Snow and Ice

All Hazards Emergency Response and Continuity of Operations Plan

Pierce County
Public Works and Utilities
Road Maintenance & Operations

For Official Use Only

Updated November 2010

APPENDIX J – Snow and Ice Response Plan

INTRODUCTION

The mission of Pierce County Public Works and Utilities, Road Maintenance and Operations Division (the Division), is to maintain, operate and preserve Pierce County's public road network 24/7 as safely and efficiently as possible. This includes the development of capabilities for responding to emergency situations in an effective, efficient and timely manner. As part of this mission, the Division conducts traction improvement, anti/de-icing, and snow removal operations to mitigate hazardous driving conditions during snow and ice events.

Pierce County's topography is extremely diverse and as a result the County can experience numerous microclimates within its boundaries. Typically the County's winter season lasts from mid November through mid March. The weather is generally wet with cool, moderate, and occasional icy events. The winter maintenance program (labor, equipment, and materials) is sized and based to facilitate the movement and safety of traffic under normal expected winter conditions. This will typically be when temperatures drop below freezing and create black ice or frost conditions. A light to moderate snowfall event may occasionally take place. These are typically characterized by brief, localized events within the County. The exceptional winter weather event in Pierce County is a heavy snowstorm over the entire County which can adversely affect normal roadway travel for a week or more. Since this happens very infrequently, it would be an inefficient management of resources to size and base a winter maintenance program for this type of exceptional winter weather event. Such planning would result in an excess of equipment and workforce sitting idle for most of the winter season.

The Division's winter maintenance program is based on history and the expected average conditions of winter for Pierce County. Therefore, when the rare heavy snow storm occurs, the program is unable to deliver an accustomed level of service to all the County's public roads, and must instead focus available resources on arterial lifeline routes. The short term consequences of this scenario are far outweighed by consequences of wasted resources if the program were sized and based on the worst scenario that could possibly happen.

The purpose of this Snow and Ice Response Plan is to provide clear, consistent, and environmentally responsible guidelines and procedures in order to keep the County's transportation network functioning as safely and efficiently as possible for the motoring public, Pierce Transit, public schools, fire, police, aid vehicles, and general commerce. It is understood that this plan cannot eliminate all the impacts or effects of a snow and/or ice emergency. Rather, the intent of this plan is to maximize the use of available resources in order to reduce the threat to public safety from a snow and ice emergency.

The Division is responsible for approximately 3,120 lane miles of roadway in unincorporated Pierce County, of which approximately 1,517 lane miles have been identified as arterial lifeline routes that provide connectivity from residential areas to the State highway system and key service centers.

GENERAL INFORMATION

Organization of Staff

Road Operations Division's 165 full time employees are assigned to each of the three Road Operations facilities with consideration to mobilization and logistics efficiencies; and are adjusted as is necessary to meet the needs presented by each unique Snow and Ice event.

Organization of Facilities

CMF - Central Maintenance Facility
4812 196th Street East
Spanaway, WA 98387
(253) 798-6000

The CMF is the Division's headquarters facility that houses administrative and engineering staff and provides administrative functions for the road maintenance districts. This facility serves: Alderton, Anderson Island, Ashford, Eatonville, Elbe, Frederickson, Graham, Kapowsin, La Grande, McKenna, Midland, Orting, Parkland, Puyallup, Roy, South Hill, Spanaway, Tanwax, and Tillicum.

ECMF - East County Maintenance Facility
11711 Prairie Ridge Drive East
Bonney Lake, WA 98391
(253) 798-6000

This facility serves: Bonney Lake, Brown's Point, Buckley, Burnett, Carbonado, Dash Point, Edgewood, Fairfax, Greenwater, Lake Tapps, South Prairie, and Wilkeson.

NCMF - North County Maintenance Facility
13209 Goodnough Drive
Gig Harbor, WA 98332
(253) 798-6000

This facility serves: Artondale, Fox Island, Gig Harbor, Home, Key Center, Longbranch, Purdy, Rosedale, and Wauna.

Organization of Equipment

The Division has the following snow and ice fighting equipment in inventory:

- 8 - 10yd Plow/Material Spreader Trucks
- 2 - 10yd Plow/Multi-purpose Trucks
- 21 - 5 yd Plow/Material Spreader Trucks
- 2 - 5 yd Plow/ Multi-purpose Trucks
- 4 - 2/3 yd Liquid Anti-icing Applicator Trucks
- 1 - 1 ½ Ton Plow/Material Spreader Utility Trucks
- 2 - 1 Ton Material Spreader Utility Trucks
- 5 - Motor Graders

Snow and Ice fighting equipment is assigned to each of the four Road Operations facilities with consideration to mobilization and logistics efficiencies; and are adjusted as is necessary to meet the needs presented by each unique Snow and Ice event.

Equipment Maintenance

Equipment Services Division (ESD) personnel, facilities, equipment and parts are housed at the Central Maintenance Facility in sufficient volume to meet the needs of the Division during response to a Snow and Ice Emergency. In order to optimize efficiencies, on-site mechanics are assigned to each Road Operations facility in order to address minor to moderate equipment maintenance and repair needs. Additional ESD staff and resources are housed in the Mid-County Maintenance Facility located at 1420 E. 112th St. in Tacoma.

Organization of Materials

The materials and supplies required to deliver an effective snow and ice emergency response are stockpiled at key Road Operations facilities and gravel pit sites with consideration to logistics efficiencies; and are adjusted as is necessary to meet the needs presented by each unique Snow and Ice event. Salt brine is produced at the CMF and ECMF and is delivered in bulk to storage facilities at other sites as is needed.

RESPONSE TO A SNOW AND ICE EVENT

The County's road network has been divided into 28 emergency response zones, each containing approximately 50 lane miles of arterial lifeline routes. Emergency response zones are sized and shaped with the following important factors in mind: connectivity of the arterial network between residential areas and key service centers; proximity to Road Operations dispatch facilities; and, proximity to resource stockpile sites.

When a snow and ice conditions affect roadways across the entire county, priority routes are monitored by Road Operations personnel on a regular basis. Some roadways may require salting, sanding, de-icing, and/or plowing several times within a 12-hour operational period. Therefore, some routes on the priority lists may not be addressed until higher priority routes are clear, depending on the severity of the event.

Priority Roadways

Each of the 28 emergency response zones has a pre-established priority listing of roadways established by the following designations:

Major arterials and collectors
Lifeline Emergency routes
Access roads to highways, freeways, and park and ride lots
Pierce Transit and school bus snow routes

Emergency Response Zones - Maps

Each of the Division's 28 Emergency Response Zones is mapped, and priority roadways within each are listed in a sequence that optimizes the County-wide effectiveness and efficiency of plowing and chemical application operations. In order to be optimally prepared for the wide range of probable winter conditions that can occur in Pierce County, Emergency Response Zone maps and priority roadway lists are broken into five groupings as follows:

Map Set A – Contains a listing of the approximately1,517 lane miles of arterial lifeline routes that provide connectivity from residential areas to the State highway system and key service centers.

Map Set A should be considered for use when the Division is operating in Phase 3 and when snow and ice conditions are moderate to heavy and available resources are adequate to deliver desirable results across all priority roadways.

Map Set B – Contains an abridged listing of the highest priority roadways and arterial lifeline routes. This list includes approximately 599 lane miles of arterial roadways that experience the highest traffic volumes under non-emergency conditions.

This map set should be considered for use when the Division is operating in Phase 2 or 3 and when conditions are light to moderate and deployment of resources to all priority roadways is not warranted. This map set can also be considered for use when the Division is operating in Phase 3 and snow and ice conditions are severe and available resources are unable to adequately improve pavement conditions on all priority roadways.

Map Set C – Contains a list of multi-lane arterial lifeline routes. This list includes approximately132 lane miles of the primary arterials that provide connectivity from secondary arterials and collectors to the State highway system and key service centers.

This map set should be considered for use when the Division is operating in Phase 3 and available resources are adequate to support the use of two or more trucks to support gang-plowing operations on each multi-lane arterial.

Map Set D – Contains a list of local access collector roads. This list includes approximately 150 lane miles of local access collector roads that provide connectivity from residential roads to the arterial and lifeline routes.

This map set should be considered for use when the Division is operating in Phase 3.5 or Phase 4 and arterial lifeline route conditions warrant re-assignment of resources to local access collector roads.

Map Set E – Contains a list of hills, curves, elevated structures and shaded areas within the arterial lifeline route system that may be affected by frost and/or black ice events.

This map set should be considered for use when the Division receives a weather forecast that predicts likelihood that pavements may be affected by the formation of frost or black ice within the next operational period.

Snow and Ice Operations - Four Phases of Response

Pierce County Road Maintenance and Operations Division will mobilize road crews based upon the severity of a snow and ice event. There are four phases of response, procedures, resource allocation, and coordination efforts crafted to address major storm events as listed below:

Phase 1

A significant storm is forecast. Measurable snow accumulation and/or severe black ice conditions with temperatures below 32 degrees are predicted. The following steps are implemented:

* The objectives of Phase 1 are preparation and prevention. Actual conditions and/or citizen RFA's will be addressed on a site specific basis.

1. Division Manager is alerted.
2. Each area is checked for snow or freezing conditions.
3. Supervisors may schedule applications of anti-icing agents.
4. Maintenance crews prepare equipment for snow and ice operations.
5. Supervisors adjust initial response schedules as the weather event unfolds.
6. Citizen and emergency services requests for action are incorporated into response schedules as priority calls in Phase 1.
7. Crews are on 8-hour shifts during this phase unless the event occurs after hours at which time the on-call Supervisor will dispatch personnel as conditions warrant. Personnel may be required to work more hours if the response phase is upgraded, or if conditions warrant.

Phase 2

Snow and/or icing conditions have occurred. Sites where snow or ice accumulations have affected County roads may be isolated to widespread. The following steps are implemented during this phase:

* The objectives of Phase 2 are to transition from preparedness into response. Citizen RFA's will be addressed on a site specific basis as resources allow. Map Set B should be considered for Phase 2.

1. Public Works Director is alerted.
2. All maintenance crews are divided into 8-hour day and night shifts (which may be expanded to 12-hour shifts at the Superintendent's discretion) to provide 24-hour coverage for commuters.
3. The Division's EOC operations may be implemented during phase 2, depending upon actual conditions and forecasts.
4. Snow and ice teams are assigned specific areas within each division and provide maintenance and support to the established priority routes within those specific areas.
5. Citizen and emergency services requests for action are noted and incorporated into the pre-established lifeline and arterial routes as applicable.
6. All personnel keep detailed records of the response activities performed during each shift.
7. Public Works Director and Department of Emergency Management (DEM) Duty Officer are provided daily updates.

Phase 3
Snow and/or icing conditions have occurred and are widespread. The long-range forecast calls for snow and ice conditions to continue. The following steps are implemented during this phase:

* The objectives of Phase 3 are to produce the best possible results with available resources. RFA's will be addressed coincident with operations as directed by the Shift Incident Commander. Map sets A, B, and/or C should be considered for Phase 3 as conditions warrant.

1. Crews are adjusted to 12-hour shifts for 24-hour coverage.
2. The Road Operations Manager is continuously updated and advised of maintenance progress and/or problem areas.
3. The Division's EOC operations will be implemented and will remain in action while in phase 3.
4. If County EOC is opened, the Divisions will provide a staff member to act as a Liaison to coordinate Division specific communications and response information.
5. Status reports are provided to the Director of Public Works once daily, or as significant changes occur.
6. Additional departments within Pierce County are requested to provide support to crews.

Phase 3.5
Heavy accumulations of snow have affected all roadways. Weather conditions have stabilized and arterial lifeline routes have been plowed and treated with de-icing products. The following steps are implemented during this phase:

* The objectives of Phase 3.5 are to produce the best possible results with available resources including the reassignment of resources to local access collector roads after desirable conditions have been achieved on arterial lifeline routes. RFA's will be addressed coincident with operations as directed by the Shift Incident Commander. Map sets A, B, C and D should be considered for Phase 3.5 as conditions warrant within each snow and ice response area.

1. Operational steps implemented to support Phase 3 are continued.

2. Division Incident Commander re-assigns resources to Map Set D response routes after desirable conditions are achieved in corresponding Map Set A response areas.

3. If weather conditions deteriorate and again significantly affect driving conditions the Incident Commander will transition to Phase 3 and resources will be re-assigned to arterial lifeline.

Phase 4
The long-range forecast calls for no additional snow accumulations and/or warmer temperatures. The following steps are implemented during this phase:

* The objectives of Phase 4 are to transition from Emergency Response Operations back to normal delivery of services. Citizen RFA's will be addressed on a site specific basis as resources allow. Shifts are adjusted as conditions and priorities dictate.

1. Large accumulations of snow and ice are removed from the traveled way and drainage courses.
2. As priority lists are completed, focus will turn to removal of any remaining snow accumulations on local access and residential roads.
3. The Division's EOC operations will stay in action until actual conditions and forecast warrant ramp down.
4. Crew schedules are adjusted back to normal 8 hour shifts.
5. Snow and ice fighting equipment and apparatus is repaired, cleaned and prepped for future use.
6. Materials and supplies are inventoried and replenished as needed.
7. Any accumulations of sand are removed as soon as reasonable following conclusion of snow and ice fighting operations.
8. After action meetings are held to assess effectiveness of response efforts and to identify improvement opportunities.

Snow Plowing and Chemical Application Guidelines

Introduction

This is a guide for Pierce County Public Works and Utilities, Road Operations Division for snow and ice fighting, specifically for snow plowing and use of solid and liquid chemicals for maintenance field personnel. Its purpose is to suggest operational actions for minimizing the impacts of a snow and ice event to the County's road system. The objectives of these guidelines are to compliment the decision-making and management practices of a systematic snow and ice fighting program, resulting in roads that can be operated in the best possible condition.

This guide is based upon the Federal Highway Administration's (FHWA) "Manual of Practice for an Effective anti-icing Program" and the "National Cooperative Highway Research Program" (NCHRP) 6-13. The Manual of Practice for an Effective anti-icing Program provides the results of four years of anti-icing field-testing conducted by 15 State highway agencies and supported by the Strategic Highway Research Program (SHRP) and the Federal Highway Administration (FHWA). This guide also uses information obtained from the National Cooperative Highway Research Program (NCHRP) 6-13.

Overview of Guidelines

Guidance for snow and ice fighting operations are presented in Tables 1 through 5 for four distinctive winter weather events. The four events are:

1. Frost or Black Ice
2. Light Snow Storm
3. Moderate or Heavy Snow Storm
4. Freezing Rain Storm

Tables 1 through 5 suggest the appropriate actions and applications for either an initial or subsequent (follow-up) snow or ice fighting operation for a given weather event. Each action is defined for a range of pavement conditions and an associated air temperature trend. For some events, the operation is dependent not only on the weather conditions and trend, but also upon the actual impact to the pavement surface condition at the time of the snow and ice fighting action. Most of the recommended actions include a chemical application in a dry solid, pre-wet solid, or liquid form. Application rates or "spread rates" are given for each chemical option to be used appropriately. These are suggested values and should be adjusted, if necessary, to achieve increased effectiveness or efficiency, for local conditions. Application rates in volumetric units (lbs/lane-mi) are calculated from dry or pre-wetted chemical/solid rates. Comments and notes are given in each table where appropriate to further guide the field personnel in their snow and ice fighting operations.

Snow Plowing and Chemical Application Guidelines

Glossary Of Terms

Anti-icing Application. An application of solid or liquid chemical delivered prior to the beginning of a weather event to prevent the formation of frost, ice, and/or a snow-ice pavement bond.

Black Ice. A very thin coating of clear, uniform ice which forms on a pavement when the temperature of the air in contact with the ground is below freezing, and small super cooled water droplets deposit on the surface and coalesce before freezing.

Freezing Rain. Super cooled droplets of liquid precipitation falling on a surface that has a temperature near or below freezing, resulting in the formation of glaze or clear ice. Non-super cooled raindrops falling on a surface that has a temperature well below freezing can also result in the formation of glaze ice.

Frost. Ice crystals deposited on surfaces with a temperature below freezing. The deposit may be composed of frozen drops of dew and/or of ice formed directly from water vapor at a temperature below 32F (sublimation).

Glaze or Clear Ice. A hard, slick, generally thick coating of ice that can form on pavements during severe freezing rain events; or, under the forces of traffic on compact snow and ice.

Light Snow. Snow falling at the rate of less than 1/2 inch per hour; visibility is not affected adversely.

Moderate or Heavy Snow. Snow falling at a rate of 1/2 in per hour or greater; visibility is significantly reduced.

Salt Brine. A salt and water solution combined at a ratio of 23.3% NaCl to 76.7% water. Salt brine may be blended with additives to improve performance at lower temperatures.

Salt Slurry, A mixture of granular sodium chloride solids and salt brine liquid at a rate of approximately 18 gals of liquid per ton of solid. The solid and liquids should be incorporated to the point that the material is of a slurry-like consistency.

Slush. Accumulation of snow that is saturated with water in excess of its freely drained capacity. It will not support weight when stepped or driven on but will “squish” until the base support is reached.

Solid Chemical. Granular sodium chloride (rock salt) applied to the pavement surface to melt snow and ice and to improve traction. Solid chemicals may be blended with sand/grit to improve traction until bare and wet conditions are achieved.

Pre-wetting: The practice of applying liquid chemical to dry material before it is placed on the pavement to improve the chemical melting process.

Chemical Spread Rate. For solid chemical applications, it is simply the weight of the chemical applied per lane mile (lbs/lane mile). For liquid applications it is the amount of liquid chemical applied per lane mile (gals/lane mile).

Snow Plowing and Chemical Application Guidelines

Table 1. Weather event: *Anti-icing Prior to a Forecast Event*

Using a 23% Salt Brine Concentration of *Sodium Chloride (NaCl)*

Pavement Temperature	Initial Operation / Response				Subsequent or Ongoing Operations			Comments
	Surface Condition	Recommended Action	Application Rates gals/lane mile		Recommended Action	Application Rates gals/lane mile		N/R = None Recommended
			Salt Brine 23%NaCl	Salt Brine 23%NaCl w/calcium		Salt Brine 23%NaCl	Salt Brine 23%NaCl w/calcium	
Above 32°F Steady or Rising	Dry, bare & wet, or light ice	Apply liquid chemical as needed	30	N/R	N/R	N/R	N/R	*Monitor pavement temperature closely *Treat isolated patches of frost or ice with salt brine at 30 gals/lm .
20F to 32°F Remaining in Range	Dry or bare & wet	Apply liquid chemical	30-40	N/R	N/R	N/R	N/R	*Re-apply chemical only if current conditions warrant; or if additional ice/frost is forecast to occur before next operational period.
	Light frost or ice	Apply liquid chemical	30-40	N/R	Reapply liquid chemical when needed	30-40	N/R	
15F to 20°F Remaining in Range	Dry or bare & wet	Apply liquid chemical	30-40	N/R	N/R	N/R	N/R	*Re-apply chemical w/calcium only if current conditions warrant; or if additional ice/frost is forecast to occur before next operational period.
	Light frost or ice	Apply liquid chemical	40+	40+	Reapply liquid chemical when needed	40+	40+	
Below 15°F Steady or Falling	Dry or bare & wet	Apply liquid chemical w/calcium	N/R	30-40	N/R	N/R	N/R	*Re-apply chemical w/calcium only if current conditions warrant; or if additional ice/frost is forecast to occur before next operational period. *Applications of salt brine without calcium additives are not recommended at temps below 15F.
	Light frost or ice	Apply pre-wet solid chemical w/calcium	N/R	40+	Reapply liquid chemical w/calcium when needed	N/R	40+	

CHEMICAL APPLICATIONS: Local experience should refine these recommendations. Liquid chemicals should not be applied to glaze or clear ice, or to moderate or heavy concentrations of packed snow. Time the chemical applications to *prevent* deteriorating conditions or the formation of a snow-ice pavement bond. Monitor temperature and dew point to determine application timing. The recommended snow and ice control material application rates depend on atmospheric and pavement conditions at the time of treatment and on how these conditions are expected to change over the time period (window) between the current treatment and the next anticipated treatment.

Table 2. Weather event: *Frost or Black Ice*

Pavement Temperature	Initial Operation / Response				Subsequent or Ongoing Operations			Comments
	Surface Condition	Recommended Action	Application Rates Lbs/lane mile		Recommended Action	Application Rates Lbs/lane mile		N/R = None Recommended
			75/25 Solid NaCl /Sand	Solid NaCl		75/25 Solid NaCl /Sand	Solid NaCl	
Above 32°F Steady or Rising	Dry, bare & wet, or light ice	Apply solid chemical as needed	400	200	N/R	N/R	N/R	*Monitor pavement temperature closely *Treat icy patches if needed with pre-wet solid at 200 lb/lane-mi.
20F to 32°F Remaining in Range	Dry, bare & wet or light ice cover	Apply solid chemical	400	200	N/R	N/R	N/R	*Apply chemical only if current accums and ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Moderate to heavy ice cover	Apply solid chemical	500	250	Reapply solid chemical when needed	500	250	
15F to 20°F Remaining in Range	Dry, bare & wet or light ice cover	Apply solid chemical	400	200	N/R	N/R	N/R	*Apply chemical only if current accums and ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Moderate to heavy ice cover	Apply solid chemical	500 - 600	250 - 300	Reapply solid chemical when needed	500 - 600	250 - 300	
Below 15°F Steady or Falling	Dry, bare & wet or light ice cover	Apply solid chemical w/calcium	400	200	N/R	N/R	N/R	*Apply chemical w/calcium only if current accums and ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Moderate to heavy ice cover	Apply pre-wet solid chemical w/calcium	600 +	300+	Reapply solid chemical w/calcium when needed	600+	300+	

CHEMICAL APPLICATIONS: Local experience should refine these recommendations. All solid chemicals should be pre-wetted with salt brine at concentrations up to 18gals per ton, depending upon conditions and resource availability. Time the chemical applications to *prevent* deteriorating conditions or development of packed and bonded snow. Monitor temperature and dew point to determine application timing. The recommended snow and ice control material application rates depend on atmospheric and pavement conditions at the time of treatment and on how these conditions are expected to change over the time period (window) between the current treatment and the next anticipated treatment.

Snow Plowing and Chemical Application Guidelines

Table 3. Weather event: *Light Snow*

Pavement Temperature	Initial Operation / Response				Subsequent or Ongoing Operations			Comments
	Surface Condition	Recommended Action	Application Rates Lbs/lane mile		Recommended Action	Application Rates Lbs/lane mile		N/R = None Recommended
			75/25 Solid NaCl /Sand	Solid NaCl		75/25 Solid NaCl /Sand	Solid NaCl	
Above 32°F Steady or Rising	Dry, wet slush, or light snow cover	Plow as needed	N/R	N/R	N/R	N/R	N/R	*Monitor pavement temperature closely *Treat icy patches if needed with pre-wet solid at 200 lb/lane-mi; plow if needed
20F to 32°F Remaining in Range	Dry or bare & wet	Apply solid chemical	400	200	N/R	N/R	N/R	*Apply chemical only if current accums and snow/ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Slush, or light snow cover	Plow as needed Apply solid chemical	500	250	Plow as needed; reapply solid chemical when needed	500	250	
15F to 20°F Remaining in Range	Dry or bare & wet	Apply solid chemical	400	200	N/R	N/R	N/R	*Apply chemical only if current accums and snow/ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Light snow cover	Plow as needed Apply solid chemical	500 - 600	250 - 300	Plow as needed; reapply solid chemical when needed	500 - 600	250 - 300	
Below 15°F Steady or Falling	Dry or bare & wet	Apply solid chemical w/calcium	400	200	N/R	N/R	N/R	*Apply chemical w/calcium only if current accums and snow/ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Light snow cover	Plow as needed Apply pre-wet solid chemical w/calcium	600	300	Plow as needed Apply pre-wet solid chemical w/calcium	600	300	

CHEMICAL APPLICATIONS: Local experience should refine these recommendations. All solid chemicals should be pre-wetted with salt brine at concentrations up to 18gals per ton, depending upon conditions and resource availability. Time the chemical applications to *prevent* deteriorating conditions or development of packed and bonded snow. Monitor temperature and dew point to determine application timing. The recommended snow and ice control material application rates depend on atmospheric and pavement conditions at the time of treatment and on how these conditions are expected to change over the time period (window) between the current treatment and the next anticipated treatment.

PLOWING: Before you apply any ice control chemical, the surface should be cleared of as much snow and ice as possible.

Snow Plowing and Chemical Application Guidelines

Table 4. Weather event: *Moderate or Heavy Snow Storm*

Pavement Temperature	Initial Operation / Response				Subsequent or Ongoing Operations			Comments
	Surface Condition	Recommended Action	Application Rates Lbs/lane mile		Recommended Action	Application Rates Lbs/lane mile		N/R = None Recommended
			75/25 Solid NaCl /Sand	Solid NaCl		75/25 Solid NaCl /Sand	Solid NaCl	
Above 32°F Steady or Rising	Wet slush, or light snow cover	Plow as needed	N/R	N/R	N/R	N/R	N/R	*Monitor pavement temperature closely *Treat icy patches if needed with pre-wet solid at 200 lb/lane-mi; plow if needed
20F to 32°F Remaining in Range	Bare & wet	Apply solid chemical	400	200	N/R	N/R	N/R	*Apply chemical only if current accums and snow/ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Slush, or snow cover	Plow as needed Apply solid chemical	500	250	Plow as needed; reapply solid chemical when needed	500	250	
15F to 20°F Remaining in Range	Bare & wet	Apply solid chemical	400	200	N/R	N/R	N/R	*Apply chemical only if current accums and snow/ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Snow cover	Plow as needed Apply solid chemical	600+	300+	Plow as needed; reapply solid chemical when needed	600+	300+	
Below 15°F Steady or Falling	Bare & wet	Apply solid chemical w/calcium	600	300	N/R	N/R	N/R	*Apply chemical w/calcium only if current accums and snow/ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Snow cover	Plow as needed Apply pre-wet solid chemical w/calcium	600+	300+	Plow as needed Apply pre-wet solid chemical w/calcium	600+	300+	

CHEMICAL APPLICATIONS: Local experience should refine these recommendations. All solid chemicals should be pre-wetted with salt brine at concentrations up to 18gals per ton, depending upon conditions and resource availability. Time the chemical applications to *prevent* deteriorating conditions or development of packed and bonded snow. Monitor temperature and dew point to determine application timing. The recommended snow and ice control material application rates depend on atmospheric and pavement conditions at the time of treatment and on how these conditions are expected to change over the time period (window) between the current treatment and the next anticipated treatment.

PLOWING: Before you apply any ice control chemical, the surface should be cleared of as much snow and ice as possible.

Table 5. Weather event: *Freezing Rainstorm*

Pavement Temperature	Initial Operation / Response				Subsequent or Ongoing Operations			Comments
	Surface Condition	Recommended Action	Application Rates Lbs/lane mile		Recommended Action	Application Rates Lbs/lane mile		N/R = None Recommended
			75/25 Solid NaCl /Sand	Solid NaCl		75/25 Solid NaCl /Sand	Solid NaCl	
Above 32°F Steady or Rising	Dry, bare & wet, or light ice	Apply solid chemical as needed	400	200	N/R	N/R	N/R	*Monitor pavement temperature closely *Treat icy patches if needed with pre-wet solid at 200 lb/lane-mi.
20F to 32°F Remaining in Range	Dry, bare & wet or light ice cover	Apply solid chemical	400	200	N/R	N/R	N/R	*Apply chemical only if current accums and ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Moderate to heavy ice cover	Apply solid chemical	500	250	Reapply solid chemical when needed	500	250	
15F to 20°F Remaining in Range	Dry, bare & wet or light ice cover	Apply solid chemical	400	200	N/R	N/R	N/R	*Apply chemical only if current accums and ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Moderate to heavy ice cover	Apply solid chemical	500 - 600	250 - 300	Reapply solid chemical when needed	500 - 600	250 - 300	
Below 15°F Steady or Falling	Dry, bare & wet or light ice cover	Apply solid chemical w/calcium	400	200	N/R	N/R	N/R	*Apply chemical w/calcium only if current accums and ice bond warrant; or if additional accums are forecast to occur before next operational period.
	Moderate to heavy ice cover	Apply pre-wet solid chemical w/calcium	600 +	300+	Reapply solid chemical w/calcium when needed	600+	300+	

CHEMICAL APPLICATIONS: Local experience should refine these recommendations. All solid chemicals should be pre-wetted with salt brine at concentrations up to 18gals per ton, depending upon conditions and resource availability. Time the chemical applications to *prevent* deteriorating conditions or development of packed and bonded snow. Monitor temperature and dew point to determine application timing. The recommended snow and ice control material application rates depend on atmospheric and pavement conditions at the time of treatment and on how these conditions are expected to change over the time period (window) between the current treatment and the next anticipated treatment.