond, VA 23231

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## Introduction

The Pocahontas Parkway (895) is an 8.8-mile cash and fully electronic toll road with an elevated bridge crossing the James River. It is located southeast of Richmond, Va. Route 895 connects the Chippenham Parkway (Route 150) with Interstate 295 to create a southern bypass of the city. It is the only crossing of the James River for six miles in either direction. In late 2016, Globalvia acquired the concession and currently owns and maintains the Pocahontas Parkway.

The 2021-2022 Pocahontas Parkway Winter Maintenance Plan describes the policy, objectives, and operational procedures for the delivery of Winter Maintenance on 895. This plan includes all snow and ice removal operations on the boundaries of the 895 network. The fundamental objectives of the Winter Maintenance Plan are as follows:

- To ensure the safest, most convenient and fluid transit as possible on 895 or sections of roads that have been affected by winter weather conditions, particularly snow and ice.
- To avoid, or at least reduce as much as possible, any degradation of highways affected by the weather conditions.
- To manage all necessary operations to effectively achieve the two above goals keeping overall costs to a minimum.

Treatment can be separated into two types: treatment against ice and treatment against snow. Treatment can be preventive if it is carried out before the event takes place. Treatment is corrective if it occurs afterwards. Preventive treatment, if properly implemented, has the advantages of lower labor costs, reduced consumption of chemicals, simpler, more efficient work with snowplows, lower environmental impact, and a higher service level for users.

One of the fundamental aspects of preventive maintenance is to act in a timely fashion. This can be achieved by obtaining and observing weather forecasts prior to a winter weather event, so that the information about the type of event is available and decisions can be made about to proceed with winter maintenance operations.

## Definitions

Term	Definition
<b>Winter</b>	Pertaining to or concerning the winter season
<b>User</b>	Travelers of the Pocahontas Parkway
<b>Preventive</b>	Maintenance related action taken to prevent negative outcomes from occurring
<b>Corrective</b>	Maintenance related actions taken proactively and prior to issues arising to aide in preventing issues from occurring in the first place
<b>Snow</b>	Frozen water released by clouds in extremely small crystals which fall to the ground in the form of flakes by grouping together.
<b>Heavy Snow</b>	More than 2 inches per hour of snow for at least 2 hours.
<b>Ice</b>	Water in its solid, crystalline state due to a sufficient decrease in temperature.
<b>Pre-Treatment</b>	A form of anti-icing where chemicals are applied to the road up to 48 hours before a winter storm. This prevents a bond from forming between the pavement and the snow and ice after the storm starts.
<b>Anti-Icing</b>	Application of chemicals to roads before a snow-pavement bond occurs when the temperature drops. Anti-icing emphasizes prevention.
<b>Pre-Wetting</b>	Involves treating the dry de-icing chemicals with liquids before they are applied to the roadway as part of the de-icing efforts. This accelerates the activation of the chemicals before they are applied to the road. Pre-wetted chemicals typically are not applied to roads before snow or ice accumulates

<b>De-Icing</b>	The practice of removing snow or ice once it has bonded to the pavement. This involves plowing and continual application of chemicals. Plowing generally begins when an inch or more of snow has accumulated on the road.
<b>Sodium Chloride</b>	For snow and ice control, sodium chloride – or salt – is the most plentiful and inexpensive de-icing material. It is mined as rock salt or distilled from seawater. When salt is applied to the road, it creates brine, which keeps snow and ice from bonding to the pavement. Salt is effective to temperatures of about <b>27 degrees Fahrenheit</b> and above.
<b>Calcium Chloride</b>	An expensive de-icing chemical, calcium chloride is most often mixed with salt to provide some moisture so the chemical reaction causing melting can take place. It is used when temperatures fall into the <b>low 20s Fahrenheit</b> . At those temperatures, moisture isn't present to help salt start the melting process. In liquid form, calcium chloride provides quicker melting action.
<b>Abrasives</b>	Small gravel or sand that cannot melt snow or ice. Often, abrasives are mixed with salt to provide additional traction and reduce the cost of applying chemicals. Abrasives can be used on roads generally not treated with chemicals. De-icing chemicals, such as salt and calcium chloride, are very detrimental to gravel-surfaced and surface-treated roads (those pavements with a salt-and-pepper appearance). Chemicals are used very sparingly on these types of roads and only when necessary.
<b>Black Ice</b>	Black ice, also known as “glare ice” or “clear ice,” refers to a thin coating of glazed ice on road. While not truly black, it is transparent, allowing you to see the asphalt pavement through it. Black ice often occurs along with wet roads, making it hard to see and especially hazardous for driving or walking.

## Contacts

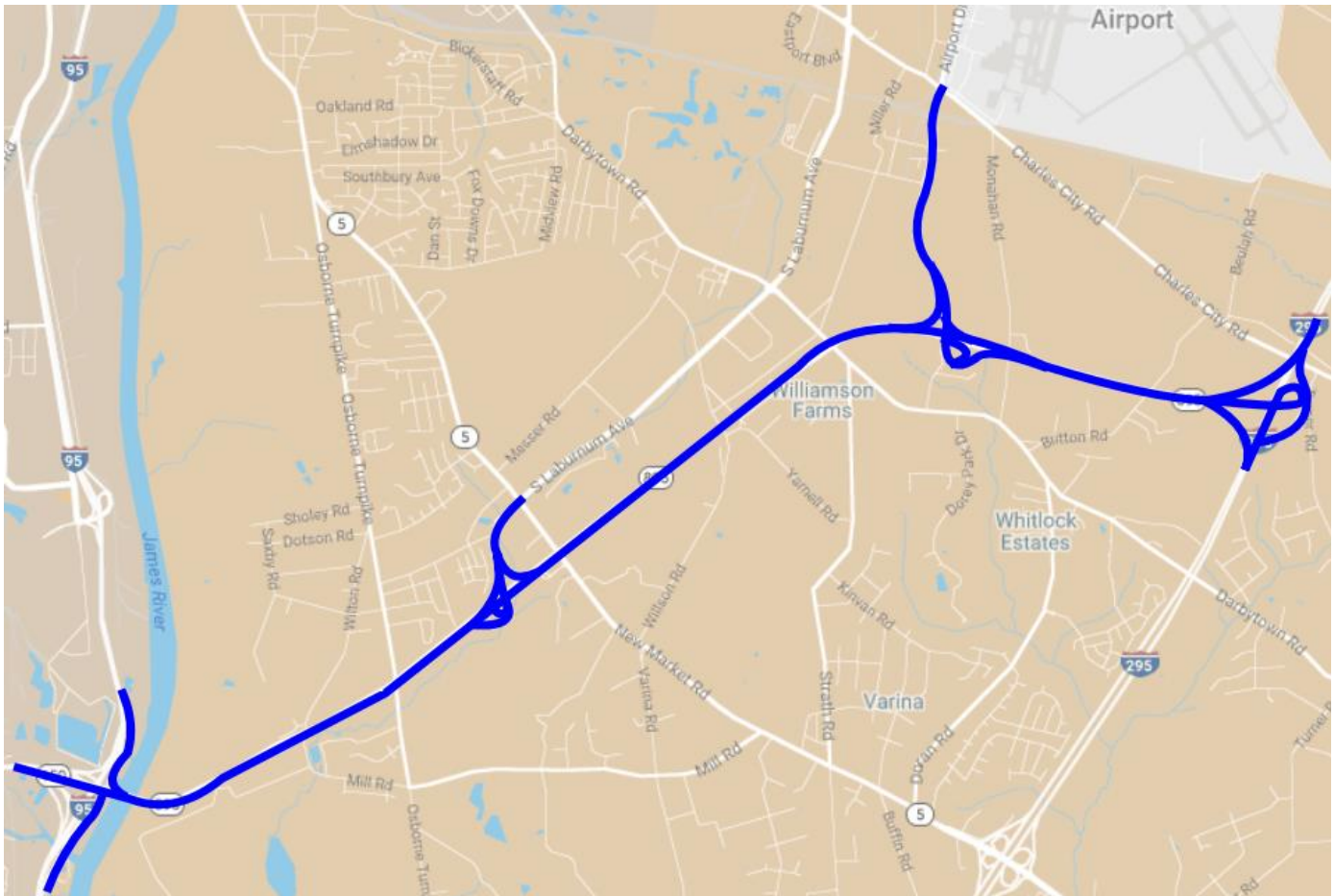
Name	Company	Title	Phone	Email
[REDACTED]	Globalvia Ops	Maintenance Manager	[REDACTED]	[REDACTED]
[REDACTED]	Globalvia Ops	Maintenance Foreman	[REDACTED]	[REDACTED]
[REDACTED]son	Globalvia Ops	Maintenance Tech	[REDACTED]	[REDACTED]
[REDACTED]	Globalvia Ops	Maintenance Tech	[REDACTED]	[REDACTED]
[REDACTED]	Globalvia Ops	Maintenance Tech	[REDACTED]	[REDACTED]
[REDACTED]	Globalvia	O&M Manager	[REDACTED]	[REDACTED]
[REDACTED]	RJ Smith	Project Manager	[REDACTED]	[REDACTED]
[REDACTED]	Cargill	Account Manager (Salt)	[REDACTED]	[REDACTED]
[REDACTED]	Real Estate	RE Agent (salt shed)	[REDACTED]	[REDACTED]



## Location of Services and Project Limits:

*All mileage is approximate*

Winter Weather Operations on 895 will be performed within the right-of-way limits on all of 895, all of the Airport Connector, and all of the Laburnum off-ramp. 895 consists of 9.9 center lane miles and approximately 40 lane miles including all ramps up to the intersection of non-895 route(s) pavement edge.



## Bridge Structures

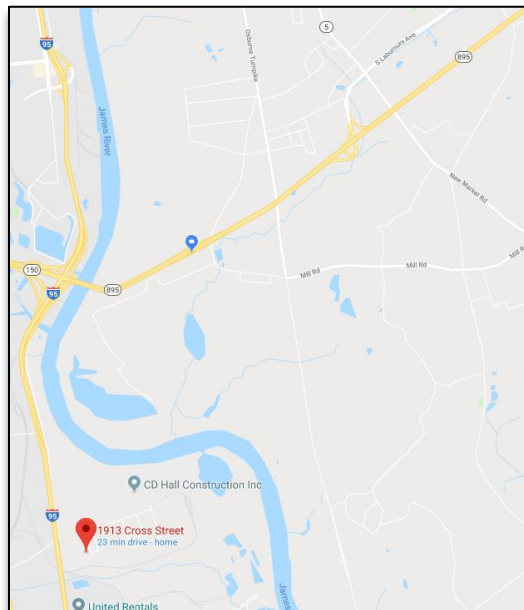
The majority of 895's roadway is asphalt. However, 895 contains numerous concrete bridge structures, including the Veteran's Memorial Bridge that crosses over the James River. Due to concrete freezing at higher temperatures than asphalt, bridge structures may utilize a slightly different procedure with regards to anti-icing and snow plowing. Below is a table of all bridge structures with coordinates:

BRIDGE STRUCTURES		
No.	Description	Coordinates
043-2908	Airport Connector Road over Rte. 895	<a href="#">37.478853, -77.339886</a>
043-2909	Airport Connector Road over Spouse Road	<a href="#">37.494041, -77.341244</a>
043-2910	Airport Connector Road over CSX Railroad	<a href="#">37.496761, -77.340925</a>
043-1016	Ramp D over Cornelius Creek	<a href="#">37.459499, -77.383233</a>
043-5093	Ramp to Laburnum Ave. over Rte. 895	<a href="#">37.458216, -77.384433</a>

043-1010	Rte. 895 EB over Cornelius Creek	<a href="#">37.459086, -77.382800</a>
043-1013	Rte. 895 WB over Cornelius Creek	<a href="#">37.459225, -77.383025</a>
043-1033	Rte. 895 EB over Darbytown Road	<a href="#">37.478190, -77.351209</a>
043-1036	Rte. 895 WB over Darbytown Road	<a href="#">37.478358, -77.351381</a>
043-1041	Rte. 895 EB over Manahan Road	<a href="#">37.477269, -77.333276</a>
043-1042	Rte. 895 WB over Manahan Road	<a href="#">37.477489, -77.333254</a>
043-1009	New Market Road over Rte. 895	<a href="#">37.461547, -77.379060</a>
043-5095	Wilton Road over Rte. 895	<a href="#">37.447030, -77.404711</a>
043-5094	Mill Road over Rte. 895	<a href="#">37.447030, -77.404711</a>
043-5092	Osborne Turnpike over Rte. 895	<a href="#">37.451196, -77.395490</a>
043-5020	Britton Road over Rte. 895	<a href="#">37.474463, -77.318989</a>
020-1054	Rte. 895 WB ramp to Rte. I-95 SB	<a href="#">37.443294, -77.427779</a>
020-1055	Rte. 895 WB ramp to Rte. I-95 NB	<a href="#">37.442398, -77.424084</a>
020-2048	Rte. I-95 NB ramp to Rte. 895 EB	<a href="#">37.434122, -77.431331</a>
043-1910	Rte. 895 EB over James River and Rte. I-95	<a href="#">37.442680, -77.426604</a>
043-1911	Rte. 895 WB over James River and Rte. I-95	<a href="#">37.442854, -77.426550</a>
043-1043	Loop B over Rte. I-295	<a href="#">37.470708, -77.308056</a>
043-2082	Loop D over Rte. I-295	<a href="#">37.473203, -77.306590</a>

## Salt Shed

The salt shed stores up to 500 tons of salt used for di-icing activities on the Pocahontas Parkway and is located at 1913 Cross Street, North Chesterfield. VA 23237. Snow plowing trucks will typically start their snow plowing routes at this location to fill up on salt first.



# Snow Operations

## Echelon Plowing

An echelon formation for double-axle snow trucks will be utilized by our subcontractor for snow removal operations. Echelon plowing is defined as a grouping of plow-equipped winter vehicles used to plow a multi-lane roadway, with each plow assigned to one lane, all plowing to the right, and in close enough proximity that traffic is prevented from traveling in between the winter vehicles. The winter vehicle servicing the far-left lane shall be the lead vehicle, followed by the vehicle in the next lane to the right and continuing in sequence from left to right for all lanes. When the far left lane is plowed to the left, the winter vehicle servicing that lane is not considered to be part of the echelon plowing group.

Rte. 895 roadways consist predominately of freeway type roadways and as such echelon plowing is a critical operation in the safe removal of snow and ice. Echelon plowing operations require that snowplow trucks operate at a spacing of 50 to 100 feet to discourage motorists from passing plows or crossing through the windrows, which result from the movement of snow from the left lanes to the shoulder area. These procedures are followed because:

- The passing maneuver is too hazardous due to the lead plow leaving a heavy windrow of snow
- The road ahead is known to be in hazardous condition due to conditions such as heavy drifts, slipperiness and accidents
- Visibility is limited, rendering passing hazardous
- Heavy traffic volumes dictate that, even if passing were permitted, only a small percentage of the overtaking vehicles could make their way through the primary passing route available

Snow plow routes for 895 have been created utilizing tandem axle and single axle combination units, plows, spreaders, and tow plows, as well as spare pieces of winter maintenance equipment, if required.

## Mobilization Guide

Weather Forecast	Mobilization Level	Response Plan	Salt Application Rate
<b>Precipitation:</b> 20% or greater <b>Accumulation:</b> Ice/snow possible <b>Ambient or Pavement Temp:</b> 30-36	Anti-Ice	Spot treatment of other critical structures and locations	<b>Liquid Mag:</b> 36 gal/linear mile <b>Salt Brine:</b> 50 gal/linear mile <b>Salt:</b> 325 lbs/linear mile
<b>Precipitation:</b> 20-49% or greater <b>Accumulation:</b> Snow possible <b>Ambient or Pavement Temp:</b> 30-36	1	Spot treatment of other critical structures and locations	325 lbs/linear mile
<b>Precipitation:</b> 50-100% chance <b>Accumulation:</b> Up to 1 inch of snow <b>Ambient or Pavement Temp:</b> 25-29	2	Light salting operation	400 lbs/linear mile
<b>Precipitation:</b> 50-100% chance <b>Accumulation:</b> Up to 2 inches of snow or up to 1/10 inch of ice <b>Ambient or Pavement Temp:</b> 20-24	3	Salting operation	475 lbs/linear mile
<b>Precipitation:</b> 50-100% chance <b>Accumulation:</b> Up to 6 inches of snow or up to 1/4 inch of ice <b>Ambient or Pavement Temp:</b> 15-19	4	Salting / plow operation	550 lbs/linear mile

<p><b>Precipitation:</b> 50-100% chance  <b>Accumulation:</b> More than 6 inches of snow or more than 1/4 inch of ice  <b>Ambient or Pavement Temp:</b> 10-14</p>	5	Salting / heavy plow operations; all resources are deployed	625 lbs/linear mile
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### Anti-Icing / De-Icing

Liquid anti-icing operations for snow and ice control will be performed at the discretion of the Maintenance Manager in accordance with the mobilization guide in the section above. Pre-treatment of 895 using a liquid solution – typically of salted brine – to lower the freezing temperature of the road, prevents or delays roads from freezing and causing hazardous conditions.

The quantity of anti-icing liquid is contingent on the severity of the storm and the number of snow trucks mobilized to respond to the storm. Our subcontractor has one truck with a 6,000 gallon tank and two trucks with a 3,000 gallon tank used for anti-icing measures.

The salt brine concentration for each batch will be verified by our subcontractor with hydrometer readings to verify the proper mixture. Improper concentrations will not only affect the effective eutectic temperature of the solution on the roadway but can also damage tanker equipment. The optimal concentration is 23.3%.

### Salt Inventory

The salt shed should be kept stocked for winter weather operations with up to 350 tons of rock salt. Salt is purchased through Cargill. Salt can be ordered at 1-800-600-7258 or 1-440-716-4686 (Kaitlyn Jackson).

### Equipment

The following list is the equipment that is required to successfully perform the winter maintenance (i.e., snow and ice removal services). This list makes up our subcontracted as well as in-house equipment.

Qty	Year	Make	Model	Type	Description
10	2016	Western Star	4700SF	Sub-Contracted	Tandem or multi-axle dump trucks equipped with contractor-owned 11' snowplows. 8 cu yd chemical spreader and two (2) 100-gallon liquid truck-mounted spray units
1	2021	Hitachi	ZW180HLA	Rented	Rubber Tire Loader for loading salt
2	2016	RAM	5500	Owned	4WD pickup truck (3/4 ton or 1 ton) with a plow, Arrow Board, and Lights. Note quoted 1-ton, single cab)
2	2018	BOSS	STB03236	Owned	9'0" Super Duty Snowplow for 4WD Pickup Truck
2	2018	BOSS	VBX Spreader	Owned	Salt spreader for 4WD pickup truck

### Weather Monitoring

It is the responsibility of the maintenance team to regularly and frequently check the weather forecast for possible upcoming winter weather events. The Maintenance Manager and Foreman should check the weather forecast daily. If winter weather, such as snow or ice, is listed in the forecast, the maintenance team will begin preparations by following the checklist below.

## Snow Event Procedure Checklist:

Activity	Completed?
Monitor the local weather forecast	<input type="radio"/>
Notify staff of potential winter weather snow event	<input type="radio"/>
Notify RJ Smith of potential winter weather snow event	<input type="radio"/>
Perform a salt shed salt inventory check	<input type="radio"/>
Perform an emergency generator fuel and maintenance log check	<input type="radio"/>
Perform an in-house BOSS brand snowplow (x2) and salt spreader (x2) visual inspection	<input type="radio"/>
Perform a RAM 5500 maintenance and fuel inspection for both trucks	<input type="radio"/>
Perform a front-end loader maintenance and fuel inspection	<input type="radio"/>
Confirm the operation of our Laser temperature gauges	<input type="radio"/>
Set schedule for maintenance team	<input type="radio"/>

## Snow Event Example Timeline

### Monday

1. The Maintenance Manager reviews the weather forecast and notices that snow is forecast for Wednesday
2. He notifies all local staff members of the potential event
3. He reaches out to the snow removal subcontractor to begin preparations for a potential snow event
4. He performs an inventory check of the salt shed to ensure there is an ample amount of salt for the event
5. He begins preparing a schedule for his maintenance team so that they can be available 24 hours – this may include sending them home early to prepare for increased hours later in the week
6. He checks the emergency generator weekly reports and physically verifies the amount of fuel – if fuel is low, he will schedule the fuel subcontractor to refuel the generator prior to the storm
7. The maintenance team foreman instructs his team to check both of their trucks – ensuring they have adequate fuel and the trucks are prepared for the snow event
8. The foreman visually inspects in-house snow plows and salt spreaders, confirming they are ready
9. The foreman performs an inspection of the front-end loader to ensure safe operation

### Tuesday

1. The Maintenance Manager confirms that all precautionary preparations are completed – ample salt in shed, fuel in generator and equipment, and the subcontractor is aware and has allotted resources for potential storm
2. He checks the weather forecast again – the snow storm is now expected to start early Wednesday morning at 4am; he communicates this change with the subcontractor and his maintenance team
3. He sends two of his maintenance technicians' home – they will report to the Salt shed Wednesday morning at 1am; two technicians remain on-site to handle any emergency maintenance tasks
4. He instructs the foreman to attach the snowplows and salt spreaders to the RAM 5500 maintenance trucks
5. He continues to monitor the weather, 2 - 4 inches of snow are expected to fall
6. Based on the most recent forecast information, and following the mobilization guideline outlined later in this plan, he works with the subcontractor to mobilize four snow plow trucks – scheduled to arrive at the salt shed at 1am on Wednesday morning



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## Wednesday

1. 12:30am – Two maintenance technicians arrive at the salt shed in one of the RAM 5500 maintenance trucks outfitted with snow plows and spreaders; they power on the front-end loader
2. 1:00am – Four snow removal trucks from the subcontractor arrive at the salt shed to begin loading salt into their salt spreaders
3. 1:30am – The maintenance technicians use the front-end loader to load their RAM 5500's salt spreader and all four snow plow trucks – noting how many buckets of salt were used for loading
4. 2:30am – All trucks are loaded with salt and head to the Pocahontas Parkway toll plaza to remain on standby until the snow begins – two headed in the eastbound direction and two headed in the westbound direction.
5. 3:00am – The maintenance technicians in the RAM 5500 trucks patrol 895, stopping at various bridge structures to take the surface temperature. The temperatures are below 36 degrees Fahrenheit, so they begin salting the structures
6. 3:15am – The maintenance technicians activate two of the snow plow trucks to begin salt treatments on other concrete bridge structures as well as they head back to the salt shed to refill their salt spreader
7. 4:00am – The asphalt temperature has reached 34 degrees Fahrenheit – the maintenance technicians dispatch the remaining two trucks to begin de-icing activities on the entirety of the parkway, now that all ramp/concrete structures have received treatment
8. 4:30am – snow begins to fall
9. 5:00am – The maintenance technicians are back to 895 and have dropped their plows to begin pushing snow that is accumulating on concrete ramps and bridge structures
10. 5:30am – All four snow plow trucks have been activated and are plowing snow in the lanes of 895; the salt has activated and helping to melt the snow and keep the asphalt from freezing
11. 9:00am – Two more Globalvia Maintenance Technicians arrive at the salt shed with the second RAM 5500 and load salt into the salt spreader
12. 9:30am – The snow stops falling; plowing activities continue with two RAM 5500s and four snow plow trucks
13. 11:00am – There is no more snow on the forecast and 895 travel lanes are cleared; the maintenance manager deactivates two of the snow plow trucks and moves the other two to standby mode, staged at the toll plaza facility; the two maintenance technicians that arrived early Wednesday morning are sent home
14. 1:00pm – no snow is forecasted, the remaining two snow plow trucks are deactivated – two remaining maintenance technicians continue to patrol the road for areas of black ice, dropping salt where needed

## Subcontractor Requirements

Globalvia Operations USA, LLC will be subcontracting a large portion of the snow and ice removal services to RJ Smith Construction – one of the largest snow removal services companies in the Commonwealth of Virginia.

### Performance Criteria

- A. Globalvia will be in-charge of directing the mobilization of all snow and ice resources for a winter weather event. This shall include all winter weather resources associated with this Contract. Globalvia may utilize the Winter Weather Mobilization Guidelines to initiate a mobilization start time, a demobilization time, determine the size of mobilization, determine the type of resources and equipment required, etc. The Contractor may and should provide input but shall fully comply with the final mobilization plan as directed by Globalvia.
- B. The Contractor shall provide anti-icing, snow and ice control equipment with operators for winter weather events on 895 right-of-ways. The Contractor shall perform highway winter weather event liquid anti-icing, and snow and ice

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Removal Services in accordance with the Globalvia's requirements, seven (7) days a week, twenty-four (24) hours a day.

- C. The liquid anti-icing, snow and ice removal services shall be performed on the routes defined the *Location of Services* section above. Globalvia will contact the Contractor when a forecasted event is predicated as to when to mobilize, and what equipment is needed. Globalvia will maintain oversight of operations during the event and will direct the Contractor when to demobilize. The Contractor shall maintain contact and communication with Globalvia throughout the event, adjusting equipment and personnel as requested by Globalvia to minimize frozen precipitation on the roadways during the weather event, and to remove all precipitation from all travel areas including shoulder, gore areas and crossovers. Globalvia will notify the Contractor of the demobilization and may reduce equipment as needed. The Contractor shall be responsible to notify all sub-contractors and assure that all equipment shall be on site as required.
- D. The anti-icing program expectations shall meet or exceed Globalvia's Winter Weather Mobilization Guideline attached for treatment of all roadways, bridges, and ramps prior to the anticipated winter weather event as directed. The Contractor shall provide equipment to remove snow and ice during each winter weather event. A meeting will be held in late summer to discuss the winter weather event services for the upcoming season.
- E. In winter snow and ice events, motorist's expectations are to proceed in a safe and orderly manner. During winter weather events all travel lanes, turn lanes, intersections, shoulders and interchanges, enforcement areas and police parking locations shall be kept free and clear of snow and ice. During times of freezing precipitation, the Contractor shall make a constant, continued and diligent effort to treat and remove any snow or frozen precipitation from the highway. The Contractor shall be responsible for the removal of any snow or ice or combination thereof that may appear after the cessation of the event to include but not limited to a drifting snow, refreezing of water, etc. At all times the Contractor shall ensure that snow removal operations (including plowing) do not obstruct other routes and shall not cause any connectors, gore areas or emergency crossovers to be obstructed.
- F. The following is Globalvia's expected timeframes after the cessation of the winter weather event for the removal of frozen precipitation from non-vehicular surface areas:
- 0"- 4" accumulation -Within 12 hours.
  - >4"- 12" accumulation- Within 24 hours
  - 12"- 18" accumulation- Within 36 hours
  - 18" accumulation- Within 48 hours unless Globalvia authorizes an extension of time.

### Emergency Mobilization:

A sudden or unpredicted winter weather event.

- One half of the spreader/plow trucks equipment indicated shall be deployable within sixty (60) minutes upon notification between October 1 through April 30.
- Full mobilization of equipment for winter weather event must occur in two (2) hours or less of notification.

### Equipment Requirement

- A. Globalvia requires the Contractor to provide a minimum quantity of equipment, except when specified in order to meet or exceed the anticipated needs of maintaining all designated roads safe for the traveling public and free of any winter precipitation: The numbers referenced below reflect anti-icing and salt/plow trucks, supervision trucks and heavy equipment (loaders, motor graders, backhoes, blowers, etc) which must be provided under the Contract.

## Performance Standards

- A. All roads shall be maintained in a manner so that all pavement travel lanes for mainline pavement, ramps, turn lanes, crossovers, intersections, interchange and bridges shall be kept free and clear of snow and ice so that traffic can proceed in a safe and orderly manner throughout the inclement weather occurrence.
- B. It is expected that the condition of the mainline pavement and associated turn lanes, ramps, shoulders and intersections are passable and safe for drivers during the entire winter weather event even if all lanes are not yet open. The Contractor must provide constant attention to such issues as freeze backs and loss of travel lanes even after clearing the roads.
- C. All paved shoulders are to be 90% -100% free of frozen precipitation and pushed back at least twelve (12) inches beyond the edge of pavement within the time required of the falling precipitation ceasing point.
- D. Blades on snow plows must be moved to the “up” position while performing snow removal duties over tolling equipment. This includes the treadles in the high-speed toll lanes – both eastbound and westbound on 895. This also includes the manual toll lanes both eastbound and westbound on 895.



## Personnel

- A. Manpower Requirements: The Contractor shall provide for each piece of snow removal equipment drivers (including relief drivers) who possess a valid Commercial Drivers' License (if required) and the demonstrated snow and ice removal skill and experience to operate the equipment. Each driver shall be fully able to operate snow and/or ice removal equipment. The driver shall be trained to adjust the gates on the spreader to the correct calibration, start and stop the engine on the spreader, and be able to turn the snow plow while the truck is parked or while moving. The driver shall be capable of operating all the features on the truck including spreader, snowplow, and liquid chemical spray tanks, if equipped. The driver shall also be responsible for filling the chemical spray tanks on his/her vehicle. The driver shall be responsible for immediately reporting any problems or breakdowns to his/her supervisor for repairs. The supervisor is responsible for immediately notifying the Globalvia of all breakdowns and repaired or replaced vehicles.
- B. Schedules: The Contractor shall be responsible for establishing equipment operator schedules so that no individual driver/operator/supervisor is permitted to work more than 12 consecutive hours (to include stand-by hours) without having at least a 6-hour break.
- C. Contact Information: The Contractor shall provide Globalvia, in writing, a list of emergency phone numbers (for use on weekends and nights) for snow and ice emergency operations (See Contractor's Contact List, Attachment 19) to ensure the time provisions for notifying the Contractor are met. This list shall contain company contact names and telephone numbers and must be received by October 15th of each year.
- D. Training: The Contractor's supervisors will be required to attend a training/orientation session presented by Globalvia at a time mutually agreeable between Globalvia and the Contractor. The training is expected to take

between 2-3 hours. The Contractor will be responsible for training his/her drivers/operators at no additional cost(s) to Globalvia. Training must be completed by October 15<sup>th</sup> of each contract year term.

## Certification of Training

- A. The Contractor shall provide Globalvia with a letter certifying that all drivers/operators designated or later assigned to perform work under this Contract have been properly trained to perform the assigned duties. This letter of certification shall include the name, drivers' license number, the number of hours of training, and verification of a valid commercial driver's license (if required) for each driver, operator or employee that performs any work under this Contract, including the name(s) of the person(s) who performed the training. This letter of certification must be received by Globalvia within seven (7) days of completing the training and shall be completed by November 1<sup>st</sup> and updated as needed. Under no circumstances shall the Contractor assign work to any employee that is required to have training, without performing or allowing such training first, with reference to this Contract

## Communication

- A. Communication devices used between the Contractor and Globalvia shall be a cellular or compatible phone that works in the assigned area. All personnel shall have in their possession an appropriate communications system between the operator and Globalvia.

## Equipment

- A. Bidders shall have (owned, leased or sub-contracted), trucks with plows and spreaders and all other equipment required herein along with experienced and trained operators, fuel, communication devices and any other incidentals, for the route segment of roadway to be maintained during winter weather events in order to be considered.
- B. The Contractor must provide at least eight (8) dedicated plow / spreader trucks for the Pocahontas Parkway
- C. The prices shall be inclusive of all equipment costs as well as incidentals (escort vehicles), fuel, supervisors, personnel costs associated with the performance of snow and ice removal services. Escort vehicles shall be available for each loader, backhoe, grader, bulldozer and anti-icing tanker when necessary.
- D. All offered vehicles must meet DMV requirements for licensed commercial vehicles. This shall include the visibility of all lights on the front and rear of the vehicle with the plow and spreader equipment installed.
- E. The Contractor shall conduct all anti-icing and snow removal services in accordance with the Virginia Work Area Protection Manual (VWAPM) and subsequent revisions, each vehicle involved in a moving/mobile operation shall be equipped with at least one rotating amber light or Globalvia approved equal and be visible 360 degrees. Vehicle hazard warning lights shall not be used instead of rotating lights or equivalent, but as a supplement. Each escort vehicle shall also be equipped with appropriate flashing lights.
- F. All plow trucks shall be equipped with auxiliary headlights and shall have the tail lights visible and not blocked by the spreader chute. Auxiliary lights must be visible when the plow is in the "up" position.
- G. Each tandem or multi axle dump truck shall be equipped with a snow plow of a minimum of eleven (11) feet in length, and a chemical spreader with an eight (8) cubic yard or equivalent material capacity.
- H. The Contractor shall be responsible for providing and replacing cutting edges/blades for plows. Contractor shall be required to replace blades at the discretion of Globalvia.

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- I. The Contractor shall provide tire chains when needed, as determined by Globalvia, for all equipment including loaders, backhoes, snow blowers, and graders. In the event a Contractor's vehicle becomes immovable or out of service the Contractor shall immediately notify Globalvia or designee. No payment will be authorized until the vehicle is back in operating status. The Contractor will be responsible for rescuing their equipment should it become immovable. If replacement equipment is needed, the Contractor shall provide a replacement within one (1) hour.
  - J. Each plow shall be capable of being turned. At least 35% of the plows shall have the capability of being controlled or turned from within the cab of the truck. Each chemical spreader shall be calibrated with adjustable settings.
  - K. The Contractor shall be responsible for properly securing all equipment and materials on their vehicles at all times.
  - L. All spreaders shall be operable and in good working condition to fulfill the contract requirements.
  - M. All plow blades shall be carbide cutting edge.

### General Contract Requirements

- A. Each piece of offered equipment shall be subject to inspection by Globalvia personnel. The inspection is to ensure that the equipment meets all Federal DOT and Virginia State Inspection standards as applicable. Location and time of inspection and any needed re-inspection shall be determined and performed at the convenience of Globalvia. Globalvia reserves the right to reject any offered equipment.
- B. The Contractor shall have all equipment operational by October 15th of each year

### Materials

- A. Globalvia will purchase all salt and sand required. Globalvia will be responsible for arranging for delivery and the appropriate bulk storage of these materials at a location provided and/or paid for by the Globalvia. The contractor will be responsible for obtaining or mixing brine solution as needed.
- B. These materials may also be stored at the Globalvia salt shed located off of I-95 southbound and Cross Street. The salt shed facility can be used as a staging area for materials during a snow and ice event.
- C. The Contractor shall provide a loader and operator if required, load and unload all materials with inventory control, at the designated area. Maximum numbers of loaders needed for this purpose is a total of one. The Contractor shall be responsible for damages to any equipment or facility damaged by their operations. The Contractor shall be compensated at the hourly rate for rubber tire loader with operator.

### Supervisor Requirement

- A. The Contractor shall provide one supervisor with:
- B. contractor owned plow, mobile phone or other means of communicating with the drivers for Globalvia roadway per shift during each snow removal operation. The cost for each shift supervisors is listed on the Contractors Bid Price Sheet.
- C. The Contractor's supervisor shall ensure their drivers sign in properly, have the necessary equipment, know their assigned routes, and perform the work according to Globalvia standards. The standards will be presented at the snow removal training sessions. Supervisors shall patrol the highways within his/her area of responsibility and report the road conditions to Globalvia. The Contractor's supervisors shall be knowledgeable of recommending when the roadway should be treated and/or plowed.







- D. The Contractor's supervisors must be able to communicate with the Contractor's drivers and Globalvia. The supervisor must be able to communicate effectively in English.
- E. The Contractor's supervisors cannot serve as the mechanic(s) to keep the Contractor's equipment operational or as an operator or driver for the Contractor's equipment or in any other capacity other than a supervisor.
- F. The Contractor's supervisor shall be responsible for reporting any truck that is out of service to Globalvia or designee, as soon as he/she is aware of the problem.

#### Subcontractor Mobilization Guideline

- A. The subcontractor will mobilize equipment at the discretion of Globalvia who will reference the Mobilization Guide provided in this Maintenance Plan.

## Snow Removal Example Photographs

The pictures below are examples only. Depending on the type of event, sleet, freezing rain, snow or any combination of frozen precipitation, the roadway may look different than the example pictures provided below.

	<p>Example of passing snow removal. Snow is removed from roadway.</p>
	<p>Example of a snow removal on the verge of failing. Snow is starting to build on the travel lane.</p>
	<p>Example of a snow removal failing in left lane. Left lane is covered by snow preventing the traffic from traveling in a safe, drivable and orderly manner.</p>
	<p>Example of a snow removal failure. Traffic unable to proceed in a safe manner.</p>



**Southern Connector located in Piedmont, SC responses to survey of toll facilities**

**Fort Worth, TX**

**HWY21FH005**

**(15 pages)**

## SURVEY OF TOLL FACILITIES

### **General Operations:**

1. Is the toll facility private or state regulated? **The facility is a public/private partnership. The facility is operated by a non-profit organization, but tolls are set by SCDOT pursuant to the license agreement.**
2. When was the toll facility officially opened to traffic? **2001**
3. How many lane miles does the toll facility maintain? **60**
4. How many days did the toll facility respond to snow and ice removal events in each of the last 5 years?

	2016	2017	2018	2019	2020
Days with Snow and Ice Removal Events	<b>5</b>	<b>4</b>	<b>5</b>	<b>2</b>	<b>4</b>

### **Snow and Ice Removal Pre-treatment Operations: Describe and/or provide documentation of the following:**

5. All pre-treatment options and subsequent chemical applications currently used by the toll facility during snow and ice removal events. **Snow and ice operations are performed by SCDOT. They primarily consist of brine applications, sodium chloride applications, or applications of a mixture of sand and sodium chloride. Additionally, the application of any of these three methods combined with calcium chloride. The specific application is determined by the conditions at hand.**

4a. How long each specific pre-treatment option and subsequent chemical applications are effective in treating the roadway after initial application. **This is dependent on the application rate, the temperature, storm intensity, existing conditions, and type of precipitation.**

4b. Any formal criteria of when to use specific pre-treatment

options and subsequent chemical applications. Specific applications are dependent on various factors as stated in the preceding response, but SCDOT has guidance in the SCDOT Maintenance Manual.

**Snow and Ice Removal: Describe and/or provide documentation of the following.**

6. An inventory (trucks, plows, front-end loaders, spreaders, etc.) including the number of covered salt storage facilities and quantities of salt that are dedicated to snow and ice removal events. Since SCDOT provides the snow removal operations for this toll facility, the snow and ice equipment owned by SCDOT is intended for use for all of SCDOT maintained roads and are not dedicated to the toll facility.
  
7. Methods/technologies to monitor moisture and ice formation on roadways, highway overpasses, or bridges. SCDOT does have Road Weather Information Systems (RWIS) throughout the state to monitor pavement and weather conditions, but there are none of these RWIS systems located on the toll facility. The information collected from these systems along with weather forecasting information combined with firsthand information from employees physically evaluating routes are used to confer appropriate treatments and times.
  - 6a. If you use sensor detection systems, the systems, and procedures for their use. RWIS systems monitor and collect weather information that is available on SCDOT internal intranet systems.
  
  - 6b. If you do not use sensor detection systems, any future plans by the toll facility to utilize them or other technologies capable of monitoring moisture and ice formation on roadways, highway overpasses or bridges. N/A
  
8. Procedures for snow and ice removal.
  - 7a. If you have formal procedures in place, provide a copy of the established procedures. See attached.
  
9. Training procedures for maintenance technicians who perform spot



checks and inspections of road conditions during snow and ice removal events. Provide details on the training procedures necessary to become a spot checker (i.e., initial number of training days/hours, certification requirements, length of annual refresher courses, etc.) **SCDOT has no formal training program as described in this question. Maintenance technicians performing condition assessments would be experienced personnel.**

**Documentation Checklist: Please provide the following if available.**

- ✓ Pre-treatment options, durations of effectiveness, and criteria for use
- ✓ Inventory of snow and ice equipment
- ✓ Systems/methods used to detect moisture and icy conditions
- ✓ Operational and training procedures for snow and ice removal
- ✓ Contract between toll authority and state, including snow and ice removal events

## 30.8 WINTER WEATHER

### 30.8.1 Winter Operation Program Goals

The goals of the winter operations program are as follows:

- establish a comprehensive winter operations plan;
- develop a well-trained professional crew;
- ensure use of safe and effective materials;
- ensure equipment is available and effective;
- ensure operations are effective, efficient and safe;
- avoid potential liability and manage risk exposure;
- maintain an effective public relations program;
- provide a safe transportation system;
- keep traffic moving;
- maintain business and commerce;
- provide for emergency response vehicles; and
- keep the public informed (e.g., use of media contact person, prepared news releases).

### 30.8.2 Weather and Environment

Because the specifics of winter weather are difficult to predict, the planning approach is to assume typical winter events based on data from previous years. Operationally, the RME must be prepared to adjust the plan once better information is available about a specific storm. Some of the variables that can affect operations include the following:

- amount of snow or ice,
- rate of snowfall or freezing rain,
- duration of the storm,
- timing of the storm,
- temperature,
- wind conditions, and
- type of snow.

These factors affect the manner in which winter storm operations should be conducted in order to achieve the objective of dry pavement.

Real-time winter weather information is available to the RME through the DOM intranet webpage. This information is provided by roadway sensors that collect temperature, traffic counts and vehicular speeds. The RME should also employ road patrols to provide first-hand information of winter conditions, especially in troublesome areas for which there are no roadway sensors.

### 30.8.3 Winter Storm Procedures

Maintenance procedure [Mnt-01 “Winter Storm Procedures”] and its accompanying checklist set forth procedures to be followed regarding winter storms for key positions within SCDOT, including the RME. The procedure is organized into four parts. Some of the more important work items under each part of the procedure are described below:

1. Status 1 – Winter Season Preparation. This part of the procedure concerns work to be performed prior to the winter season, this includes the following:
  - ensuring the snow and ice plans are current;
  - verifying contracts for salt and calcium chloride and with county public works, contractors and rental agencies are current;
  - ensuring road weather information systems are operational;
  - checking snow and ice equipment and providing training;
  - ensuring material supplies are adequate; and
  - checking that “Bridge Ices Before Road” signs are in place and bridge weep holes are clean.
2. Status 2 – Winter Weather Threat. This work should begin one to two workdays prior to a winter event. It consists of the following work:
  - reviewing the snow and ice plan with employees,
  - checking pavement temperatures to determine when to initiate anti-icing,
  - monitoring weather forecasts, and
  - determining the resources and shifting arrangements required.
3. Status 3 – During the Winter Storm. During the winter event, RME responsibilities are as follows:
  - activating the snow and ice plan in regard to shifting arrangements;
  - deploying assets as needed to achieve snow and ice goals;
  - updating the road conditions web page and the Emergency Operations Report; and
  - requesting help if needed prior to major detrimental effects (e.g., closing an Interstate).
4. Status 4 – After Winter Storm. After the storm has passed, the RME should perform the work listed under this part of the procedure, including the following:

- determining when to cease full operations,
- clearing the winter road conditions web page of winter weather conditions,
- inspecting and cleaning equipment,
- reviewing winter weather supplies for reordering, and
- conducting a post-storm meeting to review operations.

The RME should understand this procedure prior to developing winter operations plans and incorporate the applicable information into their snow and ice plans.

### **30.8.4 Snow and Ice Plan**

All maintenance offices under the RME are required to update their snow and ice plan each year. The snow and ice plan should include the following elements:

- activity schedule,
- route and bridge priorities,
- personnel and accommodations,
- materials,
- equipment,
- treatment types and timing,
- external support and coordination,
- reports,
- cleanup, and
- evaluation.

These topics are discussed in the following sections.

#### **30.8.4.1 Activity Schedule**

The activity schedule should address the following:

1. Shift and Route. Assign shifts, equipment, routes and duties to employees.
2. Notification and Deployment. Consult with the DME in regard to sending employees home in preparation for plan implementation and standby staffing.
3. Readiness Maintenance for Equipment. Verify equipment is operational. Calibrate and service, if needed.
4. Mobilization of Equipment and Fueling. Stage equipment at assigned locations prior to an event. Ensure adequate plans are in place for fueling the equipment.
5. Ordering, Receiving, Stockpiling and Distributing Materials. Verify inventory levels and report them to the DOM. Ensure an adequate plan is in place for re-supplying during events.

6. Coordination with Other Agencies. Verify contact information and update any agreements prior to an event. Include a copy of agreements in the snow and ice plan.
7. Overload Support. Coordinate outside assistance from other counties or districts through the DME.

#### 30.8.4.2 Route and Bridge Priorities

A snow and ice plan should include the assignment of priorities to routes. As part of the priority assignment, the plan should identify the priority or emergency routes that should be treated first and the features that should receive special pretreatment prior to the main deployment of resources (e.g., bridges, steep or long grades, troublesome horizontal curves). SCDOT's practice is to remove snow and ice from roadways in the following priority:

1. First Priority. These routes consist of all Interstates and primary and secondary routes considered to be essential to the movement of traffic; they are called "bare pavement routes." These routes are established by the DEA and are reviewed annually for any needed addition or deletion. Continuity of routes from county to county is also reviewed. The Director of Maintenance will approve the District system and ensure continuity of routes from District to District.
2. Second Priority. Other SC routes and US routes not included in the First Priority roads.
3. Third Priority. Other secondary routes not included in the First Priority roads.

#### 30.8.4.3 Personnel

The personnel section of the snow and ice plan should include the following:

1. Training. Equipment operators and others involved in winter operations must be trained. Information concerning training is provided in ([Chapter 16 "Training"](#)) and ([Appendix I "Training Requirements"](#)). Dry runs for practicing routes are a part of the training process. Training should be on specific equipment and include calibration of the equipment.
2. Safety. Information related to safety is provided in ([Chapter 10 "Personnel Protection"](#)) and ([Chapter 11 "Fleet and Equipment Safety"](#)).
3. Responsibilities. This portion of the snow and ice plan describes the typical coordination requirements and typical duties and responsibilities for plan implementation. Personnel included are:



- Resident Maintenance Engineer,
  - Assistant Resident Maintenance Engineer,
  - Maintenance Shop Supervisor,
  - Shift Area Supervisors,
  - Shift Area Coordinators,
  - standby crews,
  - office support staff,
  - local agencies,
  - local construction personnel,
  - contractors, and
  - out-of-area SCDOT personnel.
4. Personnel Roster and Crew Assignments. The plan should provide information on:
- current contact information for all personnel,
  - equipment assignments,
  - route assignments,
  - on-call rules and information,
  - area and shift rosters, and
  - personnel assigned to assist.
5. Personnel Accommodations. This part of the plan includes planning information about the following:
- food, water, sleeping bags and stranded survival kits;
  - meal arrangements;
  - recovering costs for meals; and
  - hotel arrangements for external assistance (where appropriate).
6. Meals. When employees are required to work outside of normal working hours in the event of an emergency, a meal(s) will be allowed for those employees. The meal expense must be reasonable and limited to the allowance established by the Budget and Control Board.

The following documentation must be maintained and submitted when paying an outside vendor or reimbursing an employee for a meal:

- itemized invoice for the meal;
- list of all employees;
- employee number;
- nature of the event and copy of official notification of emergency situation;

- dates and times employees were required to stay at their official headquarters; and
- designate the meal that is being provided (i.e., breakfast, lunch, dinner) and the time of day the meal is being provided (e.g., 8:30 p.m., 5:00 a.m.).

In the event of an emergency, the request to unblock the procurement card will be made to the Comptroller General. This will allow the procurement card to be used to purchase meals. If the procurement card is used at a restaurant to purchase a meal(s), the following documentation must be maintained with the receipt and given to the procurement card liaison:

- itemized invoice for the meal;
- list of all employees;
- employee number;
- nature of the event and copy of official notification of emergency situation;
- dates and times employees were required to stay at their official headquarters; and
- designate the meal that is being provided (i.e., breakfast, lunch, dinner) and the time of day the meal is being provided (e.g., 8:30 p.m., 5:00 a.m.).

Each division or subdivision head is responsible for monitoring the charges for meals during the event. All cost for meals are subject to audit and review by Internal Audit, Procurement, Comptroller General and external auditors.

[\[Fiscal Procedure Memorandum 62 "Meals during and Emergency Event"\]](#)

#### **30.8.4.4 Materials**

The materials section of the snow and ice plan should address:

- salt and calcium products,
- sand and other abrasives, and
- pre-wetting and other chemicals.

For these materials, provide planning information for:

- purchasing procedures and vendor contracts;
- stockpiling, storage and handling;
- availability and performance characteristics; and
- environmental considerations.

Material is stockpiled at the county facilities and yards. Stockpiled materials are inventoried and stockpile depletion reports are prepared during storm events.

Coordinate re-supply of bulk salts through the DME.

### **30.8.4.5 Equipment**

The types of equipment identified in this section of the snow and ice plan can include:

- salt handling equipment;
- loaders and conveyors;
- plows and plow blades;
- spreaders;
- pre-wetting and anti-icing equipment;
- motor graders and spare blades (carbide); and
- spare parts for vital equipment (spreaders) and coordination of pony motors, pumps, chains, etc., across the District.

### **30.8.4.6 Treatment Types and Timing**

#### **30.8.4.6.1 General**

The types and timing of treatments for snow and ice removal are largely a matter of experience with the work and with the roads and bridges in the county. An important consideration in deciding upon the treatment for a given situation is the bond that forms between the pavement and the snow and ice. Trying to prevent the bond is called “anti-icing,” while trying to break the bond after it has formed is called “deicing.” Anti-icing generally provides for better service. The standard reference for anti-icing is [[FHWA Manual of Practice for an Effective Anti-icing Program](#)].

The snow and ice plan should include guidance relative to the following equipment issues:

- spreader and applicator calibration,
- broadcast and spray application, and
- breakdowns and consequent actions.

Preparatory considerations should include:

- checking emergency gear and equipment,
- ensuring hourly operating expense charts are included for the equipment (including generators),
- checking maintenance schedules to ensure they are current,

- checking and topping off fuel and fluids,
- setting and checking spreader application rates, and
- checking to ensure materials are loaded.

#### 30.8.4.6.2 Standard Practice

The desired practice is to apply anti-icing chemicals in a timely manner to prevent the bonding of snow or ice to the pavement. Anti-icing chemicals should be applied to Second and Third Priority roads when time permits and the forecasted severity of the storm justifies application. If snow or ice does begin to accumulate, the Snow and Ice Clearing Practice provides for the direct application of deicing chemicals to First Priority roads. These roads will be the first cleared of snow and ice following the storm. Insofar as possible and practical, maintain traffic on these routes during a storm; however, it is not the practice to maintain a bare pavement throughout the course of the storm.

The routes on the Second and Third Priority system will be cleared by plowing operations and without direct application of deicing chemicals, except in cases of extreme emergencies. Examples of sensitive locations that should be monitored include bridges, shaded areas on hills, superelevated curves and intersections.

Application of chlorides to the roadway will be consistent with the objective of protecting the environment. The recommended application rates are considered to be correct and proper for various weather and highway conditions. Heavier applications are discouraged. The RME should identify environmentally sensitive areas that may require alternative rates and devise special instructions for snow and ice removal techniques for these locations.

SCDOT does not remove snow and ice from sidewalks or clear driveways or driveway entrances.

#### 30.8.4.6.3 Anti-Icing

An anti-icing strategy involves applying salt or other chemicals that lower the freezing point of water to the pavement before a storm hits. When sleet, freezing rain or snow begins to fall, the chemicals will prevent ice from forming on the pavement. Instead of freezing over, the pavement stays wet or slushy, which means travel is safer and cleanup is easier.

#### 30.8.4.6.4 Recommended Material Application Rates

[Figure 30.8-A](#) presents the recommended material application rates for both anti-icing and deicing.

Material	Anti-icing <sup>1</sup>	Deicing <sup>2</sup>
Salt Brine	25 to 40 gallons per lane mile of 23% to 25% solution. Do not use over 25% solution for anti-icing. It may be applied before any precipitation begins. The brine will dry and leave salt residue on the roadway that will go back into solution when precipitation begins.	40 to 60 gallons per lane mile. Once solution is formed, continue to re-apply at a rate of 25 to 40 gallons per lane mile as needed until icing potential has subsided.
Salt (NaCl)	100 to 200 lbs of salt per lane mile. May be mixed with sand, but with a ratio of not less than 3 to 4 parts salt to 1 part with sand. Note: sand does not possess any ice melting capacity.	200 to 400 lbs of salt per lane mile. Once solution is formed, continue to re-apply salt as needed at rate of 100 to 200 lbs per lane mile as needed until icing potential has subsided.
Liquid Calcium Chloride (CaCl)	Do not use liquid calcium chloride on a dry road surface or bridge surface for anti-icing. It may be used as anti-icing if enough moisture is present to produce a wet solution on the roadway and precipitation is falling. Recommend rates are 25 to 35 gallons per lane mile.	30 to 50 gallons per lane mile. Once solution is formed, apply at a rate of 25 to 35 gallons per lane mile as needed until icing potential has subsided.
Pre-wetted Salt (NaCl)	100 to 200 lbs of salt per lane mile. It is recommended that salt be pre-wetted with salt brine at a rate of 10 to 15 gallons per ton or liquid calcium chloride at a rate of 8-12 gallons per ton.	200 to 400 lbs of salt per lane mile. It is recommended that salt be pre-wetted with salt brine at a rate of 10 to 15 gallons per ton or liquid calcium chloride at a rate of 8-12 gallons per ton.

Notes:

1. Anti-icing. The rates may vary due to road temperature, type of precipitation and amount of precipitation.

Once solution is formed on the roadway or bridge deck, keep it in solution by adding additional chemicals as needed based on the intensity of the storm and the temperature of the road surface.

2. Deicing. When snow and ice is in solution, keep it in solution by adding additional chemicals as needed based on the intensity of the storm and the temperature of the road surface. Re-treatment time may vary from less than one hour to four hours. Also, remember that sand does not melt ice or snow.

If the surface and air temperatures are both below 25°F, the recommended application rates may need to be increased and more reliance on liquid calcium chloride may be needed as it works better than salt at lower temperatures.

**Figure 30.8-A — MATERIAL APPLICATION RATES**



### 30.8.4.7 External Support and Coordination

This element of the snow and ice plan should incorporate information regarding support agreements and external coordination with local police, fire departments and emergency agencies. Possible types of agreements and their contents include the following:

1. County Public Works Department Agreement. The agreement should address:
  - areas needing assistance;
  - additional personnel, material and equipment needs; and
  - responsibilities.
2. Contractor and Vendor Agreements. These agreements consist of contractor agreements for services and equipment only and vendor material agreements.

### 30.8.4.8 Reports

For HMMS reporting, [HMMS Activity 701 “Hazardous Conditions”] is used for plowing and de-icing. Standby and preparation should be charged to [HMMS Activity 907 “Administration”]. Related training, including dry runs for practicing routes, should be reported to [HMMS Activity 901 “Training”].

During a winter storm event, the RME must report the following information to the DME through the SCDOT intranet:

- time charged for personnel and equipment (including generators);
- mobilization status of equipment;
- sand, salt and chemicals used;
- sand, salt and chemicals in stock;
- current snow and ice conditions; and
- status of any road closure.

This information should be updated regularly to keep it current.

### 30.8.4.9 Cleanup

The cleanup section of a snow and ice plan should address the following:

- required equipment – all equipment should be cleaned thoroughly and lubricated after an event,
- sweeping roads and streets,
- checking and cleaning drainage facilities,
- checking and cleaning bridge decks and structures, and
- checking material stockpile condition and need for re-supplying the stockpiles.

For winter ice events with significant vegetative debris, refer to the Debris Removal Plan for guidance.

#### **30.8.4.10 Evaluation and Improvements**

Include an element for evaluating and improving the snow and ice plan. Activities to include are:

- post winter meetings,
- material inventory,
- organization of winter data, and
- implementation of corrections based on feedback.



**State Highway 130 Segments 5 and 6 located in Buda, TX responses to survey of toll facilities**

**Fort Worth, TX**

**HWY21FH005**

**(8 pages)**

# SURVEY OF TOLL FACILITIES

## General Operations:

1. Is the toll facility private or state regulated? [Facility is operated by a Private company, regulated by TxDOT](#)
2. When was the toll facility officially opened to traffic? [October 2012](#)
3. How many lane miles does the toll facility maintain? [Approximately 240 Lane Miles](#)
4. How many days did the toll facility respond to snow and ice removal events in each of the last 5 years?

	2016	2017	2018	2019	2020
Days with Snow and Ice Removal Events	1	4	6	0	3

## Snow and Ice Removal Pre-treatment Operations: Describe and/or provide documentation of the following:

5. All pre-treatment options and subsequent chemical applications currently used by the toll facility during snow and ice removal events.
  - 4a. How long each specific pre-treatment option and subsequent chemical applications are effective in treating the roadway after initial application. [Crews begin applying brine at the start of precipitation while temperatures are above freezing, locations are continually treated and monitor, when ice is detected crews begin continuous salt application until weather event is over](#)
  - 4b. Any formal criteria of when to use specific pre-treatment options and subsequent chemical applications. [Liquid brine to be applied when surface is wet and above freezing, and salt to be applied when surface is wet/below freezing and or frozen](#)

## Snow and Ice Removal: Describe and/or provide documentation of the following.

6. An inventory (trucks, plows, front-end loaders, spreaders, etc.) including the number of covered salt storage facilities and quantities of salt that are dedicated to snow and ice removal events.

[See attached Stand Operating Procedure](#)

7. Methods/technologies to monitor moisture and ice formation on roadways, highway overpasses, or bridges.
- 6a. If you use sensor detection systems, the systems, and procedures for their use. [N/A](#)
- 6b. If you do not use sensor detection systems, any future plans by the toll facility to utilize them or other technologies capable of monitoring moisture and ice formation on roadways, highway overpasses or bridges. [SH130 does not intend on utilizing monitoring devices. As weather events are identified, SH130 pro-actively treats the road and monitors.](#)
8. Procedures for snow and ice removal.

7a. If you have formal procedures in place, provide a copy of the established procedures. [See attached Stand Operating Procedure](#)

9. Training procedures for maintenance technicians who perform spot checks and inspections of road conditions during snow and ice removal events. Provide details on the training procedures necessary to become a spot checker (i.e., initial number of training days/hours, certification requirements, length of annual refresher courses, etc.)  
[SH130 performs annual training of Standard Operating Procedure for Snow and Ice Control Operations. This consists of 10 hours of training per an employee annually.](#)

**Documentation Checklist: Please provide the following if available.**

- ✓ Pre-treatment options, durations of effectiveness, and criteria for use
- ✓ Inventory of snow and ice equipment
- ✓ Systems/methods used to detect moisture and icy conditions
- ✓ Operational and training procedures for snow and ice removal
- ✓ Contract between toll authority and state, including snow and ice removal events





# SH 130 Concession Company, LLC

<b>OPERATION:</b>	Snow and Ice Control Operations
<b>LOCATION:</b>	SH130 Segments 5 & 6
<b>PLAN COMPLETED BY:</b>	██████████
<b>SCOPE OF WORK:</b>	Snow and Ice Control Operations
<b>PLANNED FOREMAN:</b>	██████████

TOP 5 SAFETY HAZARDS	
Repetitive, Medium, or High Risk require separate Hazard Analysis	
1	Slips, Trips & Falls
2	Struck By
3	Caught Between
4	Cold Weather
5	Fatigue

HOLD POINTS/INSPECTIONS/CHECKLISTS	
Job Hazard Analysis	
Annual Snow and Ice Control Operations Training	

PERMANENT MATERIALS	
DESCRIPTION	QUANTITY
Not Applicable	

EQUIPMENT DESCRIPTION	QUANTITY	TRAINING?
Dump Trucks	3	Yes
Dodge Ram 3500	5	Yes
2000 Gallon Brine Tank Distributor	1	Yes
Western Tronado 1.5 CY Salt Spreaders	5	Yes
Cat 930m Loader	1	Yes
Bobcat T770 Skidsteer	1	Yes
40 ft Connex Boxes	4	Yes
6000 Gallon Brine Tank (Torch LT)	1	Yes
2500 LB Super Saks (Torch RS)	150	Yes

SOP REVIEW AND SIGN OFF		
MAINTENANCE MANAGER	_____	_____
OPERATIONS MANAGER	_____	_____
	_____	_____
	_____	_____

TOP 5 QUALITY RISKS	
1	Damage to Existing Facility
2	Improper Application of Chemicals
3	
4	
5	

CREW MAKEUP		QUANTITY
DESCRIPTION		
CDL Truck Drivers		3
Operators/Drivers		5
Foreman		1

SMALL TOOLS & SUPPLIES / SAFETY EQUIPMENT		QUANTITY
DESCRIPTION		
Winter Jacket High Visibility		1
Snow Boots		1
Gloves		1

REQUIREMENTS	
FORMS	
MSDS	
Route Map	

LESSONS LEARNED	
CREW FEEDBACK	

WORK SEQUENCE / OPERATIONAL PLAN (STEP-BY-STEP)	HOLD POINT
<p><b>Training</b></p> <ul style="list-style-type: none"> <li>- Job Hazard Analysis</li> <li>- Training to take place in October each year</li> <li>- Review, Training and Testing of Equipment and Materials</li> <li>- Review of Routes</li> <li>- Review Safety Precautions and PPE</li> </ul> <p><b>Advance Preparation and Monitoring</b></p> <ul style="list-style-type: none"> <li>- Job Hazard Analysis</li> <li>- Monitor Weather Daily - Looking at 2 week weather forecast for temperatures below freezing and precipitation/accumulation.</li> <li>- When a weather event is identified, notify crew of dates to provide advanced notification of extended hours and overtime</li> <li>- Load trucks with brine distributors and salt spreaders, load material in tanks</li> <li>- Monitor weather, proceed to steps below</li> </ul> <p><b>Weather Event Operations</b></p> <ul style="list-style-type: none"> <li>- Dedicate crew members as monitors to observe the roadway for ice accumulation</li> <li>- Apply Brine per dedicated routes during precipitation, while ambient temperature is above freezing</li> <li>- When ice is detected and temperatures are below freezing, salt is to be applied</li> <li>- Drive and apply materials on dedicated route, report to Maintenance Manager if assistance is needed and condition of roadway.</li> <li>- Apply material first on bridges and any area identified to have ice, proceed with the following priorities as necessary as shown below.</li> <li>- Additional crew members are to assist with loading material as vehicles arrive back to the maintenance facility.</li> </ul> <p><b>Priorities of Assignments</b></p> <ul style="list-style-type: none"> <li>- Bridges, flyovers;</li> <li>- Hills, curves</li> <li>- Ramp lanes (acceleration and de-acceleration lanes)</li> <li>- Intersections</li> </ul> <p><b>Routes</b></p> <p>Route 1: Mainlanes Maha Loop to SH21; anything accessible from off ramp</p> <p>Route 2: Mainlanes SH21 to SH80; anything accessible from off ramp</p> <p>Route 3: Mainlanes SH80 to I-10; anything accessible from off ramp</p> <p>Route 4: All Frontage Roads</p>	

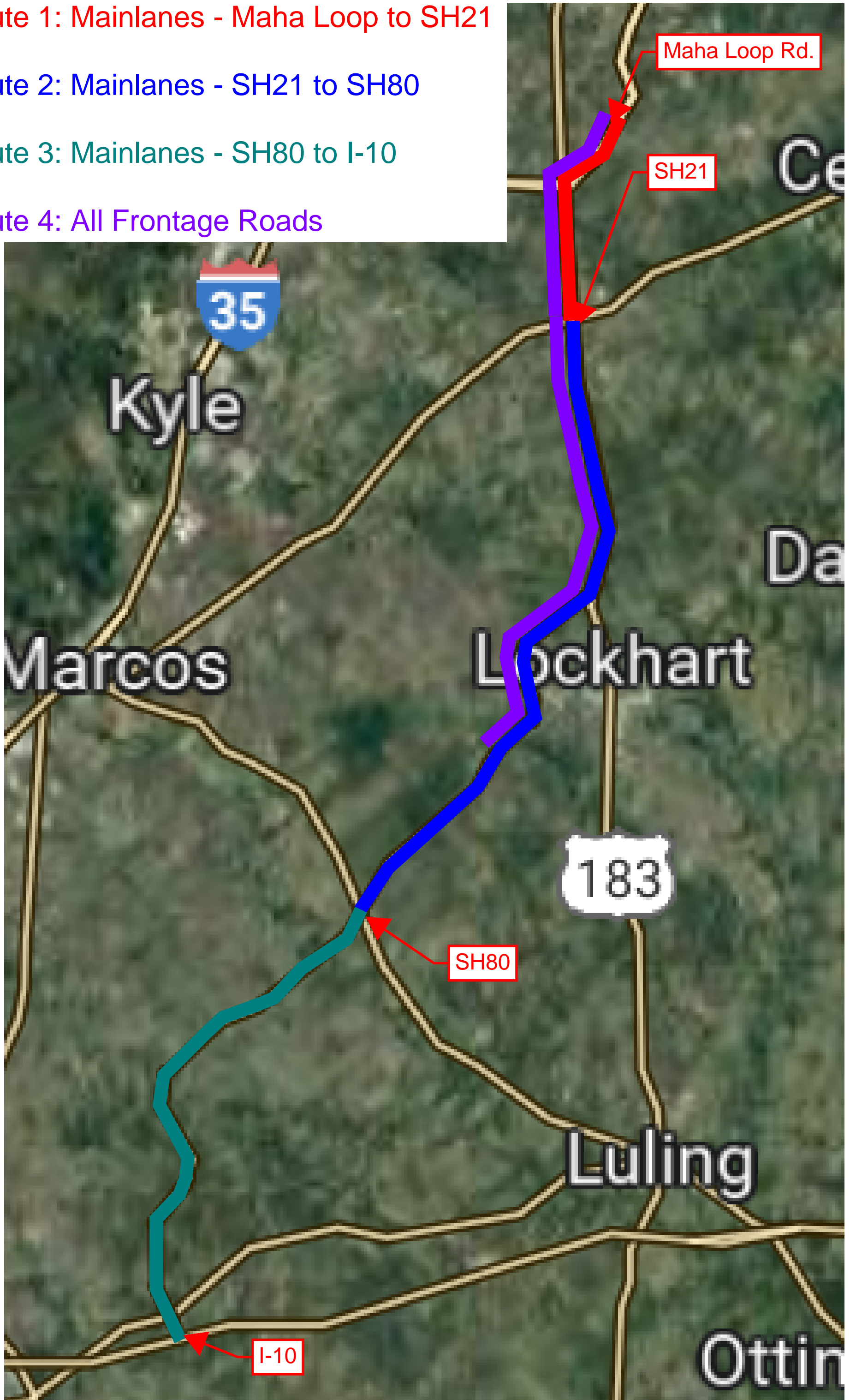
# SH130 Snow and Ice Control Operations Route Map

Route 1: Mainlanes - Maha Loop to SH21

Route 2: Mainlanes - SH21 to SH80

Route 3: Mainlanes - SH80 to I-10

Route 4: All Frontage Roads



# TORCH<sup>TM</sup>LT

## ADVANCED LIQUID DE-ICER



## Safer Road Conditions Faster and Longer Lasting with TORCH<sup>TM</sup>LT

Plowing snow at night on a high mountain pass can be a dark, lonely place. The public is counting on you to make the roads safe so they can get where they need to go safely.

A TORCH<sup>TM</sup>LT often symbolizes light and heat, a way forward through a dark place. TORCH<sup>TM</sup>LT Liquid De-icer is the next step in de-icing technology. TORCH<sup>TM</sup>LT provides our Winter Maintenance Professionals a liquid de-icer with the heat to start melting fast, on contact, and has the staying power for the long turnarounds on rural roads.

A liquid de-icer that will start acting fast and last until you are able to get back, TORCH<sup>TM</sup>LT is the new, exciting way forward in Winter Maintenance Technology. To get your roads clear and safe fast, follow the light of TORCH<sup>TM</sup>LT.

- Product stability that provides a consistent product in storage and application.
- Performance at lower temperatures even after a 1 to 1 dilution.
- Reduced application rates compared to typical de-icing products.
- Clear Roads approved product
- Enhanced performance at a competitive price.

# Torch RS™



**Torch RS™** is a multi-chloride granular deicer containing sodium, magnesium, calcium and potassium chlorides. These chlorides combined with extremely low insolubles, produce an active chloride level between 99.3% - 99.6%. The combination of the chlorides and the high purity of the product, allow the product to perform longer and at lower temperatures than common road salts.

**Torch RS™** is a mined product with a hard crystal that provides instant traction. The **Torch RS™** is a kiln dried product, which enables the product to flow easily in application equipment and eliminate bridging.

**Torch RS™** is produced to enhance the melting process with fines to aid in a quick burn and larger gradations for longer performance. The gradation of the larger granules have been reduced to limit the loss of material off the side of the road.

*Torch RS™ is a very versatile product that can be used as a road deicer and to produce salt brine. This versatility reduces the need to store multiple products and increases the efficiency of both operations.*

## **Torch RS™**

### **PROVIDES FLEXIBILITY BY THE FOLLOWING ATTRIBUTES**

- Provides a quick burn that brings the road surface back to a safe condition faster.
- Extended performance with higher concentration of chlorides allowing for prolonged times between re-application, maximizing fleet efficiency.



- Product stability in application equipment being a kiln dried product.
- Product is stored inside to ensure product quality.
- Reduced application rates compared to typical de-icing products.
- PNS approved product.
- Up to 10% more active chlorides than most typical road salts