

Operational Guidelines for Snow and Ice Control Operations

Snow removal and ice control usually requires the timely application of either chemicals, abrasives or a chemical-abrasive mixture to roadway surfaces in combination with aggressive snow plowing operations. Choice of material is dependent upon the weather and road conditions. Occasionally, conditions such as low temperatures do not require material application.

MATERIALS

The following materials are those that are primarily used by the NHDOT for snow and ice control on state roadways. This section describes the general purpose of each material and the typical use that is expected under normal conditions. Choice of materials will depend on experience and consideration of the following variables: pavement temperature, nature of the particular snow and ice event, forecasted storm conditions, air temperature and wind velocity, traffic volume, time of day/year, and the availability of resources.

- 1) **Salt (NaCl)** – Salt (whether rock salt or solar salt) is the primary material used on the majority of roads maintained by the NHDOT. The primary purpose of the salt is to prevent the bonding of snow and ice onto the pavement surface. Unless salt is pre-wetted with a liquid having a lower working temperature than sodium chloride, the lowest effective working temperature is approximately 15 degrees F.
- 2) **Winter Sand** – Winter sand consists of coarse, clean, sharp sand or other granular material that passes through a square meshed 3/8 inch screen and is mixed with a sufficient quantity of either salt or flake calcium chloride to prevent freezing in the stockpile.
- 3) **Salt Brine** – Salt brine is a 23% solution of salt in water that is used to either “pre-wet” solid materials that are applied from the plow trucks or to “pre-treat” the highways in advance of a storm event. Unless salt brine is mixed with additives, the effective working temperature is approximately 20 degrees F or higher.
- 4) **Calcium Chloride (CaCl)** – Liquid calcium chloride is used to pre-wet the solid materials that are applied by the plow trucks to lower the effective working temperature of salt and to help keep the solid materials on the road during the application process. In addition, flake calcium chloride is used as an additive to abrasives (sands) to prevent freezing in stockpiles and to thaw culverts and catch basins.
- 5) **Liquid Magnesium Chloride (MgCl₂)** – Liquid magnesium chloride is used to pre-wet the solid materials that are applied by the plow trucks to lower the effective working temperature of salt and to help keep the solid materials on the road during the application process.
- 6) **Liquid Chloride Blends** – Liquid Chloride blends are used to stretch the working range of salt brine without incurring the full cost of a Liquid Magnesium Chloride product. Blends allow NHDOT to utilize a single liquid at a maintenance facility

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that can handle the majority of our normal winter storm temperatures. The standard blend that is currently used by NHDOT is a Salt Brine/Magnesium Chloride blend at an 80:20 ratio respectively (SB/ MgCl₂).

RECOMMENDED APPLICATION RATES

NHDOT Salt Application Quick-Reference Chart			
Pavement Temp. Range	Application Rate (#/LM)	Pre-Wet Material (if available)	Comments
Near 32°	0 to 100	Salt Brine or Blend	A little salt goes a long way when temperatures are near freezing
25° to 32°	100 to 200	Salt Brine or Blend	Salt is very effective here. Pre-wetting with a brine/blend will allow lower application rates.
20° to 25°	200 to 300	CaCl, MgCl ₂ or Blend	Salt effectiveness is dropping off in this range. A Blend or straight CaCl or MgCl ₂ will help.
15° to 20°	300 to 400	CaCl, MgCl ₂ or Blend	Pre-wetting is especially important. Your liquids will provide the lower working temperatures needed.
15° or Below	Snow is usually dry and blowing in this range. If no ice or pack exists, plow only. DO NOT APPLY		If necessary, spot treat icy patches with abrasives. Should glazing occur on high-volume, high-speed roadways, sand will not last and higher salt applications, with liquid chloride pre-wetting, if available, will be necessary.
General Notes:			
(1) Application rates should be on the lower end when temperatures are on the higher side of the range or remaining steady. Falling temperatures, and temperatures on the lower side of the range, will require applications on the higher side, and possibly in the next range if dropping rapidly. (2) High-volume, Type 1-A & 1-B corridors will often require an additional 50#/LM (3) In any of the ranges, if the snow is dry and blowing off of the roadway, avoid application. (4) Abrasive – Chemical mix may be needed at extremely low temperatures or on very lightly traveled highways.			

Material is normally applied to the middle 1/3 of pavement width and on the high side of banked curves. Spread width may be increased or decreased depending on the action of traffic. Materials are applied early in the storm to develop a brine on the pavement and prevent build-up of packed snow. It takes much less anti-icing chemical to remove compacted snow when the treatment is placed between the pavement/snow layer than if it is placed on top of the snow. If snow continues and accumulates on the pavement, plowing should continue and additional chemical or mix treatments should be made if compaction develops.

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SPREADING PRACTICES

Each spreading unit is calibrated to insure that selected rates of application are attained. Timing of the initial application during each storm is very critical. It should be delayed until there is sufficient accumulation on the pavement to hold and contain the material spread. However, the pavement may become glazed prior to this time and may require an earlier treatment.

Portions of each patrol section are unique due to various physical conditions and will require a greater application rate or an additional application during some storms. However, these areas should be judged and treated separately and not used as a barometer to evaluate and subsequently direct complete applications over the entire section. In order to conduct an efficient operation, periodic observation of the pavement surface conditions must be performed.

Width of material spread (throw plus roll) should be restricted. Reduction of the spread width by windrowing chlorides will increase the concentration of the chemical where it is needed and therefore increase the effectiveness of the application. Spreading operations should generally be conducted at speeds less than 25 mph on two lane roads. Air turbulence created at speeds greater than 25 mph makes it difficult to retain all the material discharged within the desired width. Spinner and belt speeds and spread pattern must be adjusted to obtain the correct spread rate and to retain the material within the lane (s) where the additional material is required.

On multi-lane undivided roadways, the passing lane in either direction may be spread simultaneously from the adjacent travel lane. Belt speed, spinner speed and vehicle position need not be changed since the normal spread pattern on this type roadway is achieved by spreading simultaneously upon two lanes during the singular directional pass of the spreading unit.

Special Attention For Bridges

Bridge decks normally freeze or glaze sooner than adjacent pavement sections, especially in the late fall and early winter. Special care and good judgment is required in the use of de-icing chemicals on all bridge decks.

PLOWING OPERATIONS

Plowing operations are generally initiated after one to two inches of snow have fallen and continue until the storm has ended. Widening and sight distance enhancement is performed following cessation of the storm as necessary, and generally during daylight hours when best visibility prevails.

For snow storms with a predicted accumulation in excess of two inches, plowing usually begins after the initial salt application has formed a brine and after one to two inches of

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snow has fallen (dependent on intensity of snowfall) and continues for the duration of the storm. After a storm terminates, a final cleanup plow run is made and a light salt application is laid down as necessary to remove any remaining snow or ice.

For light accumulation snowfalls, snow squalls, and so-called “Alberta Clippers” of short duration, plowing may begin immediately and may include simultaneous salting and/or sanding to provide the desired results quickly and efficiently.

Truck-mounted snowplows and wing plows are utilized to clear pavements and shoulders of frozen precipitation. Storm intensity (generally measured in inches per hour) varies considerably in New Hampshire but average major snow storms are approximately one inch (1”) per hour. This intensity rate and the allowable snow accumulation is used in planning the availability of equipment necessary for snow removal operations.

Sleet & Freezing Rain

Frozen precipitation including sleet and the build-up of ice caused by freezing rain are special situations, and not subject to procedures indicated above. When a changeover from snow or sleet to freezing rain is predicted or anticipated, snow and/or sleet is left on the pavement to capture the freezing rain thereby preventing a glare ice situation, which without question is the most treacherous condition that occurs on highways. Treatment includes application of salt at a rate of 300 pounds per lane mile as needed throughout the storm, including on Type 4 low-salt roadways. Heavy rain tends to wash off applied salt or sand, making it difficult to keep the pavement ice-free.

Special Attention For Bridges

Accumulations of snow along gutter lines and sidewalk or catwalk areas of all bridges should be removed when accumulation of snow and/or ice affects highway safety. Removal operations should commence on the high side of bridges on banked curves to minimize snowmelt and re-freezing or glazing of the travel lanes.

GENERAL

It is the policy of NHDOT to perform snow removal and ice control operations in a consistent and impartial manner throughout the state. There are a few plowing procedures that are frequently misunderstood. In an attempt to clarify Department operations, the following policies and procedures are explained.

Mailboxes And Other Structures Within The Highway Right-Of-Way

Occasionally mailboxes or other devices such as decorative fences and ornamental landscaping are damaged by snow plowing operations due to poor visibility, the mailbox or structure being buried in a snow bank, or the weight/volume of the snow being plowed. This damage is not deliberate and in most cases is unavoidable. NHDOT is **not** responsible for damage and does not repair, replace or re-erect mailboxes that are located within the highway right-of-way. These devices are located within the highway limits under suffrage and are the responsibility of the property owner. NHDOT will work

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with the mailbox owners to locate the box in the safest possible location and offer advice on its design to minimize potential damage.

Widening Or Pushing Back Snow Banks

Following storms with heavy snowfall, or when several storms result in substantial snow banks, NHDOT will undertake a roadway widening procedure, which will push back the snow banks. This is a necessary operation because it accomplishes the following:

- (A) Provides room for future snow storage.
- (B) Reduces or prevents melted snow from running out onto the roadway pavement and creating icing conditions.
- (C) Increases safe sight distance at intersections and driveways.
- (D) Maintains a uniform line by eliminating protrusions at driveways and intersections.

Unfortunately, there is no way to prevent depositing snow in previously cleaned driveways or walkways except to leave a hazardous projecting mound of snow. With thousands of driveways of all sizes and descriptions along our highway system it is impossible to clear these individual drives due to logistical and financial considerations.

Signalized Intersections

At those locations where there are steep highway grades, law enforcement officials or authorized NHDOT employees may put traffic signals on flash for the duration of the storm.

Sidewalks

NHDOT occasionally reconstructs existing, or constructs new sidewalks adjacent to highways during construction work. However, the ongoing maintenance of the sidewalks, including snow removal, is the responsibility of the local community. This policy has been and continues to be firm and longstanding statewide.

On Street Parking

In addition, in those communities where on-street parking is permitted, snow removal from the parking areas, including plowing and disposal of, is a local responsibility. The local NHDOT crew will adjust its plow pattern when possible to assist the community if at all possible, which could include pushing back snow banks during No Parking hours, or leaving a windrow as close to the traveled way as possible. Usually these arrangements are made locally between the municipality and the NHDOT Patrol Foreman.

Reduced Winter Maintenance

The process to establish a reduced winter maintenance area commences when NHDOT receives a written inquiry from a municipality's authorized officials. The NHDOT will

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field review the section(s) requested to see if the section's geographic, traffic volume and environmental conditions would permit consideration of reduced winter maintenance. If NHDOT determines it is feasible to reduce the level of service, the municipality must submit signed approvals from governing town officials, police chief, fire chief, chief of ambulance service and the school board/superintendent of schools. The governing body of the municipality to accept comments from the public will convene a public meeting attended by Department representatives. The level of service anticipated will be discussed and will include items such as the amount of bare pavement that would be expected, the surface condition, and the time of treatment. If the changes are acceptable, the section will be approved and public notices made. Additionally, the department will erect roadway signs delineating the area as a reduced winter maintenance zone. NHDOT officials reserve the right to change the designation if safety concerns arise and the designation is found to be inappropriate. Reclassification of the roadway to a Class V (town maintained highway) typically will also be discussed with the officials of the municipality.

Night Patrol

The Department deploys employees to regularly patrol the Department's roadways during the off evening hours to address isolated areas of concern (i.e. refreeze from melting snow, blowing snow) throughout the state. In addition, these employees are responsible for calling in the patrol crews when a storm is beginning during these off hours.

PERFORMANCE MEASUREMENT

Performance during and immediately following individual events will be periodically monitored versus the goals specified above for the applicable corridor priority.

Indicators of **too high** a level of service will include the following:

- Multiple salt applications at rates beyond those specified within the *NHDOT Salt Application Quick-Reference Chart* included herein
- Travel speeds routinely occurring above the suggested maximum travel speeds
- Bare travel lanes routinely provided well before the bare travel lane goals or occurring either during pauses in the storm or shortly after precipitation has ended
- Bare shoulders routinely provided within the bare travel lane goals
- Routine occurrence of white salt residue build up in the travel lanes and shoulders following the storm and after the pavement has dried.

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Conversely, indicators of **too low** a level of service will include the following:

- Multiple salt applications at rates below those specified within the *NHDOT Salt Application Quick-Reference Chart* included herein
- Average travel speeds routinely below the suggested maximum travel speeds
- Travel lanes routinely not meeting the bare travel lane goals
- Excessive build-up of snow in the travel lanes under less than extreme storm conditions
- High incidence of vehicles sliding off the road
- Excessive call-outs beyond that required from neighboring crews having similar weather conditions or call-outs within 4 hours of sending the entire crew home

Performance during and following the winter season will be measured by monitoring material usage, labor costs, and equipment costs with respect to the number of lane miles maintained and the number of treatable storm events addressed. Assessment of LOS compliance will be made based upon consideration of the resources used versus the winter severity encountered, as well as through comparisons between adjacent and nearby geographical areas that have encountered similar winter conditions. At locations where Road Weather Information System (RWIS) stations may exist, data from the station's weather sensors (i.e. end of precipitation) and camera images will be used to measure performance as compared to the policy requirement.

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