Highway Factors Attachment – Pennsylvania Department of Transportation Maintenance Manual, Chapter 4: Winter Services

Mount Pleasant, PA

HWY20MH002

(86 pages)

CHAPTER 4
WINTER SERVICES

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Appendices

4.1 INTRODUCTION

GENERAL POLICY

Winter weather in Pennsylvania is difficult to predict and there are many variables affecting winter maintenance operations such as type of precipitation, air and pavement temperature, traffic, wind, time of day and day of week. Winter Maintenance is considered by many to be an art, not an exact science.

The Pennsylvania Department of Transportation's (PennDOT) mission during the winter season is to provide safe, passable roadways throughout Pennsylvania during winter events as efficiently as possible. Judgment based on experience is essential in conducting and timing remedial work to overcome ice and snow hazards. As each storm situation varies, it is important to emphasize that this policy be used as guidance to assist foremen and other managers in making well informed, judgment decisions in the exercise of their snow removal and ice control responsibilities.

Traffic volume and posted speed are the primary factors in determining the level of winter maintenance service with the highway grade also being an important factor. The Interstate System and other heavily traveled highways are maintained in such a manner that reasonably bare pavement is produced as soon as practical after termination of a storm. On State highways with low traffic volumes, PennDOT attempts to provide some bare pavement, but not necessarily from shoulder to shoulder, within a day or two after a storm ends. In all cases, service will proceed by priorities of routes as quickly and efficiently as possible.

It is impractical to develop specific rules on winter maintenance operations due to the numerous variables involved in winter storms. The judgment of the local highway foreman governs the type, quantities and application schedule of materials used to control snow and ice. It is the intent of PennDOT to use the appropriate deicing or anti-icing material needed to restore safe travel conditions as soon as practical following termination of winter storms. Salting and anti-icing units are usually equipped with calibrated mechanical spreaders that accurately control the application rates of materials. Employees are instructed to apply the proper application rate at the appropriate time.

Planning, preparing, and scheduling of resources must occur far in advance of winter storms. In fact, a successful winter services program is a year-round activity and requires a continual focus on fundamentals. Preparations for next winter's operations begin on the last day of the previous winter season.

RESPONSIBILITIES

A safe driving surface is of primary importance. The aim of snow and ice removal operations is to return the surface to normal conditions as soon as possible within the limitations of the Department's Level of Service Guidelines. The desired results can be obtained by proper use of storm forecasts, personnel, equipment, and materials. A coordinated effort must be made between all Districts and Counties to provide the public with a uniform driving surface. Listed below are responsibilities by areas.

EXECUTIVE OFFICE

- Provide Winter Service goals and objectives
- Review and approve Winter Maintenance and Services Guidelines

BUREAU OF MAINTENANCE AND OPERATIONS STAFF

- Determine needs, write specifications, and develop repair and maintenance programs for snow and ice removal equipment
- Support Districts / Counties in the event of any winter related emergencies, or MET team deployment
- Approve goals and operating procedures recommended by the County Transformation Team
- Provide assistance and guidance in implementation of operating procedures

- Develop and implement a Winter Services Quality Assurance Program
- Coordinate winter material procurement
- Coordinate weather systems and forecast services
- Develop training materials and plan annual Snow Academy Training
- Review and disseminate snow and ice information
- Develop annual Winter Leadership Presentation
- Develop Goals and Operating Procedure recommendations
- Keep abreast of latest snow and ice removal technologies and developments
- Develop and update Winter Maintenance and Services guidelines
- Provide oversight to encourage consistent operations in regards to corridor maintenance, material application, anti-icing, etc.

DISTRICT MANAGEMENT STAFF

- Provide assistance and guidance to Counties to ensure implementation of Winter Maintenance and Services Guidelines
- Support Counties in the event of any winter related emergencies, or MET team needs
- Oversee the inspection of equipment to ensure fleet is prepared for winter
- Coordinate equipment allocation, routing and verification
- Coordinate delivery and distribution of winter materials
- Coordinate training programs
- Assist in Winter Services Quality Assurance program
- Establish temporary winter service personnel staffing levels
- Coordinate winter personnel assignments
- Review equipment routing assignments for concurrence
- Evaluate and optimize personnel, equipment, and material resources
- Verify that the GIS Snow Route Application is accurately populated/refreshed as per BOMO standards
- Coordinate with County management to conduct annual review of agreements with external partners
- Coordinate with County management to perform routine quality assurance verification of RMS data for accuracy

COUNTY MANAGEMENT STAFF

- Prepare equipment routing assignments via the annual update of the GIS Snow Route Application, which includes assigning equipment to each truck
- Inspect and repair equipment to ensure fleet is prepared for winter
- Keep winter material quantities at adequate levels
- Implement Winter Maintenance and Services Guidelines
- Conduct annual snow and ice removal training
- Call out personnel for winter operations
- Prepare needed Winter Services reports
- Determine material application and rate in accordance with Winter Maintenance and Services Guidelines and District recommendations
- Provide routine weather updates to all drivers via radio
- Verify spreaders

ASSISTANT HIGHWAY MAINTENANCE MANAGER/FOREMAN

- Ensure that routine equipment maintenance is performed and breakdowns are reported
- Ensure adherence to all safety policies and procedures
- Make routine checks and report quantities of material on hand
- Fill out crew day cards, loader sheets, and other required records
- Make work assignments
- Ensure that proper materials are applied in a timely manner in accordance with recommended application procedures (as directed)
- Evaluate road conditions/determine duration of snow fighting efforts
- Ensure proper storage and clean-up of materials and equipment
- Utilize available resources to achieve Department Objectives

FOCUS ON FUNDAMENTALS

Fundamental resources that must be ready for deployment include:

People: Equipment Operators, Foremen, Managers, Mechanics and Office Personnel who possess the knowledge and skills needed to perform their jobs well.

Equipment: The right types and pieces of equipment properly maintained, available when and where needed to perform winter operations.

Materials: Store in proper manner, in the right locations, ready for application as needed.

A focus on fundamentals also includes effective scheduling: detailed operational assignments for people, equipment, and materials, so that resources are ready and available for deployment as needed to achieve Levels of Service goals for each route before, during, and after winter storm events.

COMMUNICATIONS

Efficient, accurate, and timely transmission of information before, during, and after winter storm events among parties who need to know, including PennDOT staff and external partners.

SITUATIONAL AWARENESS

Having accurate and up-to-date awareness of road and weather conditions is an important component of Situational Awareness. Successful snow and ice control

operations require continual monitoring of weather conditions, weather forecasts, resources deployed, and Levels of

Service achieved on each route. Such monitoring provides awareness of current and changing conditions. This knowledge is indispensable for communications among relevant parties dealing with the winter storm event. For example, in the case of severe weather that warrants closure of a road, PennDOT staff must communicate and coordinate in a timely manner with external partners such as local and state police to reroute traffic. Tools such as closed circuit TV (CCTV), Roadway Information System (RWIS), Automatic Vehicle Location system (AVLS), and Road Condition Reporting System (RCRS), as well as conventional and social media can be used to maintain situational awareness.

CONTINGENCY PLANNING

Having plans to address unexpected and potentially challenging situations is one key to success during winter weather events. Situational awareness is essential to contingency planning. When conditions warrant, Levels of Service decisions can be particularly critical. Temporary redeployment of resources from lower to higher priority routes may be necessary to achieve and maintain Levels of Service on higher priority routes. Diverting resources (people, equipment, materials) from lower to higher priority routes (and then back again) requires advance planning so that disruptions to routine operations are minimal. Situational awareness supports decisions to activate contingency plans.

CHAPTER ORGANIZATION AND SCOPE

This chapter discusses all phases of ice and snow control operations. As nearly as possible, it chronologically lists all winter-related activities starting with those performed in the spring, continuing with summer and fall activities, and concluding with the winter season. Employees throughout PennDOT, including Equipment Operators, Foremen, Highway Maintenance Manager, and District and Central Office personnel, perform these activities. In some cases, rental operators and municipal employees executing municipal services contracts also complete these activities – yet are bound by the same guidelines. Where applicable, this chapter identifies by job titles those with primary responsibilities for activities.

Changeable conditions during winter storms require flexibility of operations. Ice and snow control is a highly complex and varying task requiring knowledge and expertise. The types and amounts of deicing materials to be applied, determining plowing versus spreading, and Levels of Service are field decisions and must be made by the Highway Maintenance Manager or a designated representative in charge of local operations.

Subject to weather conditions and irregular winter schedules, the Department will continue to perform such other maintenance activities as stated in Section 4.5.13, Dark Hours Training and Other Activities Performed during Winter Season. However, because of the major impact that winter storms have upon our society, other maintenance activities are secondary to the ice and snow control program.

4.2 WINTER RELATED ACTIVITIES DURING APRIL AND MAY

A successful ice and snow control program must be approached as a year-round activity. If adequate preparations have not been completed by the time the first snow falls on the ground, it will be impossible to do the job efficiently no matter how good or experienced the maintenance organization has become.

Figuratively speaking, it may be said that the next winter begins on the day that this winter ends. Beginning winter preparations about nine months ahead allows ample time to focus on the fundamentals, particularly

the people, equipment, and materials that must be ready for deployment by the start of the next winter season.

In preparation for next winter, topics addressed during the spring season include:

- Review of operations for the winter that just ended.
- Inspection and storage of equipment.
- Inventory and storage of winter materials.
- Cleanup of stockpiles and highways.
- Review of municipal agreements.

4.2.1 COUNTY SPRING SEASON REVIEW

The best way to start preparing for next winter is to review what happened last winter. Use After Action Reviews (AARs) to document winter operations. Conduct a County AAR at the end of each winter season, shortly after the last winter storm event while the operational aspects of winter services are still fresh in everyone's minds. Participants include the Highway Maintenance Manager, Assistant Highway Maintenance Manager, Equipment Manager, County Plant Maintenance Coordinator and other key County personnel designated by the Highway Maintenance Manager. AARs should be held when specific operational shortcomings or concerns indicate the need for a review. Appendix A includes a Winter Operations AAR template. The AAR, Form M-602 (6-15), is available for use in fillable form PDF format on the Department's \\pdfpfap2k01\data\penndot shared\FORMS PennDOT Authorized\M-602.pdf

AARs reveal what worked well and what did not. AAR findings should trigger short-term corrective actions and contribute to long-term planning. An example of a short-term corrective action is ordering and installing a replacement engine for a snow blower. Problem areas and opportunities for improvement that require more time, resources, and planning often involve:

- Equipment routing, cycle times and scheduling of personnel.
- Materials supply and application rates.
- Rental agreements and municipal contracts.
- Shift schedules.
- Call-out procedures.
- Situational awareness.
- Contingency planning.
- Quality and reliability of temporary personnel.

Address any longer-term items or issues identified during the spring AARs and resolve them prior to the start of the next winter season, whenever possible.

The Highway Maintenance Manager must send a memo outlining the results of the County AAR to the Assistant District Executive for Maintenance by April 15th. Documenting and sharing what each county learned about improving winter operations will better prepare the Department for next winter.

4.2.2 DISTRICT SPRING SEASON REVIEW

The Assistant District Executive for Maintenance should review the results of the County AARs. A District AAR is to be completed no later than May 15th. The Assistant District Executive for Maintenance, District

Equipment Manager, all Assistant District Maintenance Managers and all Highway Maintenance Manager should attend. Appendix A includes Winter Operations AAR template.

The District AAR should evaluate District ice and snow control operations. Use the AAR to identify best practices, particularly new and innovative practices. Items noted in the county reviews that require District action should be addressed at the appropriate time. As with County AARs, topics covered during District AARs should include:

- Equipment routing, cycle times and scheduling of personnel.
- Materials supply and application rates.
- Rental agreements and municipal contracts.
- Shift schedules.
- Call-out procedures.
- Situational awareness.
- Contingency planning.

The Assistant District Executive for Maintenance is to send a summary of the District AAR to the Director, Bureau of Maintenance and Operations no later than May 31st. Incorporate information from the District AAR into the annual Winter Leadership presentation, as appropriate (see Section 4.3.7).

4.2.3 WINTER EQUIPMENT INSPECTION AND STORAGE PREPARATION

The months of April and May are the best times to inspect snow removal equipment. This allows time to evaluate the condition of the equipment and to schedule needed repairs and maintenance so that the equipment is in proper working condition for the next winter season.

The District Executive determines the equipment inspection protocol. This may involve a set inspection procedure to follow each year, or the inspection procedures may be left to the Highway Maintenance Manager to decide. In the latter case, inspection methods will vary depending on the type of winter and the age and general condition of each County's snow removal equipment. Document results of inspections, including needed repairs and maintenance. A Winter Equipment Checklist included in Appendix B may be useful for this purpose.

County Equipment Managers are responsible for scheduling repairs and maintenance so that equipment is in good working order by the start of the next winter season. The District Equipment Manager should monitor progress and verify that all needed repairs have been completed. Additional information can be found in the latest version of the Equipment Manager's Manual, Publication 177.

4.2.4 WINTER MATERIALS

Qualified personnel are to inventory all winter materials at the stockpile where they reside in accordance with the current SAP Plant Maintenance standards. Material moved between stocking areas shall be "transferred" in SAP Plant Maintenance and "issued" from current materials when used. The following are key milestones:

- Complete physical inventory by May 31st.
- Complete data input into the SAP Plant Maintenance system by June 25th.
- Complete adjustments and reconcile with SAP Plant Maintenance inventories by June 30th.

To determine the amount of salt required for the next winter season, calculate an average salt usage for the previous five years. Use this 5-year average as a baseline capacity. Subtract the amount of salt on inventory as

of March 31st from this baseline. Provide the difference between the baseline and the inventoried amount to BOMO for use in establishing a bid package. Counties are responsible for maintaining salt inventory levels throughout the winter season as follows:

- Create purchase orders to acquire and maintain fill quantities equal to 75% of available working capacity or 5-year average, whichever is lower (including inventoried amounts), from November 1st through January 15th
- Maintain 60% working capacity or 5-year average starting February 1st
- Maintain 30% working capacity or 5-year average starting March 1st
- Maintain 10% working capacity or 5-year average starting April 1st
- Districts should consider purchasing salt against the next winter season at the current price, if budgets allow.

4.2.5 SPRING CLEAN UP OF MAINTENANCE STOCKING AREAS

Following SEMP guidelines, maintain stocking areas in a neat and orderly condition at all times. All County maintenance personnel are responsible for the upkeep of stockpiles.

Assistant Highway Maintenance Managers are responsible for ensuring that stockpiles meet the Department's quality assurance standards. The annual spring cleanup of stocking areas deserves special emphasis. At this time, clean and repair bins and storage buildings, as needed, before transferring remaining salt and other environmentally sensitive materials into them from stockpiles without permanent storage buildings (see Section 4.2.6). Clean and repair salt storage pads at stockpiles without permanent storage buildings as needed. Soil- and salt-staining cleanup must comply with SEMP guidelines. Salt laden aggregate produced by the cleaning of stockpile grounds both during and after the winter season which cannot be recovered and reused will be disposed of using residual waste handling procedures.

4.2.6 TRANSFER OF REMAINING SALT TO COVERED SALT STORAGE BUILDINGS

Every District has several covered material storage buildings. As soon as the winter materials inventory and spring cleanup are completed (see Sections 4.2.4 and 4.2.5), transfer of all environmentally sensitive materials from stockpiles without permanent storage buildings should begin. Any stockpiles located within 500 feet of wells or streams are to be emptied first, with the other stockpiles following in a logical sequence.

Transferring salt and other environmentally sensitive materials to permanent storage buildings will eliminate a potential pollution problem, keep the materials in a usable condition, and help in the general cleanup and appearance of stocking areas. Material moved between stocking areas shall be "transferred" in SAP Plant Maintenance and "issued" from Current Materials when used.

4.2.7 CLEANUP OF ANTI-SKID MATERIALS FROM HIGHWAYS

Spring is the time for cleaning and removing anti-skid materials from highways, bridge decks and expansion joints, drainage facilities, raised medians and islands, joints, inlets, scuppers, gutters and drainage courses. This should be done as soon as possible after the last winter storm of the season. Clean up and disposal of waste materials must comply with appropriate SEMP policies and procedures, as applicable.

Failure to conduct a proper anti-skid cleanup operation:

- Leaves the highways in an unsightly condition.
- Creates the potential for roadway runoff pollution to surface waters.
- Blocks drainage facilities, leading to damage on roads and shoulders.

- Reduces the effectiveness of herbicides (spray falls on anti-skid deposits instead of potential growth areas).
- Delays traffic line painting.
- Impacts to bicyclists who desire to use the roadway's shoulder.
- Impacts to bicyclists who desire to use the roadway's shoulder.

Depending on the amount and type of work involved, anything from hand brooms and shovels to tow brooms and self-propelled mechanical sweepers can be used for anti-skid cleanup. The Department is not responsible for sweeping state routes within city or borough boundaries.

For additional information refer to Publication 23, chapter 8, "Drainage and Drainage Systems" under the section "Enclosed Surface Drainage Facilities In cities, Boroughs and Incorporated Towns."

4.2.8 STOCKPILE LOCATION PLAN GUIDELINES

A density factor (snow lane miles divided by square mile) was calculated for each county. The density factors tabulations on pages 4-8 through 4-10 permit the direct determination of the snow lane miles to be serviced from as stockpile based on the county's specific density factor. The calculation is based on the premise that a county with a high density of roads per square mile should be able to service more lane miles from each stockpile location, and it established a minimum lane mile assignment of 135 snow lane miles/stockpile and a maximum of 225 with a straight line relationship in between.

The last step of the computation is to obtain the allowable number of stockpiles per county. This is done by dividing the snow lane miles per stockpile into the total county snow lanes listed on the Highway Features Inventory printout. The PennDOT County Office is not counted as a stockpile.

Certain other factors such as poorly placed existing stockpiles which cannot be vacated, roadway configuration and distribution, large metropolitan areas, rivers, state forest areas, terrain, etc., can also have an influence on the number of stockpiles that a county requires. These factors must be considered on an individual county basis but the number of stockpiles computed from the formula plus the county office is adequate for most counties.

After the allowed number of stockpiles is computed, county maps must be reviewed to decide where the stockpiles should be located. After this is determined, it will be primarily up to the District to locate available land and initiate the purchasing process. While reasonable efforts are to be made to retain operationally and environmentally acceptable sites, it is recognized that it will be necessary to vacate rental sites. The plan showing the final stockpile distribution should be completed, approved by the District Executive and used by the Maintenance Manager to plan stockpile acquisition and development. Stockpile location plans should be on file at the District Maintenance Office and at each County Office.

Allowable Number of Stockpile Calculations	
Density Factor (x)	SLM/SP
0 – 0.74	135
0.75 – 2.75	45(x)+101.25
2.76+	225

TABULATION SHEET					
District	County	Total Snow Lane Miles	Square Miles	Density Factor Computed (SLM/SQ MI)	Recommended Number of Stockpiles
District 1-0					
1-1	Crawford	1,965	1,016	1.93	10
1-2	Erie	2,024	812	2.49	9
1-3	Forest	405	420	0.96	3
1-4	Mercer	1,764	681	2.59	8
1-5	Venango	1,186	675	1.76	7
1-6	Warren	1,123	910	1.23	7
	TOTAL	**8,468**	**4,514**	**1.88**	**44**
District 2-0					
2-1	Centre	1,485	1,115	1.33	9
2-2	Clearfield	1,760	1,144	1.54	10
2-3	Clinton	715	902	0.79	5
2-4	Cameron	224	401	0.56	2
2-5	McKean	810	997	0.81	6
2-6	Potter	882	1,092	0.81	6
2-7	Mifflin	570	431	1.32	4
2-8	Elk	622	809	0.77	5
2-9	Juniata	773	387	2.00	4
	TOTAL	**7,839**	**7,278**	**1.08**	**51**
District 3-0					
3-1	Columbia	1,102	484	2.28	5
3-2	Lycoming	1,695	1,215	1.40	10
3-3	Montour	399	130	3.07	2
3-4	Northumberland	1,210	454	2.67	5
3-5	Snyder	664	329	2.02	3
3-6	Sullivan	492	478	1.03	3
3-7	Tioga	1,380	1,150	1.20	9
3-8	Union	660	318	2.08	3
3-9	Bradford	1,848	1,147	1.61	11
	TOTAL	**9,450**	**5,705**	**1.66**	**51**
District 4-0					
4-2	Lackawanna	1,558	454	3.43	7
4-3	Luzerne	2,285	891	2.56	11
4-4	Pike	758	545	1.39	5
4-5	Susquehanna	1,625	836	1.94	9
4-6	Wayne	1,478	744	1.99	8
4-7	Wyoming	777	396	1.96	4
	TOTAL	**8,482**	**3,866**	**2.19**	**44**

TABULATION SHEET *(continued)*					
District	**County**	**Total Snow Lane Miles**	**Square Miles**	**Density Factor Computed (SLM/SQ MI)**	**Recommended Number of Stockpiles**
District 5-0					
5-1	Berks	2,260	864	2.62	10
5-2	Carbon	617	405	1.52	4
5-3	Lehigh	1,426	347	4.11	6
5-4	Monroe	1,266	611	2.07	7
5-5	Northampton	1,241	374	3.32	6
5-6	Schulkill	1,513	783	1.93	8
	TOTAL	**8,323**	**3,384**	**2.46**	**41**
District 6-0					
6-1	Bucks	2,606	617	4.22	12
6-2	Chester	2,541	760	3.34	11
6-3	Delaware	1,586	185	8.57	7
6-4	Montogomery	2,324	484	4.80	10
6-5	Philadelphia	2,020	135	14.96	9
	TOTAL	**11,077**	**2,181**	**5.08**	**49**
District 8-0					
8-1	Adams	1,219	526	2.32	6
8-2	Cumberland	1,470	555	2.65	7
8-3	Franklin	1,393	754	1.85	8
8-4	York	2,681	914	2.93	12
8-5	Dauphin	1,591	520	3.06	7
8-7	Lancaster	2,504	945	2.65	11
8-8	Lebanon	906	363	2.50	4
8-9	UnionPerry	931	550	1.69	5
	TOTAL	**12,695**	**5,127**	**2.48**	**60**
District 9-0					
9-1	Bedford	1,725	1,018	1.69	10
9-2	Blair	1,213	530	2.29	6
9-3	Cambria	1,570	695	2.26	8
9-4	Fulton	738	435	1.70	4
9-5	Huntingdon	1,232	895	1.38	8
9-7	Somerset	1,872	1,084	1.73	10
	TOTAL	**8,349**	**4,657**	**1.79**	**46**
District 10-0					
10-1	Armstrong	1,411	660	2.14	7
10-2	Butler	1,574	794	1.98	8
10-3	Clarion	1,028	599	1.72	6
10-4	Indiana	1,733	831	2.13	9
10-5	Jefferson	1,193	652	1.83	6
	TOTAL	**6,978**	**3,536**	**1.97**	**36**

TABULATION SHEET *(continued)*					
District	County	Total Snow Lane Miles	Square Miles	Density Factor Computed (SLM/SQ MI)	Recommended Number of Stockpiles
District 11-0					
11-1	Allegheny	3,589	730	4.92	16
11-2	Beaver	1,435	441	3.25	6
11-4	Lawrence	912	397	2.30	4
	TOTAL	**5,935**	**1,568**	**3.79**	**26**
District 12-0					
12-1	Fayette	1,705	800	2.13	9
12-2	Greene	1,213	577	2.10	6
12-4	Washington	2,531	857	2.95	11
12-5	Westmoreland	2,783	1,025	2.72	12
	TOTAL	**8,232**	**3,259**	**2.53**	**38**
	STATE TOTAL	**95,829**	**45,075**	**2.13**	**486**

4.2.9 MUNICIPAL AGREEMENTS

It is Department policy to contract winter maintenance services for certain state roads to municipalities on an annual basis. Municipal agreements have proven to be an extremely effective tool in providing timely winter service. In many cases, due to the nature and locations of the roads serviced, municipalities can provide a faster response than the Department.

Highway Maintenance Managers propose roads for municipal agreements. These roads must be non-interstates and, in most cases, located within the boundaries of the municipality that will provide the service. State roads are good candidates for municipal maintenance if they:

- Intersect major state-maintained routes.
- Branch out within a municipality, causing stop and go conditions.
- Require turning movements within the municipal boundaries.

NOTE: High traffic volume roads passing directly through two or more municipalities are not good candidates for municipal agreements.

Any municipality proposed for agreement must be able to provide the proper equipment, necessary personnel, chemicals, and anti-skid materials needed to meet the Department's Levels of Service goals (see Section 4.5.3), as these goals fully apply to service providers under municipal agreements. Payments to municipalities are by direct deposit only. Municipal agreements must be carefully screened -- this policy is not to be interpreted as blanket authority to place every state road under municipal agreement.

To offset severe winters, the municipality will be compensated with an adjustment equal to the percentage of the Department's actual cost (for similar roads serviced) over and above the five year average for a particular county, less a $1000.00 deductible for Municipalities with agreements totaling $5,000.01 or more and a $500.00 deductible for all others.

Each District should provide the name, title, and business phone number of the person responsible for coordination of the District's municipal agreements to the Bureau of Maintenance and Operations. Rates for municipal agreements, which are set yearly, vary depending on the type of road serviced and local, historical and climate-related data. Rates along with other details are sent by letter to each District Executive no later than June 30th. Municipal agreements must be renewed by September 15th. See Pub 23, Chapter 10: Municipal Agreements, for more information.

Snow lane miles serviced by municipalities are to be deducted from county totals before estimating the number of snow removal trucks needed for each County (see also Section 4.3.1).

***NOTE:** Municipalities are responsible for plowing State owned bridges on locally owned roads unless there is an agreement stating otherwise. Transfer (Turnback) Agreements contain the following clause: "Upon transfer of the State Highway(s) and any Bridge(s) herein specified, the MUNCIPALITY shall have jurisdiction of the said highway(s) and bridge(s) in perpetuity. The MUNICPALITY shall further have the responsibility for performance of winter traffic services (including snow removal and application of anti-skid and de-icing materials), and cleaning on any EXCLUDING BRIDGE STRUCTURES as designated by Station and/or Segment and Offset Numbers in Exhibit "D," on the above-noted state highway(s), even if those structures remain under the jurisdiction of the COMMONWEALTH, and for reporting missing, damaged and deteriorated bridge signs on any such EXCLUDED BRIDGE STRUCTURES (to the Highway Maintenance Manager or staff)."*

4.3 WINTER-RELATED ACTIVITIES DURING JUNE, JULY AND AUGUST

Winter Services is a year round priority for PennDOT. The following sections explain what activities must be accomplished during the summer months to ensure that the Department is prepared for an effective winter season. Having a comprehensive equipment plan, along with preparation of snow routes and development of proper training materials, are all part of the strong fundamentals that help ready the Department for winter. Thinking ahead to determine the ratio of Department, municipal and rental equipment is very important. Planning for contingencies is also a key part of winter preparation. Above all, effective communication both within the Department, and externally to other key stakeholders, helps to keep the winter services strategy on track.

Included in this section is information about:

- Department, municipal and rental equipment allocation.
- Guidelines for emergency and rented equipment.
- County snow map preparation.
- Equipment Operator certification.
- Preparation of the District-specific Winter Leadership presentation.

4.3.1 GUIDELINES FOR THE ALLOCATION OF DEPARTMENT, MUNICIPAL, AND RENTAL EQUIPMENT

This section explains how the optimum number of winter service vehicles is calculated based upon the December 2003 MECE Report and subsequent associated policy letters. Each District must develop an effective combination of Department, Municipal and Rental Equipment.

Snow Lane Mile definition: A snow lane mile is a travel lane that is up to 12' wide and 1 lineal mile long. Travel lanes that are wider than 12' should be counted as additional snow lane miles, as show in the chart below:

Lane Width	Equivalent # of Lanes
0 - 12 Feet	1 Lane
13 - 24 Feet	2 Lanes
25 - 36 Feet	3 Lanes
37 - 48 Feet	4 Lanes
49 - 60 Feet	5 Lanes
61 - 72 Feet	6 Lanes

Proposed PennDOT Fleet Size calculations are a function of Interstate, NHS, Non-NHS >2000ADT, and Non-NHS <2000ADT mileage factoring in miles maintained by Agility, Municipal and Rental agreements.

Interstate factor= municipal miles/ (20xtotal urban miles/ total county miles +30xrural miles/ total county miles

NHS factor= municipal miles/ (25xtotal urban miles/ total county miles +35xrural miles/ total county miles

>2000 factor= municipal miles/ (30xtotal urban miles/ total county miles +40xrural miles/ total county miles

<2000 factor= municipal miles/ (35xtotal urban miles/ total county miles +45xrural miles/ total county miles

Required PennDOT Fleet Size= Interstate factor +NHS Factor+ >2000 factor+ <2000 factor rounded to the next whole number.

These formulas were automated in 2013 and based upon GIS Snow Route Planning Application data. A 10% overage is allowed for breakdowns.

District 6 is authorized additional rental trucks which can be used under emergency situations and to supplement plow trains on multi-lane roads as directed by the District Executive.

The Snow Route Application calculates the snow lane miles serviced by the municipality under agreement and will automatically deduct that mileage from the MECE truck calculations.

If after the above computations are made the total number of Department snow removal trucks available is less than the number allowed, the difference may be filled by rentals from private individuals or corporations. Additional rental trucks can also be assigned to replace Department trucks in case of breakdown.

Rental trucks are obtained by advertising and awarding contracts for Rental Equipment as detailed in Chapter 10, Section 7 of this manual.

4.3.2 RENTED EQUIPMENT PROGRAM

Counties have the option to rent road equipment from the private sector through a Request for Quotes (RFQ) issued to vendors under the Statewide Rented Equipment Invitation to Qualify (ITQ). See Pub 23, Chapter 18: Rented Equipment, for detailed instructions for renting equipment.

In some cases, PennDOT competes with local businesses or municipalities in securing rental equipment. Offering specific routes to rental Equipment Operators may help a District develop a reliable source of rental equipment. However, if specific routes are offered as part of a bid package, Union notification is required in accordance with Preservation of Bargaining Unit work procedures.

Additional rental trucks can also be assigned to replace Department trucks in case of breakdown. Do not schedule these trucks to any state route or note on snow maps, but hold them in reserve for emergencies or as a backup in the event of equipment failures.

Counties who have loader mounted snow blowers should consider procuring back-up rental loaders to replace a loader/blower, if necessary, for an extended period of time during or after a storm.

It is recommended that Highway Maintenance Foremen, or other county management personnel provide oversight of operations provided by rented equipment vendors and their operators through TAPER logs.

4.3.3 EMERGENCY SNOW REMOVAL EQUIPMENT NOT UNDER RENTED EQUIPMENT PROGRAM

In the event of severe winter snow storms when an emergency is declared by the Governor, or if the District Executive or designee has approved and authorized an emergency procurement, the District may utilize the procedures for “Emergency Procurements” as detailed in Chapter 1 of Publication 1 PennDOT’s Purchasing Manual, which provides encumbrance information text for emergency rental equipment; this verbiage is to be included in the header of the emergency type purchase order.

The major difference between this type of emergency procurement and a Rented Equipment Program agreement is that the Rented Equipment Program agreement is entered and placed on file before the winter snow removal season starts and can be activated automatically, when required. The emergency equipment referred to in this section is located and utilized at the time an emergency occurs.

4.3.4 DEPARTMENT GRADERS, SNOW BLOWERS AND ANTI-ICING TRUCKS

Graders, snow blowers and anti-icing trucks are to be used when and where required. They are not included in the truck allocation formula.

4.3.5 COUNTY SNOW MAP PREPARATION

Each summer, the Highway Maintenance Manager designates an individual to prepare snow maps for the upcoming winter season. Several inputs are included in the development of county snow maps, such as prior winter performance including any trouble spots; upcoming winter route priorities, widened or newly added sections of roadway, and guidelines for the allocation of Department equipment, current status of Municipal Agreements for equipment, and plans for rented resources. The following general assumptions guide the development of the snow maps:

- That a general storm condition exists and all roads will be maintained 24/7.
- That all regularly scheduled snow removal equipment, Department, and scheduled rental equipment are working.

Contingency mapping should also be developed to identify route specific information and equipment to be used to provide advanced support to interstate operations when required. Contingency plans should be included in dry run process. See Sections 4.4.2 and 4.4.13 for more information about contingency planning and dry runs.

GIS SNOW ROUTES APPLICATION

The GIS Snow Route Planning application was developed to automate basic map development. Additional benefits include providing a means to assess winter service operations by business plan network, eliminating gaps and overlaps in service routes, inventory management, and data archiving. This application integrates user input and roadway and equipment data from the Roadway Management System (RMS) and SAP Plant Maintenance.

Counties are to enter all Department equipment, including all trucks utilized in winter maintenance, and their respective plows and spreaders. All equipment details should match equipment details in Plant Maintenance. If details for new equipment are not entered in Plant Maintenance, new equipment will appear invalid in the application.

Snow routes should be assigned to each truck based on appropriate snow lane mile (SLM) allocation. The minimum required information to be entered includes segments, offsets, material application rate, and anti-icing indication and application rate, where applicable. This information is to be completed as thoroughly and accurately as possible as these elements are all frequently evaluated in reports. Inaccurate information will cause conflicts in maps and reports. Information regarding segments without winter maintenance and state owned bridges on locally owned roads (SOBLORs) should be forwarded to BOMO so they can be excluded from the segment database.

Agreements for routed rentals are to be entered according to the written contract details. Trucks under each line item should remain consistent with the written agreement, as well as any attached equipment. If a vendor is not listed in the application, contact the application support staff in BOMO for a solution. Snow routes are entered in the same manner as Department force snow routes, and all guidelines previously mentioned apply. Municipal agreements are entered similarly, but are not assigned to any equipment. All agreements and Department snow routes are accounted for in SLM calculation and gaps and overlaps formulation.

Run the gaps and overlaps after all routes are entered to mitigate gaps in service and overlapping routes. Ideally, this report should show no segments, signifying that all routes under the Department's jurisdiction are planned for servicing. Some exceptions may be justified on a case-by-case basis.

Maps are generated either by the standard Maps, or the Hardcopy Maps functions. Maps may be drilled down to the stockpile or county levels. Several summary reports are available within the application, such as gaps and overlaps, snow lane mileage, trucks by stockpile, and equipment not assigned. Additional reports are available through SAP Business Objects to users with appropriate access.

For access to the application, or to modify current user permissions, contact a Regional Administrator in your District for assistance. More information regarding the application can be obtained from the Bureau of Maintenance and Operations, Winter Services Section, or by accessing PennDOT's Data and Information page, and following the link to more information for the Snow Routes Planning application.

Link to Snow Routes Planning Application: http://pdprgisiis01/SnowRoutes/

Link to PennDOT's Data and Information page: http://164.156.155.62/pdi/

4.3.6 EQUIPMENT OPERATOR CERTIFICATION

Department policy requires that all Operators be certified to operate the equipment safely and maintain it properly. The Highway Maintenance Manager must ensure that sufficient numbers of workers are trained and certified so that snow removal equipment can be operated as required according to the County Winter Shift Schedule. If sufficient Operators cannot be found at the County level to fully staff winter schedules, the Highway Maintenance Manager must report this situation to the Assistant District Executive for Maintenance. The Highway Maintenance Manager may recruit, train, and certify CDL holders from other organizations within the District to be used on an as-need/when-available basis. If this is not possible, the District Executive may approve additional rental equipment or submit a BHR request for additional personnel.

Summer months provide the opportunity to train operators in the basics of snow removal operations, with consideration given to the impact of this on planned summer activities. While this season of the year prevents the actual plowing of snow, it does not preclude training and testing on such items as:

- Trucks, graders and loader operations.
- Mounting and adjusting the plow.
- Familiarity with plow and spreader control.
- Driving skills involving turning and backing.
- Clearance judgment with the front and/or wing plow mounted.

  Equipment Operator Instructors can offer this type of training.

TEMPORARY TRANSPORTATION EQUIPMENT OPERATOR A (TEOA) REQUESTS

Requested numbers for the Winter Maintenance Program Temporary Transportation Equipment Operator A (TEOA) positions should be based on the formula developed by the Bureau of Maintenance and Operations (BOMO) to determine the optimum number of temporary operator positions for each County. The primary purpose of the temporary TEOA positions is to provide a second operator for each snow route which is assigned to a Department-owned vehicle. This reinforces our intent to provide 24/7 coverage on each snow route during a winter event. The basic formula developed for the winter season is noted below. We understand that each organization bases is actual request on various factors that may be specific to its organization such as fuel truck assignments, medical exclusion from winter operations, upcoming retirements, etc. If an organization submits an actual request that is for more positions than the formula allows, the District must provide justification for each position.

The Bureau of Human Resources (BHR) has defined this calculation as the following: The number of Department-owned vehicles x 2 (12 hr. shifts) – (minus) number of permanent operators = number of temporary TEO positions required. An exception to this formula exists for counties where the number of permanent operators is equal to or near twice the number of Department-owned vehicles because application of the formula would not allow them to hire any temporary operators.

Counties will also be permitted to inflate the total number of temporary operators requested by 20% to provide a minimal cushion for extended events, leave, etc.

Example: 24 trucks x 2 = 48 operators required – (minus) 37 permanent operators = 11 temporary operators required x 20% = 13 temporary operators requested round up any decimal place to nearest whole number).

BOMO will review this formula annually with BHR and guidance will be provided by BHR prior to the fall season.

4.3.7 WINTER LEADERSHIP PREPARATION PRESENTATIONS

Annual presentations by District staff and County Managers will cover equipment readiness, personnel, command and control, and other topics relating to each County's winter plan.

County Managers preparing for this presentation will find copies of the PowerPoint presentation, the Excel Data sheet, and instructions on how to assemble the presentation available in a folder for the corresponding year on the PennDOT shared drive at the following location:

P:\penndot shared\Bureau of Maintenance and Operations\Maintenance Division\Winter Leadership

BOMO staff will arrange the date for the County/District presentations by July 15th.

4.4 WINTER-RELATED ACTIVITIES DURING SEPTEMBER, OCTOBER AND NOVEMBER

The months of September, October, and November are critical to preparations for oncoming winter operations. Fall season activities affect other seasons' work and deal with the full span of resources and capacity available to PennDOT to perform its winter services. This section details the responsibilities and necessary actions that prepare the Department to handle routine and emergency services when winter arrives.

The section opens with two essential topics: situational awareness and contingency planning. Both of these topics require strong up-front efforts so that downstream activities benefit. For situational awareness, the fall tasks deal with assuring that processes for gathering timely, relevant and accurate information are understood and in place. To disseminate that information, adequate communication equipment and knowledgeable staffing must be available when needed. Contingency planning is the process that prepares PennDOT to effectively handle unexpected, non-routine, or emergency situations and such situations include all aspects of winter services.

The section continues by describing the elements of fall season preparations necessary for safe and effective operations during both routine and extreme winter conditions, including:

- Training
- Situational Awareness
- Safety
- Fall meetings and communications within PennDOT and with external partners
- Weather reporting, forecasting, and emergency procedures
- Personnel-related activities such as standby time and shift planning

- Equipment and routing including dry runs
- Material types, storage, and supply

WINTER MAINTENANCE TRAINING PROGRAM

Each management level of the Maintenance organization has responsibilities for training employees in snow and ice removal. All employees directly involved in snow and ice operations shall attend annual snow and ice training every four (4) years that will be coordinated by the District and conducted by the District/County. Training shall include actual demonstrations with equipment, review of the Department Objectives and Procedures, Level of Service Guidelines, and safety.

Each County's date, time and location of Snow and Ice training will be circulated District-wide via a calendar of events to insure County and District trainers' timetables do not conflict. Snow and ice training will begin by the first week of October and end mid-November. Employees will be expected to report to their assigned County for training. In the event of an emergency or prior assignment to a PennDOT job causes an employee to miss the assigned County's training session, training sessions will be held at other locations within the District. Employees selecting an alternate location for training will take the certification portion of their Driver Training Documentation form back to the facility where they are assigned for the winter season. The supervisor at the assigned location will then determine a certification date for that employee for completion of their form.

Training topics may include, but are not limited to:

- Safety Issues / Wind Chill Chart
- Radio / Mobile Communications
- Equipment Preventive Maintenance
- Daily Check List / Repair Request
- Fluid Chart
- Spreader Installation
- Spreader Verification Charts
- Plow Installation
- Snow & Ice Control Materials
- TAPER Log – Snow and Ice Removal Event Log
- Route Familiarization
- Route Documentation
- Driver Certification
- Snow and Ice Removal Techniques
- Clean-up Operations
- Responsibilities
- Callout Procedures
- Work Reporting
- Supervisor's Investigation Report
- Vehicle & Equipment Accident Report

- Report of Injury
- Work Management Crew Day Cards
- Public Relations
- Reports & Forms
- Fuel Stops
- County Snow Routes
- Tips & Hints from Veteran Drivers

The training should contain pertinent information related to all phases of a storm event and include examples of the forms and reports used during the winter season, a list of local fuel vendors, county snow routes and suggestions and tips from veteran plow truck drivers.

The training should be structured to provide the flexibility of constant change, therefore allowing variation from year to year. Annual evaluation of the training program through observation, employee feedback and interaction on the part of the training committee members will allow for constant procedure enhancements. PennDOT is dedicated to providing the best training possible for its employees, the safest work environment within its capability, and strives to ever improve the service to the public by concentrating its focus on snow and ice removal personnel.

It is recommended that all temporary TEOA's attend County Snow and Ice training.

PERSONNEL TRANSFERS

PennDOT typically needs additional personnel during the winter to augment its maintenance staff to provide required levels of service. To accomplish this, local agreements can be negotiated for union-covered employees from various sections to be temporarily reassigned during a full call out to plow snow, operate the radio, and perform other related duties.

On or before November 1 of each year, each District needs to have winter reassignments finalized. This plan should allow for volunteers. Additional required stockpile assignments are determined by inverse seniority. In locations with critical driver shortages, PennDOT has encouraged employees that are not required to have a Commercial Driver's License (CDL) for their regular jobs to obtain them.

Although every attempt should be made to keep people as close to their homes as possible, Management must adhere to the seniority provisions of the Master Agreement/ Memorandum as related to stockpile assignments and shift preference.

COMMERCIAL DRIVER'S LICENSE (CDL)

PennDOT requires that specified classifications possess a commercial driver's license valid in the State of Pennsylvania. Human Resources have distributed a list of these classifications to management personnel. A CDL is required at the time of employment or must be obtained within 90 days after employment, and is a pre-requisite for driving most PennDOT snow and ice vehicles. Inability to obtain or maintain a valid CDL may result in termination.

Participation in mandatory CDL drug and alcohol testing is required as follows:

The Federal Government mandates that all employees who are required to maintain a commercial driver's license (CDL) to perform their job duties must be eligible for drug and alcohol testing. This testing includes pre-employment, random, reasonable suspicion, post-accident, return to duty and follow-up. Any CDL driver who tests positive for drugs or test above CDL blood alcohol content (BAC) or who refuses the test will be subject to dismissal.

4.4.1 SITUATIONAL AWARENESS

Situational awareness means having knowledge and understanding of the current state of conditions and resources that promote timely, relevant, and effective decision-making. Situational awareness for winter activities includes:

- Being fully informed about weather forecasts.
- Ensuring timely communications with all Department participants, external partners, and the public.
- Having complete understanding of procedures and actions necessary to provide accurate assessment of a winter event.
- Fostering a perspective that enhances the ability to address developing events.

County and District Offices are to develop plans and procedures for providing timely and accurate information to ensure situational awareness for Department personnel, external partners, and the motoring public regarding winter storm events. Sections in this chapter provide guidance for creating situational awareness:

- PennDOT Area Command.
- Weather Forecasting.
- Emergency Procedures.
- Proactive Call Procedures.
- Radio Operation.

Field personnel are responsible for a variety of situational awareness activities:

- The County monitors field conditions and communicates current conditions thru the District Incident Command Center (ICC) if activated or thru the appropriate Regional Traffic Management Center (RTMC).
- The District consolidates all County reports and sends information to Area Command, if the Incident Command Center (ICC) is activated.
- The District establishes trigger points to initiate the actions needed to activate the Highway Advisory Radios, Variable Messages Signs and other highway devices in accordance with the Incident Response guidelines (Publication 23, Chapter 9).
- Counties update the Road Condition Reporting System (RCRS) during winter events.

Examples of information required for communication of the current situation:

- Personnel – Available number of personnel and the number currently on-duty; manpower status reports.
- Equipment – Types and number of equipment required and the types and number in service.
- Materials – Current material totals listed by County.
- Current conditions defined using the Standardized Roadway Condition Descriptions (See PUB 23A Appendix D).
- Communication protocol and phone numbers for Department personnel and external partner organizations.

BOMO provides current Winter Road Condition Reporting guidelines at the start of each winter season. (See Section 4.4.5, PennDOT Area Command – Road and Weather Condition Reporting.) The guidelines are available on the PennDOT shared drive at the following location:

P:/PennDOT Shared/VGB

4.4.2 CONTINGENCY PLANNING

Contingency plans are courses of action developed in advance to accommodate unexpected, emergency, or non-routine events. Contingency planning is necessary preparation to address winter storm situations that are not part of the established winter operations plan.

Scope of Contingency Planning: Preparation for unanticipated winter events can be accomplished through developing "What if" scenarios that provide timely and best choice alternatives to current plans. Such scenarios should address critical weather events, emergencies, and any event that would cause deviation from established winter operations. The scenarios should state who is responsible for each action item, including who makes the decision to implement the contingency plan, what action item is to be accomplished, and the timeframe in which the actions are to be performed or completed. Full descriptions of changes of procedures and operations are to be included in the scenarios for all relevant personnel and external partners.

Document contingency plans, update them annually as necessary, and test them periodically to determine the most workable processes. Communicate contingency plans annually to all appropriate parties, both within the Department and with external partners.

Triggers for Implementing Contingency Plans: Contingency plans are implemented when local conditions require use of resources and service responsiveness exceeding established winter operational plans. Local conditions such as the following may be triggers for implementation:

- Traffic queues due to crashes or weather- related road closures.
- Major winter storm events and other weather emergencies.
- Changes in available resources including personnel, equipment, materials, and routing and scheduling.
- Unavailable or reduced communications capabilities.
- Decreased level of situational awareness.

In extreme emergencies, the Governor has the authority to activate the Pennsylvania Emergency Management Agency Emergency Operations Center and the Pennsylvania National Guard by declaring a disaster or state of emergency.

The following provides additional details on typical categories that require contingency planning:

TRAFFIC QUEUES DUE TO CRASHES OR WEATHER-RELATED CLOSURE

Each county contingency plan must include strategies for dealing with traffic queues in the event of crashes or weather-related road closure. Items to address are diversion routes, stranded motorist procedures, and communications with external partner organizations (see Incident Response guidelines, Publication 23, Chapter 9).

PERSONNEL AND SCHEDULING

Contingencies for personnel available to operate Department owned equipment include:

- Hiring temporary winter Operators.
- Using Maintenance Repairmen or those with other classifications within the County organization who maintain a Commercial Driver's License (CDL) and Department certification.

- Scheduling other non-maintenance PennDOT employees who possess a CDL and equipment certification (e.g., District line painting and/or bridge inspection crews).

- Maintenance repairmen and non-maintenance employees who operate Department owned equipment must be included in Drug and Alcohol Testing Pools.

EQUIPMENT

Contingency equipment is generally obtained from the private sector through the rented equipment ITQ (see also Section 4.3.2). Counties can contract for both routed rentals to supplement the Department owned fleet and emergency/ standby rentals. The ITQ includes qualified vendors willing to provide loaders, graders, snow blowers and other equipment as well as trucks with plows and spreaders or anti-icing units. In some areas, it is possible to obtain equipment from one of the two BOMO training sites to supplement the County fleet.

MATERIALS

Materials contingency planning provides for an acceptable level of stock in the needed location at the time required. Materials contingency planning requires a process to monitor inventory levels during winter months to insure replacement stock is ordered, received, and available for the next or extended storm event. Additionally, the contingency plan must include a documented procedure to determine when and in what amounts transfers of materials within a County or District are warranted. Constant monitoring of inventory levels enables accurate situational awareness and allows decisions to be made as early as possible.

Contingencies in this area may involve:

- Change of material choice or treatment strategy such as using a salt/anti-skid mix rather than 100% salt to stretch existing inventory levels.

- Use of liquids as anti-icing agents or pre-treating applications at the spinner.

NOTE: Temperature will play a role in the decision making process when choosing materials for a specific location or event (see Section 4.5.3 Levels of Service).

As part of materials contingency planning, consider establishing reserve storage facilities.

ROUTING AND DIVERSION PLANS

Routing contingencies include diversion plans for priority routing during events that cause operations to deviate from established winter plans (see Sections 4.5.2, Priorities of Routes, and 4.5.3, Levels of Service).

Routing contingency or diversion plans:

- Identify the alternate routing.

- Identify the location of additional or support resources that can be diverted to priority routes.

- When assigned equipment is not available.

- When service falls below Levels of Service goals due to storm conditions.

- When additional equipment is needed to establish plow train operations.

- Identify coverage responsibilities when equipment is reassigned to supplement forces on other routes.

One of the important questions that routing contingency plans will answer is, “Will existing units from the assigned location cover additional miles, or will support from lower priority routes be moved up?”

COMMUNICATIONS

Providing for effective communications during an emergency or other extreme winter event must be an integral part of contingency plans. An effective plan includes built-in redundancy in communications equipment and alternatives for contacts, should initial avenues for communication fail.

Situational Awareness

Accurate and timely situational awareness is an especially important component of contingency planning, as situations may be in a continual state of flux (see Section 4.4.1, Situational Awareness).

Ensuring contingency plans are implementable: Counties should conduct tabletop exercises and field exercises if practical, that ensure that contingency plans are understood and workable by all personnel. Counties should rehearse contingency plan actions as part of their annual winter preparation process.

One resource for contingency planning guidance is:

- Mercer County Replacement/Augmentation Policy/Protocol for Interstate Trucks (available on the PennDOT shared drive).

4.4.3 FALL SEASON DISTRICT MAINTENANCE MEETING

During October or November, each District holds a fall season District Maintenance Meeting. The Assistant District Executive for Maintenance conducts the meeting, attended by District maintenance staff, Highway Maintenance Managers, and Assistant Highway Maintenance Managers. The purpose of the meeting is to discuss current statewide policies and procedures to be followed throughout the coming winter.

The Assistant District Executive for Maintenance sends notification of the date of the fall season District Maintenance Meeting and details of the agenda to the Director, Bureau of Maintenance and Operations.

4.4.4 FALL SEASON COUNTY MAINTENANCE MEETING

Each County holds a fall season County Maintenance Meeting no later than December 1st, following the fall season District meeting. The Highway Maintenance Manager conducts the meeting. Meeting attendees include all county personnel with winter operations duties. The Assistant District Executive for Maintenance should attend and participate in the meeting.

A District representative presents relevant information from the District meeting to County meeting attendees.

Additionally, elements of winter operations plans, contingency plans, and other aspects of winter services applicable to the local conditions are the primary topics for discussion.

Suggested agenda items include:

- The AAR referred to in Section 4.2.1 County Spring Season Review.
- Priorities.
- Shift schedules.
- Leave schedules.
- Union issues.
- Call out procedures.
- Equipment Operator availability.
- Equipment care.

- Spreader verification.
- Plowing and spreading techniques including materials application rates.
- Non-snow removal activities.
- Environmental considerations and SEMP guidelines.
- Radio communications.
- Review CMMT and other County, District, and BOMO measures that relate to winter operations.
- Contingency plans.
- Situational awareness.
- Weather forecasts and forecasting services.
- Training opportunities as available.
- Other items at the discretion of the Highway Maintenance Manager.

As preparation for the fall season County meeting, the Highway Maintenance Manager should ensure that items from the spring AAR meeting are reviewed (see Section 4.2.1, County Spring Season Review). Outstanding items from the spring should be addressed, as necessary, in the fall meeting.

Based on the outcomes of the fall meeting, all winter services planning, equipment assignments, schedules, and personnel assignments are to be completed in accordance with each district's winter preparedness date.

4.4.5 PENNDOT AREA COMMAND – ROAD AND WEATHER CONDITION REPORTING

The Bureau of Maintenance and Operations established the PennDOT Area Command to serve as a focal point for communicating statewide information concerning roadway conditions and PennDOT operations during emergencies and major winter storm events.

The mission of the Area Command during adverse weather conditions and/or emergencies is to:

- Provide PennDOT's management with Interstate and other high priority route roadway surface conditions, pending weather events that may affect the motoring public, and the status of District and County operations
- Ensures that the motoring public is advised of roadway travel conditions

The PennDOT Area Command monitors the Interstate winter roadway conditions from November 1st through April 30th. It operates during statewide emergencies and as directed by Department management.

PennDOT Area Command telephone number is (717) 783-5437, 5343 or 5355; fax number is (717) 787-7839.

BOMO's Emergency Transportation Operations Manager is responsible for coordination and operations of the Area Command. Other sections within the Maintenance Division of BOMO provide timely and accurate information to management including Interstate roadway conditions, pending winter weather events that may affect the motoring public, and status of District and County operations.

The PennDOT Area Command:

- Responds to the Districts' needs and requests, and compiles accurate and timely information for use by the Department executive staff, State agencies and facilities, and public information agencies.

- Ensures that all relevant information (weather forecast, road conditions, and local observations) is shared across the District and County boundaries to assist in maintaining operations.

- Provides coordination when the Protocol for Interstate Closures and Restrictions is enacted to restrict traffic in local areas as outlined in the policy.

Each District must submit interstate condition reports to the PennDOT Area Command using the Road Condition Reporting System (RCRS). Use the Standardized Roadway Condition Descriptions to report roadway conditions. (See PUB 23A Appendix D)

Additional Area Command information can be found in Chapter 9, Emergency Operations.

RCRS Road Condition Reporting Requirements

Normal Operations (November 1 through April 30)

Normal Operations – Defined as 24/7 operations between November 1 and April 30, except when a District ICC is activated for Emergency Operations.

A. Reportable Roadways

- All Interstates within the District.

- Other roadways established for 511 Pennsylvania. Reference information is located in the following P drive location: P:\Traffic Operations\511 Network.

B. Reporting Process

Engineering Districts must determine who will be responsible for RCRS reporting of roadway conditions within the District. It is recommended that the county radio operator be responsible for gathering and entering the information into RCRS.

Roadway condition reporting will be done on a county by county basis using the Standardized Roadway Condition Descriptions. The condition should represent an average overall condition for the roadway within the particular county.

Conditions must be reported every two hours when precipitation is present and the air temperature is below freezing. When the air temperature is above freezing, the reported condition should remain **"Condition 1: Clear"** regardless of precipitation.

C. RCRS Notifications

PUBLIC AND OTHER AGENCIES

Interstate road conditions on the 511 network reported in RCRS will automatically be transmitted to the public through 511 Pennsylvania.

Interstate Road Condition Reporting is utilized by various public information outlets, the Federal Highway Administration (FHWA), PSP, PEMA, and PennDOT to assess winter conditions impacting travel.

CONDITIONS CHAIN OF COMMAND

It is vital to ensure that condition reporting in RCRS be up to date and accurate. To help accomplish this, RCRS uses a condition chain of command to notify key PennDOT individuals as information becomes outdated. These key PennDOT individuals will be notified by email and/or text message whenever a non-Condition 1 condition has not been updated within the previous 2 hours and 15 minutes.

EMERGENCY OPERATIONS (NOVEMBER 1 THROUGH APRIL 30)

Emergency Operations – Defined as any period of time between November 1 and April 30 when the District ICC is activated.

A. Reportable Roadways

- All Interstates within the District.
- Other roadways established for 511 Pennsylvania. Reference information is located in the following P drive location: P:\Traffic Operations\511 Network.
- Other key state routes pre-established by the District and the Bureau of Maintenance and Operation (BOMO).

A. Reporting Process

Same criteria as Normal Operations, except conditions must be reported for each lane of the roadway and air temperature must be provided.

B. RCRS Notifications

PUBLIC AND OTHER AGENCIES

Same criteria as defined for Normal Operations.

CONDITIONS CHAIN OF COMMAND

Same criteria as defined for Normal Operations.

RCRS PENNDOT WINTER WEATHER TRUCK USAGE REPORTING REQUIREMENTS

NORMAL OPERATIONS (NOVEMBER 1 THROUGH APRIL 30)

Normal Operations – Defined as 24/7 operations between November 1 and April 30, except when a District ICC is activated for Emergency Operations.

A. Reporting Process

There is no requirement to report PennDOT Winter Weather Truck Usage in RCRS during Normal Operations.

EMERGENCY OPERATIONS (NOVEMBER 1 THROUGH APRIL 30)

Emergency Operations – Defined as any period of time between November 1 and April 30 when the District ICC is activated.

A. Reporting Process

During Emergency Operations, the District ICC must do the following:

- Ensure that the number of snow routes and truck inventories are accurate for each county within the District.
- Ensure that the truck statistics are kept up to date to accurately reflect the numbers of deployed vehicles. At a minimum, the information must be updated every 2 hours.

4.4.6 CONTACTING EXTERNAL AGENCIES

Communication with external partners and stakeholders is a critically important part of an effective winter services plan. Key deliverables are:

Meeting with State Police, Emergency Management Organizations and other external partners.

Each fall before November 15th, each County having Interstate highways is to conduct a meeting with the State Police and other designated authorities. The purpose of the meeting is to:

- Discuss procedures that were in effect during past winters.
- Make adjustments, as necessary, to past procedures to enhance communications and responses for the coming winter.
- Work out any other problem areas prior to the coming winter season.
- Communicate established detour routes for the interstate system, limited access highways, and other routes as applicable.

The Highway Maintenance Manager conducts the meeting and the Assistant District Executive for Maintenance attends the meeting. As appropriate, also invite the principals of major trucking companies that have terminals near the local Interstate highways to this meeting.

This meeting presents an excellent opportunity to discuss the standardization of winter material treatment for Interstate highways, especially where Interstates cross county lines. When servicing Interstate highways that cross county lines, similar materials, application rates and procedures should be used where possible to achieve consistent roadway conditions.

After the initial meeting is held, good communications and working relations must be maintained. Additional meetings can be scheduled, if required.

CORRESPONDENCE WITH SCHOOL SUPERINTENDENTS

Each September, each Highway Maintenance Manager is responsible for corresponding with local school superintendents to establish communications procedures and review school bus safety rules. These letters should:

- Thank the school superintendents for past cooperation.
- Express PennDOT's concern for the safety of school children who travel by school bus.
- Include the Highway Maintenance Manager's office phone number.
- Most importantly, stress applicable safety rules of school busing contained in the Pennsylvania Motor Vehicle Code.

  A sample school bus letter is included in PUB 23A Appendix E.

4.4.7 WEATHER FORECAST SERVICE

BOMO has a statewide weather forecasting contract to forecast winter events and provide advance warning. Each District/County can also contract for localized/regional weather forecasting. For additional information regarding the current statewide weather contracts please contact the Winter Services Manager in BOMO.

The Bureau of Maintenance and Operations recommends every manager/supervisor involved in winter services/emergency operations be provided a Smartphone or wireless device with e- mail in order to e-mail forecasts and forecast maps in real time to our staff.

Possible additional sources of weather information include:

- The National Oceanic and Atmospheric Administration (NOAA). These reports provide updated weather information 24- hours per day. NOAA website can be found at: http://www.noaa.gov/wx.html.
- AccuWeather.

- The Weather Channel.
- Local media.
- Meteorological departments at colleges/ universities.
- Any other reliable source.

The Department can also utilize PennDOT's existing information systems (Roadway Weather Information Systems [RWIS], radio, or telephone) as tools to establish contact with adjacent counties and states for storm tracking capability.

4.4.8 EMERGENCY PROCEDURES

The Department has established procedures that are activated during emergencies caused by severe winter weather, flooding, or other disasters.

The Bureau of Maintenance and Operations maintains the Emergency Operations Roster (EOR) list for such emergencies. The EOR is available through the Virtual Go Bag (VGB) Portal at; P:\Penndot shared\VGB Portal.htm

The list includes:

- District and County telephone numbers.
- Home telephone numbers of designated Central Office, District and County personnel.
- Telephone numbers of other pertinent agencies such as the Weather Bureau, Emergency Management Agency, and State Police.

NOTE: If you use a hard copy of this call list, be sure to keep it current -- the list may change at any time.

Each District has Mobile Equipment Teams (MET). Equipment operators, mechanics, and foremen who are able to leave their home Districts or Counties to work in other areas of the state during emergencies are assigned to MET. The Highway Maintenance Manager also designates equipment as available for use by the MET. If resources are insufficient for an emergency situation, a request for additional manpower or equipment may be made to the BOMO Director.

Both receiving and sending organizations are responsible for supplying information and accomplishing activities associated with MET functions.

Receiving Organizations must prepare:

- Resources needed – manpower and equipment.
- Logistics information, crew meet locations, times, radio and telephone contact information.
- Plan of operation.
- Approximate duration of activation.
- Identification of available resources including materials and equipment parts.
- Administrative procedures for payrolls and expenses as well as AAR completion.
- Sending Organizations must prepare:
- Assessment of their own needs and forecast for the next 48 hours.

- Shift and manpower information.
- Identification information and types of equipment being deployed.
- Radio and telephone contact information.
- Questions for receiving organization.

Refer to Chapter 9 Mobile Equipment Teams, Section 9.2 for further information.

4.4.9 PROACTIVE CALL PROCEDURE FOR ADVERSE WEATHER

Counties must implement a proactive call procedure to keep neighboring Counties informed in advance of approaching adverse weather conditions. The Highway Maintenance Manager or designee located in the County affected by the weather system shall make a "Proactive Call" to provide advance notice to the adjoining County maintenance office(s) that the weather system may affect.

The Highway Maintenance Manager is responsible for developing and making available to relevant staff a written proactive call out procedure. The proactive call out procedure should:

- Include adjacent county contact information.
- Describe strategies to facilitate information exchange.
- Identify specific staff responsible for making proactive calls.
- Provide guidance for determining when the proactive calls should be made.
- Include guidance on the types of information to be conveyed during the call.

4.4.10 RADIO OPERATION

During the winter season, County radio station desks must be staffed adequately to provide necessary communications during winter storm events. Radio Operators must be familiar with the County roadway network and winter operational procedures. In most Counties, during the peak winter season, 24/7 coverage is required. The responsible Assistant District Executive for Maintenance must approve deviations from this coverage.

Radio Operators' duties are to:

- Keep alert for emergency calls either over the radio or from other reliable sources.
- Conduct their work in conformance with the most recent Department policy regarding logging calls, call outs, radio procedures (see Chapter 19, Radios), and use of the Customer Care Center's customer complaint forms
- Be familiar the County communication plan.
- Have the skills and resources to implement the relevant sections of the County communications plan.
- Follow District procedures for reporting current road conditions in RCRS during storm events.

Radios mounted in cars or trucks coordinate maintenance operations and communicate with the District and County Headquarters. Use radio equipment for Department purposes only. Radio messages and conversations not related to highway maintenance are not permitted.

4.4.11 STANDBY TIME

Standby time requires partial pay for Equipment Operators and in return guarantees their availability when called upon. An employee on standby is prohibited from consuming any alcohol whatsoever during the period they are in standby status and must be available for emergencies. Standby time is not considered "hours worked" for the purposes of overtime calculations nor is the employee on standby when being paid for call time.

The use of standby time should be part of the County's winter plan and strategies. Judicious use of this planning tool can ensure that resources are available to respond to winter storms during holidays. Standby time enables responsiveness to winter events while holding costs down if the anticipated event does not occur.

Adherence to the Maintenance and Trades Appendix of the AFSCME Master Agreement/ Memorandum is required when using the standby time option.

4.4.12 SHIFT PLANS

The Highway Maintenance Manager is responsible for developing shift plans prior to the Fall Season County Maintenance Meeting (see Section 4.4.4). The Department's goal is to have sufficient Operators and equipment to maintain 24/7 coverage during winter events.

GENERAL SCHEDULING GUIDELINES

Prior to and during extended winter storms or emergency events, Highway Maintenance Manager should communicate shift plans to relevant employees. All employees assigned to winter maintenance, especially Equipment Operators, are subject to be available on a 24-hour basis. All employees are obligated to keep their supervisors aware of how they can be reached during off-duty hours.

Supervisory personnel must exercise care in granting leave to employees during the winter months so that adequate forces are available to handle winter storms. Such attention to staffing is especially important during the hunting season.

MULTIPLE SHIFTS

Multiple shifts are a proven method of reducing overtime expenditures while extending ice and snow control operations beyond the normal daylight working hours. Therefore, a two-shift operation during the winter months is recommended.

Guidelines for preparing multiple shift plans are as follows:

- Highway Maintenance Manager should consider historical weather patterns for their regions when deciding how to use multiple shifts.
- The Highway Maintenance Manager will place crews on shifts in accordance with the current Maintenance and Trades Appendix of the Master Agreement/Memorandum or the appropriate Local Agreement.
- Most Counties will have snow removal trucks operating on or off shifts with prior notification.
- Recommended shift starts are:
  - First shift starts between 4:00 a.m. and 6:00 a.m.
  - Second shift starts between 10:00 a.m. and 4:00 p.m.
- Depending on conditions in each particular County, schedule a third shift or a limited number of patrol vehicles during the late night and early morning hours. Primary responsibility for this third shift will be to cover the Interstate and limited access highways. Arrange for the third shift to quit at the same time the first shift starts. The third shift should share relevant information regarding roadway conditions and other items of importance with the just starting first shift. Such scheduling of shifts also enables an uninterrupted operation in the event of a storm.

- The Highway Maintenance Managers determine equipment allocations and personnel assignments for all shifts. The goal is to provide 24/7 coverage for identified snow routes if at all possible during an event.

- Supervisory personnel must be provided for all shifts. Mechanics must be assigned to the first and second shifts to provide support during storm events.

- Very often during winter months, construction or other personnel engaged in seasonal activities are assigned to maintenance. Utilize these personnel as acting Assistant Highway Maintenance Managers, Foremen, or Radio Operators. In Counties where the Master or Local Agreement allows, it is possible to extend Interstate coverage to seven days per week by supplementing the regular work force with the extra assigned personnel and by using irregular (non- Monday to Friday) schedules.

4.4.13 DRY RUN

After equipment route assignments have been completed in accordance with equipment allocation guidelines (Section 4.3.1) and snow maps (Section 4.3.5), each Foreman shall ride the assigned route of every piece of snow removal equipment in his or her assigned section with each Operator. To ensure effective dry runs:

- Use the Dry Run Checklist (See PUB 23A Appendix F).

- Conduct dry runs in daylight and where possible dark hours. This practice will assist the Operator in noting items or situations that can be easily overlooked during dark hour's operations.

- Include Temporary Operators in the dry run process.

- Identify all drains, roadside obstructions, depressions, and posted bridges with potential obstructions that may interfere with plowing operations. Mark these objects or obstructions with either flexible delineator posts or center mount delineators mounted on channel posts.

- Discuss contingency plans during the dry run process (see Section 4.4.2, Contingency Planning). Operators should be permitted time to become familiar with additional route assignments to ensure an understanding of the contingency plan and how the plan will be implemented.

4.4.14 VERIFICATION OF WINTER EQUIPMENT - DEPARTMENT AND RENTAL

All truck and spreader combinations, both Department owned and rented, shall be verified every year. Verification is necessary to ensure that the equipment is working as specified and that proper amounts of solid materials, liquid chemicals and/or abrasives are discharged at each setting. This information is then used in conjunction with the guidelines for material application rates to select the proper auger setting for the desired application rate. (See Section 4.5.5, Material Applications and Plowing Procedures.) Important notes on verification are:

- Each District Office has a presentation entitled "Spreader Verification." This presentation shows the exact details on how verification is performed. Personnel performing verification tasks should view the presentation before beginning verification.

- Most Counties will verify with salt since salt is the most expensive deicing material and is the focal point of environmental concerns. However, verification can be done using sand or other abrasive materials if the truck is used on routes where salt is not spread.

- Department personnel shall verify non- municipal rental trucks equipped with spreaders. The rental equipment owners may be paid for the period when these trucks are being verified. Municipalities servicing state roads under lump sum municipal agreements are responsible for verifying their own equipment. Department personnel may assist the municipalities with their verified programs if requested.

- Spinner speeds are to be restricted so that no spinner will spread more than an eight foot width of material when the truck is stationary.

- Maintain verification records in accordance with the SEMP directives.

4.4.15 MAJOR IMPROVEMENTS OF STOCKING AREAS BY DEPARTMENT FORCES

Due to the mild weather during the months of September, October, and November, Department forces have the opportunity to accomplish major improvements to stocking areas (e.g., grading, cutting stockpile access roads).

Improvements such as grading, roadway work, and pad construction require the scheduling of specialty equipment (pavers, dozers) and considerable manpower. Coordinate schedules to prevent interference with ongoing roadway and bridge operations.

Prior to making improvements to any facility, check with the District Facility Administrator to ensure compliance with Labor and Industry guidelines.

When planning or making stockpile improvements, use PUB 284 guidelines.

4.4.16 STORAGE FACILITIES

The following list of material storage facilities includes a brief description of the buildings currently used by the Department.

DOME STORAGE

The Department uses high capacity plywood shingled (or in some cases concrete) dome shaped storage buildings. The building provides complete covered storage and keeps the salt in a dry and free flowing condition. When loading and unloading, keep the material under the building roof to the extent possible to mitigate leaching or runoff that can occur as a result of salt spillage.

Sizes and loading capacities for dome storage buildings are approximately:

Diameter Size	Capacity
60'	1,000 Tons
80'	1,800 Tons
110'	3,500 Tons
116'	5,000 Tons

Take care when reaching these capacities, which are considered as maximum for loading with a truck/front-end loader combination. If possible, trucks delivering salt to dome structures should have shorter dump bodies to increase maneuverability, allowing the truck bed to be raised inside the dome building. NOTE: Upon request, the salt suppliers may be able to arrange for trucks with shorter dump bodies to deliver to the locations that have dome salt storage structures.

When loading the wood dome buildings, salt should never be stored against the panels that comprise the building shell. Wood domes are being phased out and new ones will be constructed.

In accordance with SEMP guidelines, salt residue outside the building must be shoveled and swept into the building.

HIGH ARCH MATERIAL STORAGE BUILDING

The high arch material storage building (formally known as barn type storage) is ideal for sites using less than 1500 tons of salt per year. This building provides complete covered storage and is considered superior to

older bay type storage buildings. Material should be stored so as not to exceed fill limit markings, nor spill out past the building entrance. Reference Stockpile Environmental QA, Publication 23, Chapter 12 for further storage guidance.

The building must be placed on a bituminous pad. The Department is usually responsible for the construction of the bituminous pad. A private contractor selected through a competitive bid process constructs the building.

BAY STORAGE BINS

Bay storage bins are best suited for sites using less than 1500 tons of salt per year. Bins generally have a storage capacity of approximately 75 tons per bin. Depending on the amount of salt to be stored, multiple bins can be constructed.

General dimensions of these buildings are 20' x 30' per bin with a vertical clearance of about 15 feet. Because of this relatively low vertical clearance, all salt must be dumped in front of the building and carried in by a front-end loader.

The front of this building is open, and when the building is full, the salt is partially exposed. Therefore, follow these environmental protection guidelines to guard against leaching and runoff:

- Extend the bituminous pad on which the building is placed for a distance of 20 feet past the front of the building.
- Do not overload the building so that salt spills out past the front of the building.
- When fully loaded, cover the front of the salt pile with tarpaulins.
- Keep the immediate area around the building clean of salt spillage that will normally occur when loading the building with trucks. This is especially important for the pad surface in front of the building.

CRIB STORAGE

Until permanent roofed storage is constructed, crib-type storage is acceptable for stockpiles using under 1,000 tons of salt per year.

Very often, it is possible to construct this type of storage using salvaged lumber and metal. The dimensions can be adjusted to store from 200 to 1,000 tons of salt.

Because crib storage is not roofed, follow these environmental protection guidelines to guard against leaching and runoff:

- Extend the bituminous pad a minimum of 20 feet past the front on the crib.
- Do not overload the crib.
- Cover the salt with tarpaulins at all times.
- Keep the immediate area clean of spillage that occurs when loading the crib or trucks.

4.4.17 WINTER MATERIAL STORAGE AND ENVIRONMENTAL CONSIDERATIONS

When storing winter materials as described below, ensure all SEMP and Stockpile Quality Assurance guidelines are followed.

NOTE: *Recycling waste must be in accordance with SEMP guidelines.*

ANTI-SKID MATERIAL

Anti-skid material by itself can be stored in any accessible area of the storage site. Segregate anti-skid material from other materials, keep it in manageable quantities, and store it in a location that gets maximum exposure to the sun to help guard against freezing.

For safety reasons, form the anti-skid piles with no overhangs or irregular shapes.

TREATED WINTER MATERIALS

Treat stockpiles of anti-skid material with either bagged calcium chloride or salt to help prevent freezing. The Highway Maintenance Manager makes the decision to treat or not to treat anti-skid materials with calcium chloride or salt.

When treating with bagged calcium chloride, the recommended rate is 60 pounds of calcium chloride per ton of anti-skid material. When treating with salt, the recommended ratio is one ton of salt for each ten tons of anti-skid material.

Depending on the climate, the amount and type of anti-skid stockpiled, and the percentage of moisture content, the recommended quantities of calcium chloride or salt may need adjustment. Some counties located in the southern section of the state go through winter with little or no treatment of anti-skid stockpiles while some other higher elevation northern tier counties may have to increase the suggested quantities.

Another method of protecting anti-skid piles from freezing is to cap the pile with calcium chloride. When capping the pile, cover the outer surface of the stockpile with a 2-pound application of calcium chloride per square yard of surface area. The calcium chloride hardens and forms a cocoon type protection for the anti-skid material. This method of capping the anti-skid pile can be used by itself in mild climates. In extremely cold climates, this method may be used in conjunction with calcium chloride or salt treatment as described above.

If anti-skid is treated by any method, protect the environment by controlling leaching and runoff from the chemicals used. All mixed material shall be handled in the same manner as salt, following SEMP guidelines.

SALT

Salt deliveries start in the fall and all initial fill requirements should be received by November 1st. Thereafter, as the salt is used, deliveries continue throughout the winter to replenish supplies.

During the initial stocking and the following deliveries, take special care to minimize adverse environmental effects by loading and piling all salt in the approved manner and keeping salt storage locations neat and orderly.

Salt may not be delivered to any location that is not properly prepared in accordance with the Department's most recent policy and quality assurance requirements for salt storage areas.

SOLID SALT AND CALCIUM CHLORIDE

The Highway Maintenance Manager may decide to use premixed salt and calcium chloride on the Interstate system and certain other high priority roads.

The addition of calcium chloride to salt attracts moisture from the air, which enables the mixture to melt ice and snow when temperatures drop below 20°F. While the property of pulling moisture from the air is beneficial in melting ice and snow, it also causes the mixture to harden when stored at stockpile sites. Because of this, the premixed material should be stored in either a dome building or a roofed storage bin. When placed in a storage bin, the exposed outer surface of the material must be covered with tarpaulins.

BAG STORAGE OF CALCIUM CHLORIDE

Bagged calcium chloride is to be stored on pallets and, whenever possible, stored in a dry, well-ventilated building.

Bagged calcium chloride is to be used in the same order that it is received.

LIQUID DEICING CHEMICALS

Liquid deicing chemicals require a storage vessel made of a non-corrosive material such as polyethylene. Depending on the type of chemical solution, periodic agitation or circulation may be required. The storage vessel should be thoroughly flushed with water whenever the type of chemical being stored is changed.

4.4.18 SAMPLING OF MATERIAL

All materials shall be tested for conformance to contract specifications. Current contract information is available from the Department of General Services website (http://www.dgs. state.pa.us/)

LIQUID DEICING CHEMICALS

Liquid deicing chemicals must contain the specified chemical concentration level. The liquid deicing chemicals contract requires the vendor to test two (2) one-quart representative samples prior to placing the material in the storage tanks. The chemical concentration of the product can be determined by testing the specific gravity of the material using a hydrometer and then comparing the result to a corresponding value on a chart supplied by the vendor. The liquid material stored in the vessel must be clearly marked on the outside of the vessel as per SEMP and/or Model Stockpile policy.

SOLID SALT

Sodium chloride should be visually inspected at the time of delivery. It is recommended that random samples be taken during initial fill, deliveries following heavy rains, and when it is obvious that the salt does not meet specification. This will inform both PennDOT and the vendor whether the product is meeting our specification.

When a truck arrives:

Have the truck dump the load. Take a sample, if possible with delivery driver present. Two (2) one quart samples that represent a cross section of the delivered material should be forward to the PennDOT laboratory.

ANTI-SKID MATERIAL

Anti-skid should be visually inspected at the time of delivery. Obtain samples and follow the current contract testing requirements.

4.4.19 SNOW FENCE

It shall be Department policy to mitigate snowdrifting conditions on traveled portion(s) of the highway by those means deemed appropriate by the District Executive.

The use of snow fence and /or natural plantings (live snow fence) are accepted methods used to curtail drifting.

ENTERING PRIVATE PROPERTY

Section 414, State Highway Act 1945 PL 1242 supports the Commonwealth's right to enter private property for purposes of placing snow fences where deemed necessary by the District Executive to minimize snow drifting on the traveled portion of the highway.

The Highway Maintenance Manager is responsible for obtaining authorization to enter private property and/or providing notification to the property owner.

The process for entering private property is:

- Make personal contact with the property owner to explain the problem and the necessary corrective action.

- Request that the property owner sign an Authorization to Enter Form (RW-397A) which assists in protecting the Department. This form can be found in the County or District office. Refusal of the property owner to sign the form does not prevent the Department from taking corrective action. Should the property owner refuse to allow the Department to enter the property to correct a problem, a certified letter detailing the nature of the problem, corrective action planned and the date for the work to commence shall be sent to the owner.

Caution should be exercised on private property to prevent damage to any trees, shrubs, etc., when placing or removing snow fence. The property should be left in a clean, undamaged condition.

SNOW FENCE INSTALLATION/REMOVAL/STORAGE

The Department's representative shall lay out and mark the area where the snow fence is to be installed. The Highway Maintenance Foreman should contact PA 1-CALL to identify utilities. Snow fence(s) should not be placed more than 100 feet from the right of way.

Install and remove snow fence in accordance with the following schedule:

- Install after November 1st and remove by April 15th. The Highway Maintenance Manager can opt to leave the snow fence up year round when installed on Department owned R/W.
- Extensions beyond April 15th can be granted with written permission of the property owner(s).
- Snow fence shall be stored at the stockpile.

NATURAL PLANTING(S) - LIVE SNOW FENCE

The use of natural plantings along roadsides (live snow fence) is an accepted method to mitigate snow drifting. Possible strategies are to:

- Solicit cooperation from local municipalities to require land owners/developers to include plantings in their buffer zone plans to curtail drifting
- Request farmers to leave corn stalks standing where the land adjoins a state highway
- Plant non-spreading grasses or shrubs in locations that are prone to drifting. Refer to the District Roadside Coordinator for plant species recommendation and plant pattern and location.

4.4.20 SAFETY FOR ROAD USERS AND CREWS

CREW SAFETY

All employees have a responsibility to themselves for their own safety. By observing that responsibility, they fulfill the responsibility to their family, fellow workers, the community and the state of Pennsylvania. Therefore, they must observe safe practice rules and follow instructions relating to the efficient performance of their job. No job is so important or service so urgent, that time cannot be taken to perform the work in a safe manner. It is impossible to establish safety information, which applies to every situation. There is no substitute for using sound judgment and good common sense.

Drivers should be aware of the following:

- Seat belt usage is a requirement
- Practice defensive driving
- Work in a safe, productive manner and maintain safety awareness at all times
- Properly inspect, maintain and operate assigned vehicles/equipment and report defects
- Handle snow and ice chemicals by the guidelines set up in the MSDS book that should be available at all unit buildings
- Increase the visibility of the lights by cleaning off salt residue and crusted snow and ice regularly
- When stopping at intersections, be sure the plow doesn’t extend into the intersection. Begin slowing a distance back from the sign/signal because a loaded plow truck will not stop as easily as an unloaded one.

- Report accidents and injuries immediately
- Complete safety forms as required

Being prepared for the long hours of work is also essential. Get adequate rest prior to the onset of a storm. Dress in layers to be comfortable in the truck and outside as the need arises. Safety items required include: accident forms - a charged fire extinguisher - reflective triangles or flares - first aid kit – flash light- safety vest and flags. Keep a list of radio numbers handy along with the phone numbers of surrounding Units and County Offices. New drivers are encouraged to talk to experienced drivers for helpful hints. Drivers also need to be aware of speed control, stopping distances and turning radius requirements.

PUBLIC SAFETY

The safety of the motoring public is a primary consideration of everyone at PennDOT. The snowplow driver needs to constantly be on guard for unsafe acts of the public. Things that will help are:

- Being aware of and obeying all traffic laws and avoid making sudden or unannounced moves.
- Avoid pushing snow off of overpasses and into other lanes of traffic.
- Remove snow from Non-Separated Bike Lanes on State Routes.
- Avoid pushing snow onto sidewalks and into storefronts.
- Try to avoid throwing materials onto vehicles or pedestrians.

SUMMARY

Winter work at times can be stressful both mentally and physically. The hours are long and conditions grueling. Drivers are out there in the worst weather possible. Drivers have to be concerned with plowing the snow, putting down material, making sure the trucks are operating properly and the actions of the public. Employees can do the job in the safest way possible, but the inattentiveness of another driver can change a day from routine to a nightmare in seconds. Any of these are stressful, but combined with long hours of driving they can seem overwhelming. Take breaks – Get out of the truck and stretch – Good nutrition is essential – Wear clothes in layers – Make sure the truck is equipped with the proper safety items – Get plenty of rest.

4.5 WINTER ACTIVITIES DURING DECEMBER, JANUARY, FEBRUARY AND MARCH

Effective winter operations build on a strong foundation of year-round preparations. Fundamental resources, including people, equipment, and materials, must be in place and ready to deploy before the first snowfall of the season. Efficient deployment of resources requires advance planning, including scheduling personnel, allocating Department and rental equipment, and arranging timely deliveries of materials. Good working relationships with external partners must be established before winter begins, including other government agencies, municipalities, law enforcement agencies, emergency responders, school districts, and vendors. Sections 4.2, 4.3, and 4.4 address these topics.

A winter storm is a dynamic event that unfolds over hours and days. Changing conditions during a storm require continual monitoring. Information about ongoing operations, including roadway, traffic, and weather conditions, must be shared within the Department and with external partners. Timely communications provide the situational awareness that enables adjustments to snow fighting tactics as needed to achieve the Department's Levels of Service goals, including implementing contingency plans when conditions warrant.

This section describes how careful planning and the right resources properly deployed produce a successful ice and snow control program. Topics addressed include:

- Objectives of winter operations and definitions of key terms and concepts.
- Priorities of routes.

- Levels of Service.
- Materials applications (salt, anti-skid, anti-icing).
- Plowing and spreading procedures.

4.5.1 OBJECTIVES AND DEFINITIONS

The primary maintenance objective during the winter months is to keep all state roads in a safe and passable condition. Operations will proceed according to priorities of routes as quickly and efficiently as possible, but within the limitations imposed by weather conditions, availability of resources, environmental concerns, and employee safety requirements.

The Department will make every effort to achieve its stated Levels of Service goals. However, natural emergencies (e.g., regional or statewide blizzard, flood or extremely low temperatures, ice storm causing downed power lines/trees, major bridge closing due to ice jam) and unforeseen situations (e.g., salt shortages, diesel fuel supply/quality issues, homeland security events, crashes) may preclude the Department from fully achieving all Levels of Service goals. Department Managers and Supervisors should use their judgment based on experience and training in conducting proactive and/or remedial work to overcome roadway snow and ice hazards. As each storm is unique and varies as to intensity, precipitation type, duration and track, it is important to emphasize that these are guidelines to assist Department staff in making sound, consistent, informed and practical decisions in the exercise of their respective snow and ice control duties and responsibilities

Recognizing that there are limits to materials, equipment, and manpower available to address each winter event, the Department addresses roads in priority order. Higher priority routes take precedence. When conditions warrant, contingency plans established in advance should guide temporary diversion of resources from lower to higher priority routes to maintain Levels of Service for those higher priority routes.

These guidelines apply to PennDOT forces and to municipal winter service agreement providers and contractors who act on behalf of and are remunerated by the Department.

Here are definitions of some key terms and concepts:

Levels of Service are the amounts and types of resources (materials, equipment, and personnel) and work processes applied to highways to achieve the stated goals.

Safe passable roadways are free of as much ice and snow pack as is practical and can be traveled safely by motorists at reasonable speeds.

*(**NOTE:** A safe passable roadway must not be confused with "dry pavement," "bare/wet pavement," or "wet" pavement, which is essentially free of all snow, sleet, and ice from shoulder to shoulder. It is not realistic to provide bare pavements on highways during winter storm events and the Department does not have a policy to provide them.)*

Reasonable speed is the speed at which a vehicle can travel without losing traction. During and immediately after a winter storm event, a reasonable speed will most likely be lower than the posted speed limit. Motorists should expect some inconvenience and should modify their driving practices to suit road conditions.

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 intersection view clearing is performed following cessation of the storm as necessary, and generally during daylight hours when best visibility prevails.

For snowstorms 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 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 residue.

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 spreading of anti-skid 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 Pennsylvania but average major snow storms are approximately one inch per hour. This one-inch per hour intensity rate and the allowable snow accumulation is used in planning the availability of equipment necessary for snow removal operations.

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 may be 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. Heavy rain tends to wash off applied salt or anti-skid, making it difficult to keep the pavement ice-free.

The operating speed of the plow truck is directly related to efficiency and effectiveness.

Operators should maintain a speed that does not endanger life or property, but provides a reasonably prompt service. Excessive plowing speeds can result in damage to the roadway, damage to the plow, poor performance and a rough road. With excessive speed, wet snow can damage objects such as mailboxes and signs.

Plowing speeds shall be determined by actual roadway conditions and in no case exceed 45 mph. The plowing speed on urban streets should never exceed the posted speed limit and generally should not exceed 25 mph.

Snowplows are NOT emergency vehicles. There are special considerations relative to loads carried and services rendered. Statutes and Department policy do not allow snowplows to disobey traffic laws or regulations.

Operators should follow these guidelines:

- Operators are not to operate vehicles and equipment at speeds that are unsafe for conditions.
- Snow removal equipment shall not be operated against opposing traffic unless the road is closed with appropriate traffic control.
- When plowing on a two-lane road, plows start at the center of the roadway and plow to the right.
- Each Section shall have a Winter Operation Snow Removal Plan that defines specific plowing methods and priorities based on resource availability and storm conditions.
- When plowing on four-lane roadways, plowing units should be operated in tandem whenever possible.
- When plowing four lane roadways without medians several plowing techniques may be used, depending upon conditions. For heavy snow conditions, trucks should operate close together, plowing from the median barrier to the right.
- Lighter conditions may allow for greater truck spacing to allow overtaking vehicles to pass. When plows are not available to work in tandem, priority should be given to the driving lanes.
- On divided highways, with medians wide enough to use for snow storage the recommended practice is to plow the passing lane to the left after the driving lane has been plowed to the right.
- When plowing where there is a curb, gutter and sidewalk, plowing to the right is performed carefully so that snow is not stacked on the sidewalk.
- When plowing on bridges and overpasses, decrease speed so snow or ice is not pushed over the side of the structure onto traffic, pedestrians or waterways below.

- Plow and wing combinations should only to be used if the combination does not encroach into on-coming traffic.

- Benching wings are commonly used as plow extensions and to move accumulated snow farther from the roadway to enhance snow storage.

- Operators should be aware of white out conditions caused by snow plowing and should adjust operations to the extent practical to reduce the hazard.

- Traffic control may be required when using snow-blowing equipment.

- Extreme care and caution is required at turn around sites and median crossings.

SPREADING OPERATIONS

- Each spreading unit is verified 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 a four lane undivided roadway 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 of roadway is achieved by spreading simultaneously upon the two lanes during the singular directional pass of the spreading unit.

- **Play the wind in spreading.** A strong wind blowing across a street or highway can cause salt to drift as it comes out of the spreader, pushing it onto the shoulder or into a gutter. This is particularly true in rural areas where there are few windbreaks. How the wind affects spreading depends on both wind velocity and pavement condition. Spreader operators should play the wind to put salt where it will do the most good.

- Because of the much greater control inherent to the spray process, anti-icing is best applied with full-width stream nozzle systems to maintain a small width of bare pavement to reduce slipperiness. A fan spray is not recommended and care must be exercised during windy conditions.

- **Give salt time to work.** Time plowing operations to allow maximum melting by salt. When you plow salt off the pavement, you waste the deicing material and increase the cost of snow removal.

- **Know when to plow and reapply salt.** The need for another salt application can be determined by watching melting snow kicked out behind vehicle tires. If the slush is soft and fans out like water, the salt is still working. Once the slush begins to stiffen and is thrown directly to the rear of vehicle tires, it is time to plow and spread more salt.

- Has the weather changed? Remember that salt application rates may have to be increased at night, on sunless days and when the temperature drops sharply. Without the sun, the effect of solar radiation and warmth is lost. At night, traffic usually diminishes, minimizing another heat source that helps melt ice and snow. It is important to remember that pavement temperatures are seldom the same as air temperatures — a critical thought when choosing the options for snow and ice control — it is the pavement that will be treated.

- **Don't overlook salt's anti-skid value.** For years, maintenance people have observed that salt, applied as a deicer, also gives anti-skid protection. Tests conducted in cooperation with the National Safety Council show that salt, applied at normal deicing rates, gives as much anti-skid protection as abrasives. The anti-skid effect of salt is immediate as it starts melting snow or ice.

- **Safeguard the environment.** The way salt is spread can make the difference between whether the public appreciates or condemns snowfighters' efforts. Overuse and misuse ignore concern for the environment. Proper verification of spreading equipment and good storage can avoid most problems.

There is no correlation between yearly snowfall and the total quantity of salt used. The type of storm dictates frequency of application and total amount of salt necessary. A freezing rain or ice storm may require substantial amounts of salt and/or anti-skid, perhaps even more than a prolonged snowstorm.

ROADWAY CONDITION DESCRIPTIONS

PennDOT defines six winter roadway conditions. These definitions support effective communications within PennDOT and with external partners and the motoring public. See PUB 23A Appendix D for photos and descriptions of roadway conditions.

4.5.2 PRIORITIES OF ROUTES

To prioritize levels of service, PennDOT has three categories for roadways as follows:

First priority routes include all interstate and limited access highways and ramps designated as MFC-A or MFC-B in accordance with Federal MFC Classification criteria, or classified as an Interstate under the Business Plan Network (BPN) classification. All interstate and limited access highways have preference in equipment assignments and service excluding detour routes, emergency requests by the State Police or PEMA.

Second priority routes are classified as MFC-C, or NHS Non-Interstate or Non-NHS >2000 ADT by BPN. Selected second priority highways may be designated to receive first priority service with the approval of the District Executive.

Third priority routes are classified as MFC-D and MFC-E, or Non-NHS <2000 ADT by BPN. Local conditions may qualify selected third priority routes, excluding MFC-E routes, to receive second priority service with the approval of the Highway Maintenance Manager.

> ***NOTE:*** *By November 1st, each District and County should have designated priorities for all routes; priority designations guide winter services.*

4.5.3 LEVELS OF SERVICE

The following information provides guidelines for levels of service:

FIRST PRIORITY ROUTES

PLOWING OPERATION

Plow trains are a recommended plowing method for use on first priority routes and should be spaced close enough to prevent vehicles from disrupting the plowing pattern. Plow train trucks should be positioned as shown in the drawings located in PUB 23A Appendix G. The last truck is responsible for material applications if a plow/ spread operation is in order.

SPREADING OPERATION

First priority routes may be treated with straight salt, salt mixed with a salt brine or salt/anti-skid mixture at lower temperatures.

Local management decides when to use straight salt, salt/chemical, or a salt/anti-skid mix; however, there are application rate guidelines for first and second priority routes in PUB 23A Appendix H. Factors such as weather forecasts, road conditions, material availability and time may justify deviations from these guidelines.

When road surface temperatures are below 15°F, the ability of chemicals to react and the effectiveness of individual or combinations of deicing materials are difficult to predict. Here are some possible combinations to apply:

- A straight salt application may be effective with heavy traffic, sunlight and calm air.
- If available, a premixed combination of 5 parts salt to 1 part calcium chloride may prove effective, or a liquid chemical deicer may be mixed with salt by field personnel.
- Mixtures of anti-skid material and salt ranging from 1, 2 or 3 parts salt and 1 part of anti- skid can be used at low temperatures, with the mix shifting more heavily to anti-skid as the temperature drops. Salt/anti-skid mixes provide traction until salt reaction takes place. Under certain conditions, the granular nature of salt may provide traction until melting action takes place.
- Ultimately, field personnel must decide the final selection of deicing materials or a combination of materials based on availability and experience.

First priority routes shall be maintained in an operable condition (Condition 3 or better) with a minimum of two traffic lanes passable in each direction after the cessation of significant snowfall/freezing rain.

The planned schedule to service the interstate system shall be based on an average interval of two hours to manage a moderate snowstorm. Plowing and spreading should continue until traffic lanes are mostly free of snow and ice full width and shoulder area plowed as soon as practical after a storm has ended. To maintain these Levels of Service, resources may be temporarily diverted from lower priority routes.

Service to non-interstate limited access highways is secondary to the interstate system. Depending on local conditions, longer service intervals (cycle times) may be warranted as resources are temporarily diverted to maintain Levels of Service to the interstate system.

Traffic lanes of first priority routes should be cleared of ice and snow (Condition 2 or better) as soon as practical after the storm has ceased. Shoulders should also be plowed as soon as practical after the storm has ceased.

SECOND PRIORITY ROUTES

PLOWING OPERATION

Plowing operations should be scheduled to give priority to routes heading into major work areas in the morning and outbound routes in the afternoon hours.

Second priority routes are typically commercially bordered and accommodate volumes of concentrated traffic during a short duration followed by a steady flow during the daylight hours with noticeable reduction after dusk.

Service should be adjusted according to time of day and day of the week as appropriate. For example, major efforts should be directed toward peak travel time for commuters, commerce and school buses.

The service goal for second priority routes is to maintain the driving lanes reasonably clear of ice and snow (Condition 4 or better) during daylight and peak travel times. During off-peak periods, snow accumulation up to 4" may be acceptable. When conditions warrant, resources may be temporarily diverted to second priority routes from other routes to achieve these goals.

SPREADING OPERATION

Salt or salt/anti-skid mix may be used on second priority routes to accommodate high volume traffic as conditions warrant (salt/anti-skid mixture is recommended).

First & Second Priority Routes Anti-Skid/Salt Mix Application Rate Guidelines

	100% Salt lb/SLM		25/75 lb SLM		50/50 lb SLM		75/25 lb SLM	
Surface Temp.	**Dry**	**Pre wet**	**Dry**	**Pre wet**	**Dry**	**Pre wet**	**Dry**	**Pre wet**
Above 25	120	100	140*	120*	170*	150*	200*	180*
15-25	210	170	230	180	250	200	310	270
10-14	**	**	250	200	300	250	350	300
Below 10	**	**	**	**	**	**	**	**

This chart is general statewide guidance and per snow lane mile. If treating down the center of a highway, application rates should be doubled. Consider lowering rates on subsequent passes. Detailed federal guidance by type of event is located in PUB 23A Appendix H. Local decision on type of roadway and ice and snow conditions will dictate application rate decisions.

*Consideration should be made not to use antiskid mixes for events with temperatures 25 degrees and rising.

**Straight salt not recommended below 14 degrees.

THIRD PRIORITY ROUTES

PLOWING OPERATION

Plowing is the primary method for clearing snow and ice from third priority routes.

SPREADING OPERATION

Because plowing is the primary method for clearing snow and ice from third priority routes, continuous material applications over the entire roadway length are generally not necessary or advisable. Spreading materials should be confined to critical areas such as long or steep hills, sharp curves, or other hazardous locations. It is important to spread critical areas as soon as noticeable snowfall (1/2" to 1") has accumulated in order to enhance traction. Anti-skid/salt mix should be used on these parts of third priority routes; straight salt should not be used.

The following application rate guidelines are recommended for third priority routes. Deviation from these guidelines may be justified by factors such as weather forecasts, road conditions, material availability or time. The Highway Maintenance Manager must pre-approve application rates that exceed the recommended application rate.

Third Priority Route Application Rate Guidelines

Anti-Skid/Salt Mix (AS) (S)	75/25 AS/S Mix	50/50 AS/S Mix
lbs per Snow Lane Mile	270 lbs.	200 lbs.
Surface temperature below 10°F: recommend straight anti-skid applications. It is permissible to add a small amount of salt to anti-skid to keep the material from freezing.		
These application rates are based on a single Snow Lane Mile application.		

Third priority routes typically carry moderate to minimal traffic.

The service goal for third priority routes is to maintain a passable condition (Condition 5 or better), primarily by plowing. Materials may be applied to bridge decks, hills, curves and intersections when conditions warrant. A hard packed surface, or up to 5" of snow accumulation, may be acceptable on third priority routes. Severe snowstorms, high wind conditions, or diverted resources may result in temporary closures. Road closures are not to extend beyond 24 hours.

Third priority routes accommodating school buses should be scheduled for additional servicing as required.

ROUTES WITH NO WINTER MAINTENANCE

Routes and segments designated to receive no winter maintenance throughout winter are to have signage installed as necessary. See Publication 236 "Handbook of Approved Signs" for guidance on properly installing signage in such cases.

4.5.4 STORM WARNING/CALL-OUT PROCEDURES

The Highway Maintenance Manager shall establish storm-warning call out procedures to activate the maintenance organization when adverse weather is imminent. These procedures will specify a method of notifying the Highway Maintenance Manager or a designated assistant, with authorization to call out Operators and rented equipment immediately.

Appropriate documentation should be entered in the radio log. See Section 4.4.10, Radio Operation, for specific duties. Weather forecasts from the contracted Department or District forecast service and those broadcasted by the media are potential storm warning sources, as well as communications from adjoining counties, districts, and states.

4.5.5 MATERIAL APPLICATIONS, PLOWING PROCEDURES AND OTHER WINTER ACTIVITIES

PRE-WETTING SALT

There are several advantages to pre-wetting salt:

- Reduced loss of salt from bounce and scatter
- Quicker melting
- Better salt penetration into ice and snow pack
- Melts at a lower temperature if wetted with other deicing chemicals
- Salt can be spread more uniformly with less waste on shoulders and in ditches because wetted salt sticks to the pavement
- The amount of dry materials used can be cut by 20-30% because of the dual action of added brine and more materials remain on roadway
- Works faster because more brine is present
- Driving/spreading speeds can be increased because salt stays on the roadway

Any deicing chemical can be used for pre-wetting. Liquid salt, calcium chloride, magnesium chloride, or blends are commonly used. Chemicals with lower eutectic temperatures (lowest temperature at which it can still cause melting) help extend salt effectiveness on lower temperature pavements. The melting effectiveness of both dry and pre-wet salt decreases as road temperatures drop; below 10° F, there is almost no melting benefit from straight salt.

Salt is usually pre-wetted with 6-12 gallons of liquid per ton of salt. Pre-wetting can be done in the stockpile; as spreader trucks are loaded; or by spraying the salt as it is spread on the road. Pre-wetting at the shop requires less equipment but reduces flexibility of use. Pre-wetting on board the truck allows better coverage and treatment as needed. On-board pre-wetting at the auger shows better coverage than spray at the spinner however, both methods are acceptable.

Savings are possible if operators reduce application rates when spreading pre-wetted salt to take advantage of its faster action and lower salt loss. Field research has documented equal or improved performance of 20% less pre-wetted salt compared to dry salt.

PRE-WETTING ANTI-SKID

Pre-wetting anti-skid may be used to reduce wasted material. Pre-wetting at rates of 10-30 gallons of liquid chemical per ton of anti-skid abrasives has proven effective.

ANTI-ICING

Anti-icing is a proactive snow and ice control strategy. A small amount of liquid chemical is applied to pavements and bridge decks before a storm to prevent snow and ice from bonding with the surface. By contrast, deicing is the application of chemical during or after a storm to break the ice/pavement bond so plows can clear the road.

Anti-icing is commonly used on pavements where the practice is to provide a high level of service. It has proven very effective at preventing bridge deck and pavement frost. Specialized equipment is needed to apply small amounts of liquid chemicals. Detailed weather predictions are also helpful.

BENEFITS OF ANTI-ICING

An anti-icing strategy can produce significant benefits:

- Better pavement conditions (improved friction) can be achieved, reducing the number of crashes. (One study in Idaho reported 83% fewer crashes)
- Less chemical is required to prevent ice bonding than to remove ice after it has bonded to the pavement.
- Anti-icing applications are reported to last for several days, particularly in preventing frost on bridge decks.
- Clean-up after a storm may be easier with less ice bonded to pavement.
- Application can be made during regular working hours, reducing some overtime costs.
- 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 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 use of less deicer and manpower, therefore lowering the cost of maintaining safe road conditions. The use of less deicing materials also minimizes environmental concerns.

GUIDELINES FOR ANTI-ICING

Refer to the anti-icing tree for developing an anti-icing strategy prior to an event. All levels of networks of highways may be considered for anti-icing based on local need or at the county manager's discretion. The following guidelines have been established for proper execution of anti-icing:

WHEN TO ANTI-ICE

- Anti-icing **should** be the first in a series of strategies considered for each winter storm.
- Anti-icing should be conducted prior to forecasted frost, freezing fog, or black ice events on bridge decks and pavement trouble spots as a minimum, assuming conditions in this guideline for anti-icing are met. Other areas (hills, curves, shaded areas, ramps, or intersections) may be treated as determined by the county, on an as-needed basis.
- Treatment for frost or black ice incidents can be made on a regular schedule; twice per week during the typical frost season (beginning and end of the winter months), or in accordance with weather forecast information. Applications in anticipation of a possible frost incident or snow event on a Saturday or Sunday may be made on the preceding Friday.
- Anti-icing should be done during normal, low traffic volume, non-overtime work hours. In the case of a county with normal overnight working hours, anti-icing can be done at night or other off peak traffic times. In counties where split shifts are not used, anti-icing should be done so as to minimize disruption to the traveling public. Applications should normally be made 12-18 hours prior to a predicted frost or snow event depending on the material used. Some anti-icing agents will last longer than others.
- When traffic volumes are high, use of a following vehicle for traffic control may be necessary. Due to high traffic volumes, additional application may be required if the anti-icing agent residue is worn off the bridge deck or pavement surface.
- It is desirable to have completed anti-icing operations on first priority and high-ADT routes two hours prior to the onset of an event, or at least prior to snow and ice bonding on the road surface.
- Anti-icing may also be conducted prior to predicted light sleet and light (less than 0.5"/hr) or moderate (0.5"-1.0"/hr) snow events. If precipitation persists, additional anti-icing applications may be necessary to prevent refreeze due to dilution of the chemical or switching to deicing applications may be necessary.
- Anti-icing should be conducted when the pavement temperature is at or above 15° F or the pavement temperatures are forecast to rise or stay above 15° F.
- Liquid agents are the preferred material for anti-icing treatments. Although applying pre-wetted salt prior to an event can technically be considered anti-icing, liquid agents work more effectively than solids and there is also less waste with liquid applications.
- Counties may coordinate their anti-icing strategies with each other to maintain consistency when crossing county or district boundaries. BOMO personnel may also be consulted for support in these cases.

WHEN NOT TO ANTI-ICE

Liquid anti-icing should not be conducted:

- Prior to forecast of rain turning to frozen precipitation.
- When winds are more than 15 MPH
- When the anti-icing agents have the potential of causing snow to stick to the roadway under blowing and/or drifting snow conditions

- When the pavement temperature is below 15° F or forecast to fall below 15° F

PRECAUTIONS

Verification - Liquid anti-icing application equipment application accuracy should be verified at the beginning of every winter season. Application equipment that has been transferred to another truck, modified, or repaired should also be verified. Equipment should be monitored during use and adjusted and rechecked when performance appears questionable.

Anti-Icing Application Guidelines	
Liquid Chemicals	NaCL (Salt) 23.3%
Relative Humidity	Any Snow Event
Surface Temperature 25º and Above	45 Gallons per Snow Lane Mile
Surface Temperature 15º-24º	64 Gallons per Snow Lane Mile
Surface Temperature 14º and Below	Pre-treatment at lower temperatures could lead to trapping the first snow on the roadway surface and is not recommended.

Persistence - If not diluted by rain or snow, residues of liquid anti-icing agents can remain on the surface for up to four days after application. When rain, snow, or moisture in the air dilutes the residual anti-icing agent on the surface, refreezing can occur. Reapplication may be needed.

Slipperiness - Reduce application rates after dry spells, especially when pavement temperatures are warm (45°-50° F), when humidity is 45%-55%. Bridge decks and pavement surfaces where residues of oil products and/or rubber have built up may become slick when sprayed with an anti-icing liquid.

Sodium Chloride – The use of sodium chloride (common salt) combined with snow plowing is the most effective, most economical and safest snow and ice control method currently available. Salt is most effective for melting purposes at temperatures above 20 degrees F., with reduced melting ability as the temperature drops. In general, the purpose of salt is to (1) reduce adherence of snow to the pavement, (2) keep the snow in a "mealy" condition and thereby permit nearly full removal by plowing, and (3) prevent the formation of ice or snow ice (hard pack). Salt is not intended to take the place of snowplows. It is economically and environmentally unacceptable to attempt to melt snow accumulations that are plowable.

Calcium Chloride - Calcium chloride is a chemical which melts ice at lower temperatures than sodium chloride. Flake calcium chloride is used as an additive to abrasives (anti-skid) to prevent freezing in stockpiles, to thaw culverts and catch basins, to help hold the abrasive in place on the pavement and on rare occasions to trigger sodium chloride action. Liquid calcium chloride at 32% strength can be used to pre-wet solid sodium chloride to trigger the chemical reaction at low temperatures. The addition of liquid calcium chloride also is beneficial in retaining de-icing material on the roadway by increasing the adhesion of the material to the roadway.

Abrasives - Abrasives (fine mineral aggregates) are used primarily for immediate traction on hills, curves, intersections, railroad crossings and other areas and to minimize the use of salt. This does not include sand or fly ash, which is a common misconception. Sodium chloride, calcium chloride or an appropriate mixture of the two are usually added to abrasives in amounts dependent upon existing weather conditions. Stockpiles of abrasives are usually treated with chloride at the start of the season to prevent subsequent freezing.

ALTERNATIVE DE-ICERS

There is considerable research being done on new roadway deicing chemicals. Non-corrosive and environmentally friendly chemicals, in solid or liquid form, are now available but widespread use is currently limited due to the high costs and the need for specialized equipment to store & dispense them. PennDOT has and will continue to experiment with new products as they come on the market in an effort to provide an affordable and acceptable level of service while being environmentally responsible. There is considerable

research throughout the world going on in this area and PennDOT has been an active participant in some of this research.

APPLICATION OF DE-ICING MATERIALS

The use of chemicals, abrasives or chemical-abrasive mixtures is dependent not only on present roadway and weather conditions, but also on anticipated changes in these conditions and fiscal or logistical constraints experienced by PennDOT. The effects of peak traffic periods, approaching nightfall or daybreak, precipitation type, and predicted end of storm, are considered and evaluated prior to selecting the proper materials and rate of application.

Adverse roadway conditions existing during periods of low temperatures, which are predicted to rise, would generally be treated in accordance with the recommendations for the higher temperature. If the time of day, trend and weather forecast is such that a drop in temperature may reasonably be expected, treatment would generally be in accordance with the recommendation for the lower temperature. Chemicals or abrasives should not be used at low temperatures if the pavement is dry and snow is blowing off the pavement as such use would be wasteful and may be counterproductive.

Note: *Chemical deicing materials are not recommended for use on dirt and gravel roads.*

RATES OF APPLICATION

Generally, sodium chloride is the chemical of choice for most storm situations. Sodium chloride is used to prevent snow pack and ice build-up on the pavement and to aid removal of any build-up that occurs. Instructional guidelines are recommended to adequately maintain highways under most conditions and can be found in PUB 23A Appendix H.

Chemicals or mixes are 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 so that brine develops on the pavement and prevents build-up of packed snow. It takes much less deicing 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.

There are many additional circumstances which will necessitate modification to these treatments. Some of these circumstances are:

1. Rising or falling temperatures.

2. When pavement is cold and dry and snow is falling, chemicals are not applied. Plowing and treatment of icy spots, if they develop, is recommended.

3. An abrasive-chemical mix may be needed at extremely low temperatures or on very lightly traveled highways. Under these conditions the effectiveness of salt is reduced and abrasives may be needed for traction.

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 are required in the use of de-icing chemicals on all bridge decks.

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.

OTHER STORM CONSIDERATIONS

COORDINATING PLOWING AND SPREADING ACTIVITIES

The first activity for most storms is to plow accumulation and spread an ice control chemical to prevent bonding of snow and ice to the pavement. It is important that subsequent passes not occur before this chemical has an opportunity to work; this can be difficult since snow routes may have deadhead over other routes. Although there is nothing wrong with helping a fellow driver by plowing while deadheading over another route, communication is a must to prevent plowing off material before it has had a chance to work. Spreading of material should normally be limited to freshly plowed sections.

HILLS, CURVES, AND INTERSECTIONS

Higher application rates are often used on hills, curves, and intersections due to higher friction requirements. Abrasives may also be used to help facilitate this need during cold temperatures. Special treatments should begin prior to and extend beyond the hill, curve, or intersection to allow the motoring public to safely traverse the area.

BRIDGES AND OTHER STRUCTURES

Bridges and other structures are likely to be colder than the adjacent pavement when there is a rapid decrease in air temperature; cold air flowing both above and below cause this phenomenon. It is necessary to increase the application rate on these structures so that freezing will not occur prior to surrounding pavement. Exercise care when plowing overhead bridges. Do not plow snow down on railroad tracks or highways below.

Ice usually forms and snow accumulates on bridges and overpasses before it does on adjacent road surfaces. Consequently plowing and ice treatment are required on bridges or overpasses before they are required on roadways.

Snow removal at bridges, interchanges and ramps may require loading, hauling and dumping if the deck or roadway becomes restricted. Snow or ice left on bridges can create water and salt damage to the structure, frozen drains, traffic hazards, and bridge deterioration problems as a result of freeze-thaw cycles.

Icicles may form on overpasses, particularly where drains become frozen, and these icicles present a hazard to traffic passing underneath. They may have to be removed and proper warning and traffic control procedures should be followed during this process.

The following approach should be used:

- When there is a light accumulation - spread material to melt the snow.
- Build-up may be left to melt off if the forecast indicates warming weather, and drainage or possible icing will not be an issue.
- Attempt to plow building quantities of snow off the bridge end if it can be done safely with plowing operations.
- Monitor level of build-up relative to the height of the parapet, as the pile nears the top of parapet stay away from potentially disturbing it during plowing operations.
- When weather conditions permit, set up appropriate traffic control and mechanically remove the build-up.

REMOVAL OF SNOW AND ICE – CHEMICAL

The steps in this activity are normally accomplished in the following order:

1. Monitor air temperature at bridges that have snow or other moisture on decks.

2. If air temperature approaches freezing (0°C or 32°F) apply chemical materials to bridge decks.

3. Repeat chemical applications as required until bridges dry out or temperature rises above freezing.

REMOVAL OF SNOW AND ICE - MECHANICAL

The steps in this activity are normally accomplished in the following order.

1. Establish traffic control as required.

2. Using loading equipment, remove the snow and ice from the bridge deck and place it off the bridge or place in dump trucks for removal away from the bridge.

3. If necessary, place chemical materials on any remaining snow and ice material to keep from freezing on the deck.

4. Remove traffic control.

STRONG CROSSWINDS

Spreading may not be appropriate if the wind is too strong, particularly if the precipitation is blowing across the pavement. Additionally spreading in this condition could cause precipitation to adhere to the road surface.

SUPER-ELEVATED CURVES

Spreading applications should be kept to the high side of super-elevated curves. As the material works, brine will migrate over the remainder of the pavement.

DISABLED OR ABANDONED VEHICLES

Vehicles are often disabled or abandoned in storm events. Typically, snowplow drivers notify the County of the vehicle's location and the status of occupants, if any. The State or Local Police are often called to arrange for towing of abandoned vehicles or to assist stranded drivers.

AT-GRADE RAILROAD CROSSINGS

At railroad crossings, snow and slush from the plow should be emptied along the berm in advance of the crossings to avoid carrying snow and slush onto the tracks, where it may become packed in the flange-ways, creating a hazard which could derail a train. Special effort should be made to keep the crossings safe for highway and train traffic. Approaches to crossings should be treated to prevent any slippery condition, but avoid using chemicals in the track area at railroad grade crossings.

ROUNDABOUTS

One common method for snow removal is for the snowplow to start on the innermost section of the circulatory roadway and keep circulating while spiraling outward with each revolution clearing the snow from the circulatory roadway. At the same time, a second plow operator will clear the entries and exits, or the same plow operator will clear the approaches once the circulatory roadway is clear. The crown of the circulating roadway, if present, will also help dictate the plowing sequence of a roundabout.

One of the biggest pitfalls with plowing snow from the roundabout is identifying the location of the raised curb locations after heavy snowfall has occurred. Damage to the curbs may occur if care is not taken by the operator in identifying the curb locations.

Snow storage should also be considered when plowing at a roundabout. Storage should not create a sight obstruction for drivers approaching or circulating the roundabout and should not affect pedestrian access through a roundabout Limited sight-distance can occur due to snow accumulation along the outside edge of the roundabout. Knocking down the height of the snow piles or removing snow from the islands may be necessary after prolonged periods of snowfall. It is also important that snow not be stored such that it will

thaw and then freeze as ice on the circulatory roadway. Snow plowed from the roadway may contain road salts and other automobile waste that could impact vegetation if placed in sensitive landscaped areas.

CONDITIONS IMPROVING

If the initial or previous treatments have done their job, the pavement temperature is around 28ºF and holding steady or rising, and no additional precipitation is occurring or forecast; there may be no need for further action, however, current conditions must be closely monitored to ensure that freezing conditions do not occur unnoticed. This is especially the case when the pavement temperature is above 32ºF and steady or rising, whether it is during or after the precipitation. Recognition of such conditions and communication of these conditions to snowplow operators can result in significant material savings. However, it is important to monitor conditions closely using information when pavement temperature is below or slightly above 32ºF and to be aware of the potential for "quick or surprise" freeze-ups.

When the pavement is cold (below 20ºF) and new or blowing snow is light, traffic and wind (speeds of 15 mph or higher) may be sufficient for preventing accumulation and compaction in tire tracks. In this case, application of any chemical, even that added as freeze-proofing to an abrasive, may create rather than cure a problem. Once wet pavement develops where previously it was cold and dry, the dry snow can adhere and begin to build up.

If the pavement and snow are cold and dry and it is apparent that snow in tire tracks is not adhering to the pavement, plowing is all that is necessary to remove accumulation. If residual chemical or pavement temperature is high enough to form some liquid, wetting the snow or causing slush, then plowing is recommended.

ICE CONTROL

The formation of ice on the pavement presents a far greater traffic hazard than snow, especially during its early stages. Treatment for hazardous ice conditions must begin immediately. Patrols and radio operators must be instructed to promptly notify supervisory personnel when icy conditions begin to develop. The use of temperature sensors can aid in determining when dangerous conditions develop. These critical areas can be monitored more closely and treated as needed. Anti-icing is an effective strategy for frost and scheduled treatments during the week throughout the season can be used to reduce slippery conditions. If ice has already formed, an effective tool to break it up is the underbody plow.

Danger spots must be identified and addressed as needed as previously discussed.

TAPER LOGS

Material application rates may vary based on the storm event and environmental conditions. The use of T.A.P.E.R. logs is a means of tracking actions and results to build a foundation for effective material use. This system tracks the Temperature of the pavement, Application rate, Product used, Event type and the Results obtained from the operation (TAPER). The results obtained from the TAPER Logs will provide the data to adjust application rates specific to your operation or conditions. The TAPER Log is available in Appendix I.

POST STORM ACTIVITIES

Post-storm activities are almost as important as the primary operations of plowing and spreading. Support activities minimize hazards, as well as identify needs for subsequent storms. Such activities include melt water control, clean-up of special roadway features, handling & disposal of snow/ice/abrasives, material management, personnel management, equipment repair & cleaning, and facility clean-up.

MELT WATER CONTROL

Preventing snow and ice melt water from getting back into the traveled roadway is very important since refreeze could create a hazard. If plowing procedures cannot deposit snow to avoid this condition, the snow should be moved to a location where it can melt into an off-pavement drainage system. Loading and hauling or pushing snow back with loaders and plows can accomplish this.

SHOULDER CLEARING

After pavement and ramps are cleared, shoulders should be cleared to their full width to accommodate disabled vehicles and provide snow storage for the next snowfall. Areas beyond the shoulders can also be pushed back to accommodate future snow and minimize the potential of drifting. It is also important that snow be cleared beyond the shoulder high point on banked curves in order to minimize possible refreeze or snow melt on the pavement. Nose plows should not be used for plowing shoulders.

RAMP AND INTERSECTION CLEARING

Generally ramps and intersections are plowed at about the same time as the mainline sections. However, some storm conditions may dictate that they be plowed earlier or later than the adjacent mainline. Ramps and intersections should be cleared to their full width to accommodate the traveling public. Care should be taken to eliminate site distance restrictions caused by plow accumulations. Priority removal should be assigned to those locations with the highest traffic volume.

PLOWING CROSSOVERS, TURNAROUNDS, AND GORE AREAS

Crossovers, turnarounds, and gore areas should be plowed after the storm is over and other elements of the highway have been cleared. These should be done when visibility is good and traffic volume is low. The use of crossovers during mainline plowing operations should be minimized where practical. However, when it is necessary to use a crossover it should be of sufficient width to allow the plow truck to be completely off both roadways. Crossovers used as turnarounds should be clearly identified on snow route maps.

RESTORING HIGHWAY SAFETY FEATURES

Safety features like impact attenuators, guardrail, median barrier, and breakaway sign supports, and light poles are designed to minimize damage to errant vehicles. However, these safety features may become hazards when snow and ice build-up adversely impacts their effectiveness. Snow and ice must not be allowed to build up on the traffic side of attenuators, median barriers, guardrails, or breakaway features since it may prevent proper function. Signs that become buried or illegible should be given priority attention in cleaning and restoring.

LOADING, HAULING, AND DISPOSAL OF SNOW, ICE, AND ABRASIVES

Loading, hauling, and disposal of snow, ice, and abrasives is routinely required in areas with no snow storage areas, urban areas, and some drainage sensitive areas. Generally these activities are required only after heavy snowfall or abrasive use; however, drainage sensitive areas may require attention in typical winter storms. Inlets must be open to facilitate drainage; care must be taken to keep them open during clean-up operations. Loaders, graders, and trucks are typically used to relocate the snow build-up well away from the road. However, specialty equipment such as snow blowers may also be used.

CLEARING OF SPECIAL AREAS

Attention should also be given to special areas during post-storm activities; areas that may need additional clearing include State weigh scales, rest park facilities, and curb/gutter sections. PennDOT must utilize caution when clearing adjacent to non-state facilities such as rail crossings, walkways, and fire hydrants.

PERSONNEL MANAGEMENT

After a storm, overtime for drivers should be reviewed in anticipation of a subsequent storm. A call-out plan should be developed in accordance with the standard call-out procedure.

MATERIAL MANAGEMENT

Material inventories should be evaluated immediately after a storm to assess the need for re-supply. Keep in mind those businesses, cities, counties, adjacent states, and other PennDOT locations are likely trying to get stockpiles replenished as well. A prompt inventory and order placement could help get materials more quickly.

EQUIPMENT REPAIR AND MAINTENANCE ACTIVITIES

After storm and clean-up activities are complete, equipment should be prepared for the next storm. A thorough washing and inspection are a must to keep equipment functioning properly. All precautions taken between storms may prevent a breakdown during the next storm.

FACILITY CLEAN-UP

All facilities should be cleaned up in order to eliminate the possibility of chloride contamination. Spilled materials should be returned to proper contained storage areas.

EQUIPMENT

To keep equipment in top condition, establish a regular maintenance routine to be followed all winter. Equipment operators should inspect vehicles after each storm and report needed repairs to the garage or to the staff mechanic. Spreaders will need to be verified after repair to the hydraulic system.

The first step in vehicle maintenance is to make sure every operator knows what to expect of each piece of equipment. Operators should check these items carefully.

Spreaders/Sprayers — Inspect pumps, hoses, controls, and fittings. Check spinners, augers, and auxiliary engines.

CONTROLS

The two major components of any hydraulic system are the pump and the controls, whether manual or automatic. All operators should become thoroughly familiar with spreader controls. No two hydraulic systems are exactly the same. Therefore, controls may differ from truck to truck. Know your equipment and how the auger or conveyor and the spinner react at various settings.

PLOWS

Carefully inspect blades after each use. If blade wear begins eating into the moldboard, it will be very costly to replace. Remember that snow plow blades do not wear evenly. Replace blades when they are badly worn at any point! Have operators check blade wear during storms. (Right-hand plows wear most rapidly on the left side, while the opposite is true for left-hand plows. Reversible plows may show wear on either side, depending upon operating time in each position.)

ALL ELECTRICAL EQUIPMENT

Inspect and service all lighting and electrical equipment regularly, including wiring and sockets. Carry ample stocks of parts for rotating flasher units, including lenses and lamps. Faulty wiring and failure of alternators, generators and batteries cause the most downtime in winter maintenance vehicles. Nothing is more terrifying and dangerous than a stalled and darkened vehicle in a winter storm.

SAFETY EQUIPMENT

Make sure there are flashlights, flares, or reflective triangles, flags and safety vests in truck cabs. A first aid kit is also a good idea. It is preferable to wear hardhats at all times and don't start out without securing seat belts.

4.5.6 SPECIALTY EQUIPMENT

Under certain conditions, the Department uses specialty equipment.

SNOW BLOWERS

Snow blowers, self-propelled or loader mounted can be used to remove deep snow, clean interchanges, gore areas, bridge decks and areas that require the movement of large volumes of snow.

GRADERS

Useful in plowing operations, graders can also remove ice and packed snow because of the down pressure that can be applied to the under carriage blade. Negatives are that they are slow when compared to trucks, and cannot spread deicing materials. Recommended plowing responsibilities for graders are clearing interchange areas or working as part of a plow train. Available graders should be used to plow back unpaved shoulders.

LARGE LOADERS

Each County should establish rental agreements for large loaders. The primary winter function for these loaders is to help clear road closures caused by drifting or other conditions.

ANTI-ICING TRUCKS

Anti-icing trucks are designed for pre-treating the roadway surface prior to the start of a storm event. Liquid chemicals may also be used to maintain pavement conditions during an event. Prior to re-applying additional liquid chemical, accumulated snow/ice should be removed.

4.5.7 MAILBOXES AND DRIVEWAYS

Snow removal in residential areas may require communication and cooperation with homeowners. Two specific examples are:

MAILBOXES

Because the post office has certain placement requirements regarding the location of mailboxes, the Department does not prohibit property owners from placing mailboxes within the limits of the legal right-of-way. Since these mailboxes are not placed under permit regulations, technically they are encroachments, and remain at the risk of the property owner. Therefore, the Department is not liable for damages to mailboxes caused by snow removal when they are located within the limits of the legal right-of-way.

Where a potential problem with a mailbox exists, the Foreman and/or Assistant Highway Maintenance Manager should explain this policy to the property owner in a courteous manner. Normally, if mailboxes are placed as far beyond the shoulder of the highway as the postal worker can reach from his/her vehicle, and the mailbox rests on a firm upper support, the box should be able to withstand the windrow of snow from the plow.

Operators should exercise care and use slower plowing speeds when working in areas where mailboxes are present to avoid damage if possible.

DRIVEWAYS

Although windrowing snow in front of private driveways cannot be eliminated, Equipment Operators should use reasonable care when plowing residential areas to minimize homeowner inconvenience. Slower speeds can reduce windrows.

If Department employees observe a person depositing snow onto a highway, they should contact local police.

4.5.8 WIDENING AND CLEANUP

The time for widening and cleanup operations is after the travel portion of the roadway has been properly treated. To minimize overtime, employees normally perform these activities during regular shifts. Widening activities will open drainage systems, providing a place for both snowmelt and future snowfall.

The following areas may require additional attention as part of the widening and cleanup operation:

- Turning lane pavement sensors.
- Median barriers, Bike Lanes and guide rail.

- Flange areas within railroad crossings.
- Super elevated curves.
- Bridge expansion dams.
- Inlets and drainage devices.
- Gore areas.
- Intersections.
- Areas of sight distance concerns.
- Interstate crossovers.
- Potential drift areas.
- Bridge decks – ***NOTE:*** *Removal of excess snow from bridge decks decreases the "dead load" and reduces icing conditions created by freeze-thaw cycles.*

4.5.9 FROST HEAVE

Frost heave is a result of freeze-thaw cycles that can occur often during the winter months. Frost heave causes vertical movement of highway sections most often at bridge approach slabs and paved shoulders.

All Department personnel engaged in roadway work or patrols during the winter season should remain alert to report frost heave conditions to the Highway Maintenance Manager as soon as they are noticed.

4.5.10 REVIEW OF EQUIPMENT DAMAGE OR BREAKDOWN

Following each winter storm, Equipment Operators and Highway Maintenance Foremen are responsible for cleaning and checking their equipment and for reporting any repairs required to the County Equipment Manager and the appropriate Assistant Highway Maintenance Manager. Equipment Managers, upon receiving equipment damage reports, should schedule repairs for the equipment and provide Highway Maintenance Manager with copies of their repair schedules.

4.5.11 CARE AND CLEANING OF EQUIPMENT

The Department has a large investment in equipment, and to protect this investment, the following applies:

- After each storm, Highway Maintenance Foremen should provide Equipment Operators with the opportunity to steam and wash any piece of equipment that is exposed to either chemicals or anti-skid materials. Equipment assigned to any stocking area that does not have vehicle wash facilities should be sent to stockpiles with vehicle wash facilities.
- ***NOTE:*** *Wash water from equipment cleaning must be directed to the appropriate runoff control or drainage area according to the SEMP environmental stewardship program.*
- Equipment Operators should monitor plow blades before and during use, inspect them after each use, and replace them whenever necessary.
- Equipment Operators should check plow and plow assist valves for proper operation after each use.
- Tire chains must be properly maintained.
- At the end of the snow removal season, the County Equipment Manager is responsible for ensuring that all winter equipment is thoroughly cleaned to prevent corrosion from any chemical residue. Augers are

to be coated with a protective material for summer storage. All vehicle bodies, snowplows and spreaders are to be routinely inspected.

- District and County management personnel responsible for the proper maintenance of equipment should inspect all equipment periodically to assure that necessary repairs are scheduled and completed to maintain a state of readiness.

4.5.12 ISSUE OF WINTER MATERIALS

SAP/Plant Maintenance System tracks winter material issue and receipt. Timely reporting is very important to ensure accurate inventory controls. Each Operator is to maintain tracking documents such as the Form OS-520B T.A.P.E.R. log (See PUB 23A Appendix I) for each 24¬hour period. These documents are to be completed and entered on a timely basis to provide accurate information on material use and available quantities throughout the winter season. ZIPY Payroll issues can be charged by individual Operators or combined into one entry on the Foreman Payroll (ZIPY).

Foremen should visually inspect each stockpile location weekly and following storm events to confirm accurate inventory records in SAP. Accurate inventory records permit timely ordering of replacement stock. The following information should be recorded on a Winter Materials Issue form:

- County.
- Date.
- Time out/Time returned.
- Operator.
- Equipment number.
- Start/end mileage.
- Stockpile number.
- Material loaded (salt, anti-skid, liquids, etc.).
- Distance spread.
- Application rate.
- Material returned (salt, anti-skid, liquids, etc.).
- State routes treated.

4.5.13 DARK HOURS TRAINING AND OTHER ACTIVITIES PERFORMED DURING WINTER SEASON

It is Department policy to make a concerted effort to manage our resources wisely and to maintain a level of productivity that is consistent with current Department goals. This is particularly critical during the winter months.

Clearly, there will be extended periods during the winter when mild weather permits work other than snow removal. Managers must assign projects for non-daylight shift workers. During the winter season, work schedules should maintain productivity while retaining the required flexibility to deal with interruptions caused by inclement weather.

Productive dark-hour activities include, but are not limited to the following:

WINTER/SNOW REMOVAL

- Mix salt/anti-skid.
- Repair tire chains.
- Transfer material.
- Repair spreaders/augers.
- Receive winter materials.
- Perform storm cleanup/widening.
- Conduct snow/ice patrol.
- Clean sumps.
- Install/remove/repair plows/blades.
- Check spreader verification.
- Clean bridges/sidewalks.
- Cut bleeders/scuppers under guide rail.

EQUIPMENT-RELATED ACTIVITIES

- Clean equipment.
- Perform preventive maintenance on equipment.
- Transfer equipment.
- Paint equipment.
- Sharpen cutting tools.
- Build bodies for pickup trucks.
- Implement equipment repairs.
- Prepare summer equipment.
- Start all equipment at stockpiles.

TRAINING IN THE FOLLOWING AREAS ALL TRAINING SHOULD BE TRACKED AND RECORDED

- CDL.
- Defensive driving course.
- Hazardous materials.
- CPR/first aid.
- Risk Management.

- Right-To-Know.
- Planning and scheduling.
- Operator.
- Safety.
- Work zone traffic control.
- Maintenance activity procedures.

STOCKPILE/GARAGE/ADMINISTRATIVE

- Perform general housekeeping.
- Repair storage facilities.
- Refinish picnic tables.
- Paint office area.

SUPPLIES

- Paint signs.
- Paint trash barrels.
- Build tool sheds.
- Construct picnic tables.
- Tie Gabion baskets.
- Straighten guide rail.
- Hold foremen meetings.
- Conduct building maintenance.
- Perform Keep PA Beautiful activities.
- Check and maintain stockpiles.
- Make pre-cast slabs.
- Dismantle guide rail.
- Paint garage area.
- Repair/install fences.

ROADWAY/ BRIDGE WORK

- Prepare for daylight activity.
- Restore truck escape ramps.

- Survey guide rails.
- Maintain scenic overlooks.
- Perform other bridge maintenance.
- Maintain roadside picnic area.
- Remove old station markers.
- Sweep bridge water tables.
- Cut brush.
- Sweep high-volume intersections.
- Remove illegal signs from right-of-way.
- Remove graffiti.
- Maintain roadside rest areas.
- Survey/repair right-of-way fences.
- Survey lighting.
- Handle emergency pothole patching.
- Inventory roadway features.
- Open/clean drainage courses, ditches, inlets, outlets.
- Conduct rain/wind patrol.
- Replace/repair signs/posts.
- Remove rock slide removal.
- Remove trash/debris.
- Clean up accident residue.
- Conduct sign surveys.
- Heat kettles for crack/joint sealing.

4.6 STOCKPILE PLANNING AND DEVELOPMENT

The numbers and locations of stockpiles are important strategic concerns of the Department. Operations can be conducted most efficiently and in an environmentally sensitive way when stockpiles are properly situated. This section addresses stockpile location planning and land procurement. While not necessarily annual winter services activities, stockpile changes must be handled in a consistent way, reflecting the priorities of the Department.

4.6.1 STOCKPILE LOCATION PLAN GUIDELINES

Density factor tabulations permit the direct determination of the snow lane miles to be serviced from a stockpile based on the County's density factor. The density factor may be obtained by dividing the total snow lane miles by the square miles within the County. The calculation, performed by BOMO, is based on the premise that a County with a high density of roads per square mile should be able to service more lane miles from each stockpile location. There is a minimum lane mile assignment of 135 snow lane miles per stockpile and a maximum of 225 snow lane miles per stockpile with a straight-line relationship in between. The last step of the calculation is to obtain the allowable number of stockpiles per County. This is done by dividing the snow lane miles per stockpile into the total county snow lanes listed on the Highway Features Inventory Printout. The PennDOT County Office is not counted as a stockpile.

Certain other factors such as poorly placed existing stockpiles, which cannot be vacated, roadway configuration and distribution, large metropolitan areas, rivers, state forest areas, terrain, etc., can also have an influence on the number of stockpiles that a County requires. These factors must be considered on an individual County basis, but the number of stockpiles computed from the formula plus the County Office is adequate for most counties.

After the allowed number of stockpiles is calculated, the Assistant District Executive for Maintenance and the Highway Maintenance Manager must review county maps to decide where the stockpiles should be located. After this is determined, it will be primarily up to the District to locate available land and initiate the purchasing process. While reasonable efforts are to be made to retain operationally and environmentally acceptable sites, it may be necessary to vacate rental sites. The plan showing the final stockpile distribution should be completed, approved by the District Executive and used by the Highway Maintenance Manager to plan stockpile acquisition and development.

Stockpile location plans should be on file at the District Maintenance Office and at each County Office.

4.6.2 LAND PROCUREMENT AND STOCKPILE DEVELOPMENT

The Department's ultimate goal is to own or have under long-term lease (20 years or more) all permanent maintenance stocking areas. A permanent stocking area is defined as a stockpile site used year-round by maintenance forces for stocking roadway materials, parking equipment, and assembling personnel.

Each County has an approved stockpile consolidation plan. This plan shows the number and location of all stockpiles required for the efficient operation of the County. Section 4.6.1 contains guidelines relating to the establishment of a stockpile location plan. Counties dependent on rental stockpiles should try to eliminate one or more rental stockpiles per year by budgeting for the purchase of at least one stocking area in accordance with the approved County stockpile consolidation plan.

Purchases should proceed by priority with rental sites having potential environmental problems or high rental fees eliminated first. By following these steps, the Department will eliminate poorly located rental stockpiles that cannot be properly developed because of the high costs of major improvements. Strategically located state-owned sites are preferred, where the costs of major and capital improvements can be justified.

Requests to purchase stockpile sites are to be in accordance with Publication 284: PennDOT Facilities Manual.

Appendix A - Winter After Action Review Template

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M-602 (6-15)

pennsylvania
DEPARTMENT OF TRANSPORTATION

WINTER SERVICES AFTER ACTION REVIEW
EVALUATION OF PREPAREDNESS AND PERFORMANCE FOR WINTER EVENTS AND ACTIVITIES

A GENERAL INFORMATION

Date of Review:	Provide Name and Title of Requestor:	
Organization Reviewed (County Office, Stockpile, etc.):		
Address	City	Zip Code

AAR Requested / initiated by (check one):
- ❒ **Central Office**
- ❒ **District Office**
- ❒ **County Maintenance Office**

Reason for Review (check one):
- ❒ **Anticipated Event** (Go to Section B)
- ❒ **Post Event** (Go to Section C)
- ❒ **Issue Oriented** (Go to Section D)

B PREPAREDNESS REVIEW (Pre-Action)

What is the Weather Forecast? (Check all that apply):

❒ **Snow** ❒ **Ice** ❒ **Cold** ❒ **Wind** ❒ **Rain changing to snow** ❒ **Other** _____

Anticipated Arrival Date:	Anticipated Arrival Time:	Anticipated Duration:

Area to be Affected:

Manpower:	Equipment:

Pre-storm Preparations:

Strategy for Storm Response:

Coordination Required (Check and answer all that apply):
- ❒ **PA State Police** (Specify Barracks) . . . . . _____
- ❒ **County Emergency Management Agency** (Specify County) . . . . . _____
- ❒ **Traffic Management Center**
- ❒ **District Incident Command Center**
- ❒ **Schools** (Specify Schools) . . . . . _____
- ❒ **Other** . . . . . _____

Appendix A - Winter After Action Review Template

C PERFORMANCE REVIEW (Post Action)

About the Event:

Weather Conditions Experienced (Check all that apply):

❒ **Snow** ❒ **Ice** ❒ **Cold** ❒ **Wind** ❒ **Rain changing to snow** ❒ **Other** _____

Arrival of Storm Conditions Date:	Arrival of Storm Conditions Time:	Duration of Storm:	
Duration of Winter Service Response:		Area Affected:	
Manpower Availability:	Number of Call Outs:	Timeliness of Call Outs:	Number of Refusals:
Equipment Availability:	Equipment Idle (Why?):	Equipment Offline (Deadlines, Knockouts, etc...)	
Materials Availability:	Materials Usage:	Need to Reorder:	

Roads Closed (Which and Why?):

Speed Reductions (Where, How Much and Why?):

Application Rates:	School Closures/Delays/Early Dismissals:

Cooperation with Other Agencies:

Coordination Conducted (Check and answer all that apply):

❒ **PA State Police** (Specify Barracks) . . . . . _____

❒ **County Emergency Management Agency** (Specify County) . . . . . _____

❒ **Traffic Management Center**

❒ **District Incident Command Center**

❒ **Schools** (Specify Schools). . . . . _____

❒ **Other** . . . . . _____

Appendix A - Winter After Action Review Template

D ISSUE ORIENTED REVIEW (Activity Specific)

About the Event:

Weather Conditions Experienced (Check all that apply):

❒ **Snow** ❒ **Ice** ❒ **Cold** ❒ **Wind** ❒ **Rain changing to snow** ❒ **Other** _____

Arrival of Storm Conditions Date:	Arrival of Storm Conditions Time:	Duration of Storm:
Duration of Winter Service Response:		Area Affected:

Issue Identified:

Process Owners Involved:

Contributing Factors:

Solutions Identified:

Measures of Success:

Solutions Implemented:

Results:

Responsible Party:	Close Out Date:

Appendix B - Winter Equipment Checklist

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Winter Equipment Checklist

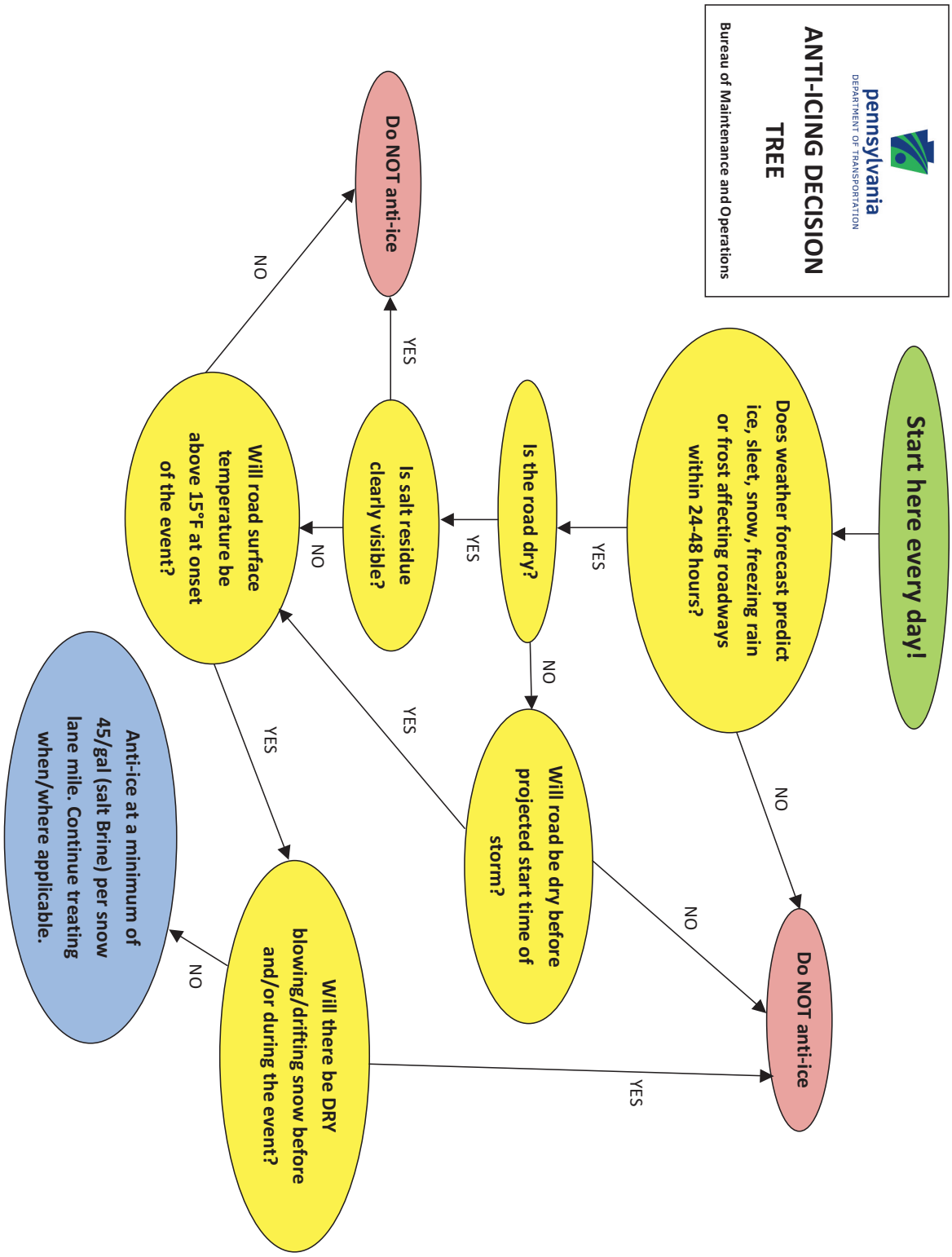
Truck Number:	**Date:**
Plow Number:	**Operator - A Shift:**
Wing Number:	**Operator - B Shift:**
Spreader Number:	**Foreman's Initials:**

	G	NG	Comments
Wing:	X	X	
plow face (wing)	G	NG	
trip lock & spring	G	NG	
front wing cylinder/hoses	G	NG	
front wing mounting face	G	NG	
rear wing cylinder/hoses	G	NG	
rear wing mounting face	G	NG	
safety chain	G	NG	
blades	G	NG	/inches left
rubber	G	NG	/inches left
Plow:	X	X	
rubber flap	G	NG	
plow shoes & brackets	G	NG	
hinge bolts & pins	G	NG	
mounting bolts & springs	G	NG	
push frame	G	NG	
lift chain & cable hardware	G	NG	
blades	G	NG	/inches left
bolts	G	NG	
nose piece	G	NG	

	G	NG	Comments
Spreader:	X	X	
auger turning right way	G	NG	
bearings	G	NG	
hoses & proper routing	G	NG	
auger motor	G	NG	
	G	NG	
Spinner:	X	X	
fins	G	NG	
hoses	G	NG	
spinner motor turning right way	G	NG	
Miscellaneous:	X	X	
paint condition:	G	NG	
tire tread depth (in /32's):	G	NG	
ZV's	X	X	
venturi turns both ways	G	NG	
material hose	G	NG	
blower hose	G	NG	
blower works	G	NG	

Additional Comments:

Appendix C - Anti-Icing Decision Tree



Appendix C - Anti-Icing Decision Tree

ANTI-ICING DECISION TREE DIRECTIONS

- Use this decision tree once per day and/or whenever the current weather forecast is significantly updated.
- If the decision tree recommends against anti-icing but conditions have changed, reevaluate the decision based on the new situation.
- If there is a winter storm forecast for sleet, snow, freezing rain or frost that will adversely affect driving conditions, it is desirable to have some form of salt residue on the road.
- If there is no or very little salt residue on the road surface, anti-icing is recommended, except under the following conditions:
  - o If the event is forecasted to start as rain.
  - o If the road surface temperature is below 15°F.
  - o If blowing/drifting DRY snow is forecast prior to or at the onset of the storm.
- Some judgment is required to decide if the storm event will be sufficient to cause driving problems. However, you should always err on the side of anti-icing, as it is a very cost effective treatment.

GENERAL PRINCIPLES OF ANTI-ICING

- Anti-icing can commence at least 48 hours in advance of the forecasted start time of a winter storm where practical. Bituminous pavements should be anti-iced first, then Portland Cement Concrete pavements. Higher priority routes should be anti-iced last as this reduces the potential for "dust-off".
- Once the decision to anti-ice has been made, the (45 gal/SLM minimum) rate may need to be increased to double the normal value to compensate for circumstances that would otherwise deplete the salt residue below a value likely to be effective. These circumstances include applying salt brine more than 24 hours before the anticipated event, roads that have surfaces on which normal anti-icing rates have been observed to be ineffective and sleet and/or freezing rain are anticipated.
- One key to a successful anti-icing program is to have quality salt brine as close to 23.3% solution as possible. Another key is to calibrate the anti-icing equipment at the beginning of and several times during the winter season.
- At this time, research indicates that up to 10% calcium chloride, magnesium chloride or agricultural based organic deicers may be added to salt brine. Concentrations above that level may cause the salt to precipitate out of solution.
- Agricultural based organic deicers when mixed with salt brine have been shown to help the salt stick to and remain on the pavement longer after the water in the brine has evaporated.

Appendix D – Winter Roadway Condition Descriptions

COMMON DESCRIPTIONS: In order to attain a common understanding of winter road conditions, the following conditions and definitions have been established. These condition descriptions represent the predominate condition of the road being reported.

Condition 1: Clear - Dry/wet pavement surface is maintained at all times.

This condition represents time periods when the pavement and air temperatures are above freezing with or without precipitation. This condition may also exist when temperatures are at or below freezing and traffic is able to maintain speeds at or near posted limits. (An example would be during the clean up phase of a minor event when roads are wet and reports indicate they are freezing dry with traffic speeds returning to normal.)

Condition 2: Wet with Freezing Conditions - Wet pavement surface is the general condition with air temperatures near or below freezing. There are occasional areas having snow or ice accumulations resulting from drifting, sheltering, cold spots, frozen melt-water, etc.

This condition should be utilized during periods of precipitation when air and/or pavement temperatures are at 34 degrees and are expected to drop to freezing or below freezing during the course of the storm. This condition should also be used when wet or light snow cover conditions are expected to persist for two or more hours with freezing temperatures.

Condition 3: Snow and/or Slush Covered - Accumulations of loose snow or slush are regularly found on the pavement surface. Light to moderate snow cover may be present in some areas (up to 2 inches on secondary routes).

Some snow packed and/or icy conditions may be present but do not represent predominate road conditions on the interstates. Reduced travel speeds may be required due to slick road conditions. Secondary routes may have up to 2 inches of snow and/or slush accumulation.

Appendix D – Winter Roadway Condition Descriptions

Condition 4: Snow Packed / Significant Snow Cover - The pavement surface has continuous stretches of packed snow with or without loose snow on top of packed snow and ice. Significant snow accumulations are present in some areas (2 – 5in).

This condition may become prevalent during periods of heavy snowfall or on lower priority routes when conditions warrant the consolidation of resources on the highest priority snow routes. Speed limit reductions and vehicle restrictions should be considered when this becomes the predominate condition on the interstate.

Condition 5: Icy - The pavement surface is predominantly covered with ice and packed snow. There may be loose snow or sleet on top of the icy or packed snow surface.

This condition may be the result of sleet, freezing rain, snow melt or refreeze. Reduced travel speeds may be necessary and motorist should be advised to limit travel or travel at significantly reduced speeds until conditions improve.

Condition 6: Impassable - The road is temporarily impassable to most or all vehicles. This may be the result of severe weather (low visibility, blowing snow, etc.) or road conditions [drifting, excessive unplowed snow (5+ inches), avalanche potential or actuality, glare ice, etc.]

Appendix E - School Bus Letter

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((County Street Address))
((County Town)), PA ((County Zip))
((Date))

Subject: Winter Transportation of School Students ((Supervisor))
((School Name)) ((Office))
((Address))
((City)), ((State)) ((Zip))
Dear ((Salutation))
The winter season is again approaching. The Pennsylvania Department of Transportation is asking for your help in coordinating a reminder to the school bus operators, and the visiting motoring public about winter safety while transporting students to and from school safely.

We are deeply concerned about the traveling public's safety, especially when it concerns the safety of our young school students.

Through combined efforts, a successful and safe winter season can be achieved between the Department, School District, school bus drivers and the motoring public. We request that you remind all of your school bus drivers, and visiting motorists of the essential rules of winter safety, some which are as follows:

1. Keep the vehicle in good condition in accordance with the Pennsylvania School Bus Driver's Manual Pre-Trip inspection.

2. Keep windshields, driver's side windows, passenger doors and mirrors completely clear at all times. Inspect tires for tread wear and correct inflation, and use tire chains when acceptable.

3. Set a regular speed, and drive slower than the posted speed limit or what you would normally drive in dry conditions, especially in inclement weather. When driving on snow or ice covered highways, judge the effect of traffic and temperature on road surface friction by noting whether other vehicles are skidding. Remember, bridges freeze before the road surface.

4. SLOW DOWN. Just because the posted speed limit is 40 mph, it doesn't mean you have to drive that fast. Remember, the speed limit is an indication of maximum safe speed during optimal conditions.

5. When following a snowplow truck, stay back 200 feet.

We assure you that it is our objective to keep the state highways as clear of snow and ice as possible. However, during severe winter conditions, we may not be able to clear all highways before the buses start their routes. Therefore, it is imperative that school bus drivers, and visiting motorist use every safe driving precaution (i.e., increased stopping distance, driving in reduced gear, reduce speed, etc.) to assure the safety of their passengers during inclement weather.

Through a cooperative effort, we can reduce the effect of hazardous driving conditions when busing school children. The Department is committed to keeping the roads safe, and they ask for your cooperation in our efforts.

Should you have any questions, please contact Maintenance Manager, telephone number.

Very Truly Yours,
Maintenance Manager

Appendix F - Dry Run Checklist

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DRY RUN CHECKLIST – ROADWAY CONDITIONS

DATE	
OPERATOR	
FOREMAN	
ASST. CMM	

COUNT	
STATE ROUTE	
BEGIN SEG/OFF	
END SEG/OFF	

One form is required for each State Route in each foreman's area. Identify each problem area listed below by SEGMENT and OFFSET. For offset identification, indicate the location of the hazard by using "B" if near the beginning of the segment, "M" if near the middle of the segment, or "E" if near the end of the segment.

DRAINAGE FACILITIES OR OTHER AREAS THAT NEED DELINEATORS

SURFACE AND SHOULDER POTHOLES

ROADSIDE OBSTRUCTIONS (SUCH AS MAILBOXES)

WEIGHT RESTRICTED SEGMENTS / BRIDGES

LOW WIRES

OVERHANGING LIMBS

Appendix F - Dry Run Checklist

DRY RUN CHECKLIST – ROADWAY CONDITIONS

POSSIBLE WATER OR ICE PROBLEMS (BASED ON AREAS PREVIOUSLY SERVICED)

GUIDERAIL (HITS, ROTTED POSTS, ECT)

LOW SHOULDERS (INCLUDE APPROXIMATE LENGTH AND DEPTH OF LOW AREA)

ADDITIONAL COMMENTS

Appendix F - Dry Run Checklist

DRY RUN CHECKLIST – EQUIPMENT

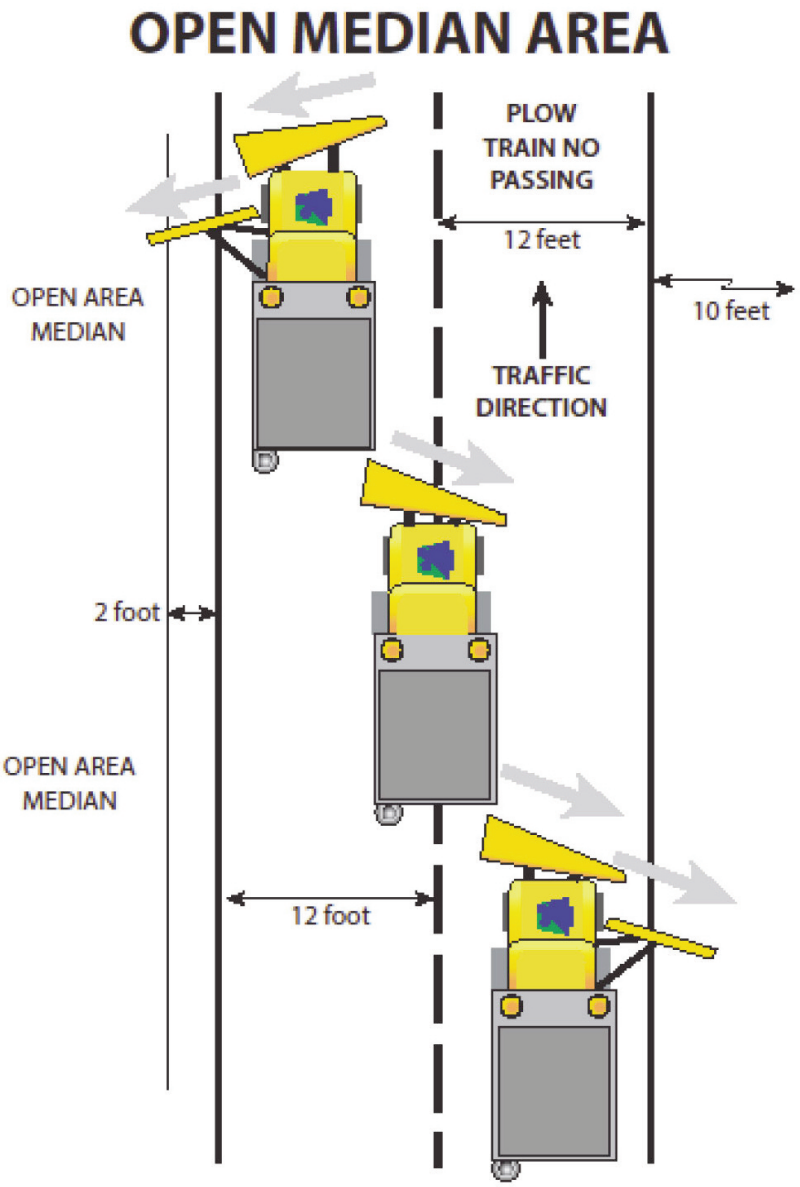
DATE		COUNTY	
ASST. CMM		STOCKPILE	
EQUIP NO.		PLOW NO.	
SPREADER			

	YES	NO
SECTION SNOW MAP WITH ASSIGNED STATE ROUTES, PRIORITIES INDICATED AND ROUTES COLOR CODED TO INCLUDE TOTAL LANE MILES.	_____	_____
HAS SPREADER BEEN VERIFIED AND IS VERIFICATION CARD IN TRUCK?	_____	_____
EMERGENCY EQUIPMENT IN CAB (FIRE EXTINGUISHERS, TRIANGLE, INSURANCE CARD, OWNERS CARD, BRIDGE PERMITS)?	_____	_____
IS TRUCK RADIO EQUIPPED?	_____	_____
INSPECT AND OPERATE SPREADER (NOTE ANY DEFICIENCIES ON M-614)	_____	_____
INSPECT AND MOUNT PLOW (NOTE ANY DEFICIENCIES ON M-614)	_____	_____
MOUNT TIRE CHAINS AND INSPECT. CHECK FOR SPARE CROSSLINKS. CHECK ALL RUNNING AND EMERGENCY LIGHTING.	_____	_____
HAVE ALL OBSTACLES AND OBSTRUCTIONS ON ASSIGNED ROUTES BEEN PROPERLY DELINEATED?	_____	_____
ARE ALL POSTED BRIDGE PERMITS AVAILABLE?	_____	_____
HAS ASSIGNED OPERATOR BEEN TRAINED ON THEIR ROUTE AND PROPER SNOW REMOVAL?	_____	_____
HAS THE EQUIPMENT BEEN CLEANED AND MAINTENED BY THE OPERATOR?	_____	_____

_____ _____

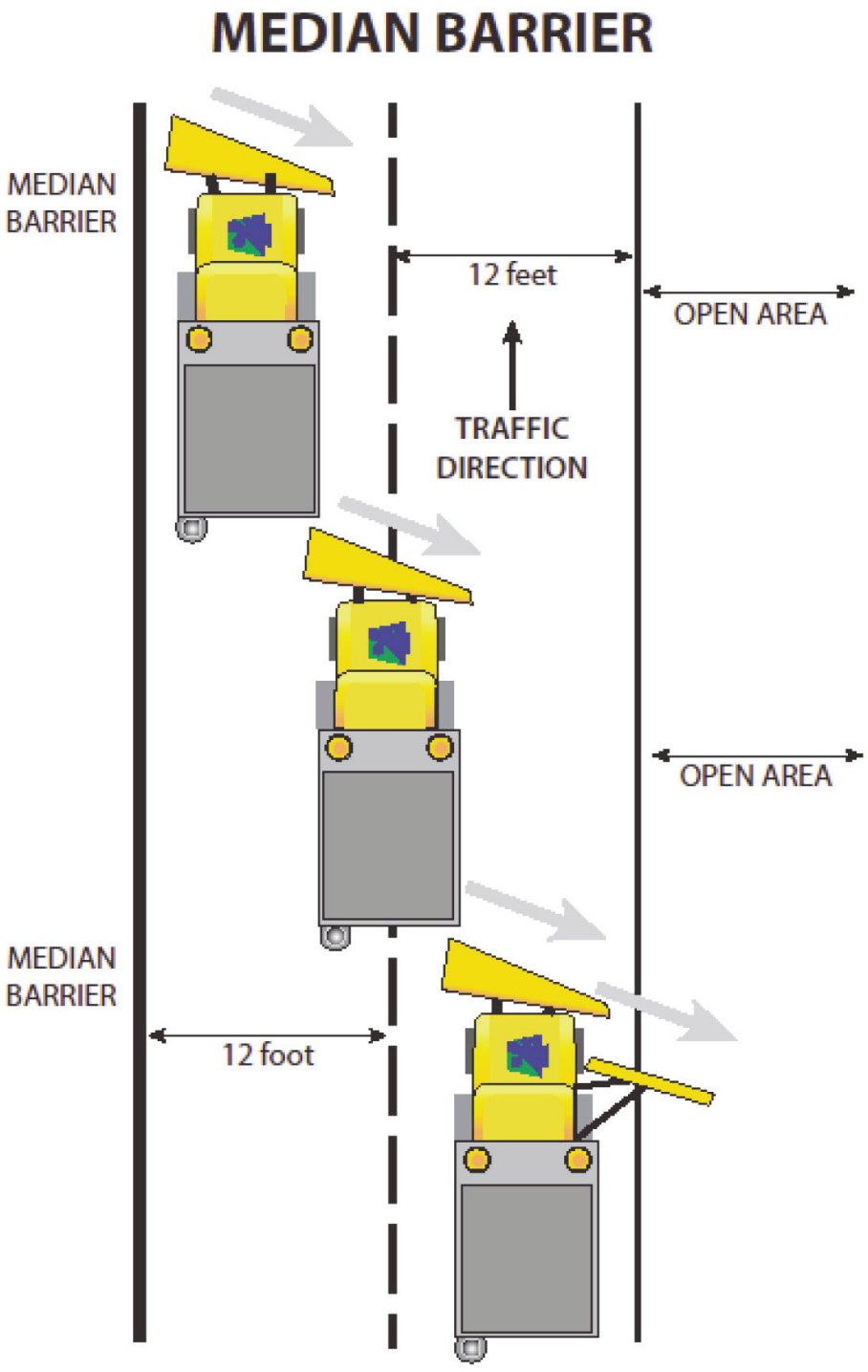
OPERATOR SIGNATURE DATE

Appendix G - Plow Train Drawing



Counties may optionally provide a shadow vehicle.

Appendix G - Plow Train Drawing



Counties may optionally provide a shadow vehicle.

Appendix H - Application Rate Tables

Table 8.

Weather event: Light Snowstorm

[All application rates are based on a single travel lane, double rate for centerline treatments]

PAVEMENT TEMPERATURE RANGE, AND TREND	INITIAL OPERATION				SUBSEQUENT OPERATIONS			COMMENTS
	Pavement surface at time of initial operation	maintenance action	material spread rate, lbs/snow lane-mi		maintenance action	material spread rate, lbs/snow lane-mi		
			dry	prewet solid		dry	prewet solid	
Above 32°F, steady or rising	Dry, wet, slush, or light snow cover	See comments	100	100	See comments	100	100	1) Monitor pavement temperature closely for drops toward 32°F and below 2) Treat icy patches if needed with material at 100 lbs/lane-mi; plow if needed
Above 32°F, 32°F or below is imminent;	Dry	Apply dry or prewet solid material	100	100	Plow as needed; reapply prewetted solid material when needed	100	100	1) Applications will need to be more frequent at lower temperatures and higher snowfall rates 2) It is not advisable to apply a liquid chemical at the indicated spread rate when the pavement temperature drops below 23°F 3) Do not apply liquid chemical onto heavy snow accumulation or packed snow
ALSO **20 to 32°F**, remaining in range	Wet, slush, or light snow cover	Apply dry or prewet solid material	100	100				
15 to 20°F, remaining in range	Dry, wet, slush, or light snow cover	Apply dry or prewet solid material	250	200	Plow as needed; reapply prewetted solid material when needed	250	200	If sufficient moisture is present, solid material without pre-wetting can be applied
Below 15°F, steady or falling	Dry or light snow cover	Plow as needed			Plow as needed			1) It is not recommended that chemicals be applied in this temperature range 2) Abrasives can be applied to enhance traction

Notes

MIX RATIO APPLICATIONS: (1) Time initial and subsequent material applications to prevent deteriorating conditions or development of packed and bonded snow. (2) Apply material ahead of traffic rush periods occurring during storm.

PLOWING: If needed, plow before material applications so that excess snow, slush, or ice is removed and pavement is wet, slushy, or lightly snow covered when treated.

Table 9.

Weather event: Light Snow Storm with Period(s) of Moderate or Heavy Snow

[All application rates are based on a single travel lane, double rate for centerline treatments]

PAVEMENT TEMPERATURE RANGE, AND TREND	INITIAL OPERATION				SUBSEQUENT OPERATIONS			COMMENTS
	Pavement surface at time of initial operation	maintenance action	material spread rate, lbs/snow lane-mi		maintenance action	material spread rate, lbs/snow lane-mi		
			dry	prewetted solid		dry light/ heavier snow	prewetted solid light/heavier snow	
Above 32°F, steady or rising	Dry, wet, slush, or light snow cover	See comments			See comments			1) Monitor pavement temperature closely for drops toward 32°F and below 2) Treat icy patches if needed with material at 100 lbs/lane-mi; plow if needed
Above 32°F, 32°F or below is imminent;	Dry	Apply dry or prewetted solid material	120	100	Plow as needed; reapply liquid or solid material when needed	120 light snow	100 light snow	1) Applications will need to be more frequent at lower temperatures and higher snowfall rates 2) Do not apply liquid chemical onto heavy snow accumulation or packed snow 3) After heavier snow periods and during light snow fall, reduce material application rate to 100 lbs/lane-mi; continue to plow and apply materials as needed
ALSO **-25 to 32°F**, remaining in range	Wet, slush, or light snow cover	Apply dry or prewetted solid material	120	100		200 heavier snow	200 heavier snow	
15 to 25°F, remaining in range	Dry, wet, slush, or light snow cover	Apply dry or prewetted solid material	250	200	Plow as needed; reapply chemical when needed	250 light snow 300 heavier snow	200 light snow 250 heavier snow	1) If sufficient moisture is present, solid material without pre-wetting can be applied 2) Reduce material application rate to 200 lbs/lane-mi after heavier snow periods and during light snow fall; continue to plow and apply material as needed
Below 15°F, steady or falling	Dry or light snow cover	Plow as needed			Plow as needed			1) It is not recommended that chemicals be applied in this temperature range 2) Abrasives can be applied to enhance traction

Notes

MIX RATIO APPLICATIONS: Time initial and subsequent material applications to *prevent* deteriorating conditions or development of packed and bonded snow. (2) *Anticipate increases in snowfall intensity. Apply higher rate treatments prior to or at the beginning of heavier snowfall periods to prevent development of packed and bonded snow.* (3) Apply material ahead of traffic rush periods occurring during storm.

PLOWING: If needed, plow before material applications so that excess snow, slush, or ice is removed and pavement is wet, slushy, or lightly snow covered when treated.

Table 10. Weather event: Moderate or Heavy Snow Storm

[All application rates are based on a single travel lane, double rate for centerline treatments]

PAVEMENT TEMPERATURE RANGE, AND TREND	INITIAL OPERATION				SUBSEQUENT OPERATIONS			COMMENTS
	Pavement surface at time of initial operation	maintenance action	material spread rate, lbs/snow lane-mi		maintenance action	material spread rate, lbs/snow lane-mi		
			dry	prewet solid		dry	prewet solid	
Above 32°F, steady or rising	Dry, wet, slush, or light snow cover	See comments			See comments			1) Monitor pavement temperature closely for drops toward 32°F and below 2) Treat icy patches if needed with material at 100 lbs/lane-mi; plow if needed
Above 32°F, 32°F or below is imminent;	Dry	Apply dry or prewetted solid material	100	100	Plow accumulation and reapply liquid or solid material as needed	100	100	1) If the desired plowing/ treatment frequency cannot be maintained, the spread rate can be increased to 200 lbs/ lane-mi to accommodate longer operational cycles 2) Do not apply liquid chemical onto heavy snow accumulation or packed snow
ALSO **30 to 32°F**, remaining in range	Wet, slush, or light snow cover	Apply dry or prewetted solid material	100	100				
25 to 30°F, remaining in range	Dry	Apply liquid or prewetted solid material	200	150-200	Plow accumulation and reapply	200	200	1) If the desired plowing/ treatment frequency cannot be maintained, the spread rate can be increased to400 lbs/lane-mi to accommodate longer operational cycles 2) Do not apply liquid chemical onto heavy snow accumulation or packed snow
	Dry, wet, slush, or light snow cover	Apply liquid or solid material	200	150-200	liquid or solid material as needed			
15 to 25°F, remaining in range	Dry, wet, slush, or light snow cover	Apply dry or prewetted solid material	300	200	Plow accumulation and reapply prewetted solid material as needed	300	250	1) If the desired plowing/ treatment frequency cannot be maintained, the spread rate can be increased to 500 lbs/lane-mi to accommodate longer operational cycles 2) If sufficient moisture is present, solid material without prewetting can be applied
Below 15°F, steady or falling	Dry or light snow cover	Plow as needed			Plow as needed			1) It is not recommended that chemicals be applied in this temperature range 2) Abrasives can be applied to enhance traction

Notes

MIX RATIO APPLICATIONS: (1) Time initial and subsequent material applications to prevent deteriorating conditions or development of packed and bonded snow -- timing and frequency of subsequent applications will be determined primarily by plowing requirements. (2) Apply material ahead of traffic rush periods occurring during storm.

PLOWING: Plow before material applications so that excess snow, slush, or ice is removed and pavement is wet, slushy, or lightly snow covered when treated.

Table 11. Weather event: Frost or Black Ice

[All application rates are based on a single travel lane, double rate for centerline treatments]

PAVEMENT TEMPERATURE RANGE, TREND, AND RELATION TO DEW POINT	TRAFFIC CONDITION	INITIAL OPERATION			SUBSEQUENT OPERATIONS			COMMENTS
		maintenance action	material spread rate, lbs/snow lane-mi		maintenance action	material spread rate, lbs/snow lane-mi		
			dry	prewetted solid		dry	prewetted solid	
Above 32°F, steady or rising	Any level	See comments			See comments			Monitor pavement temperature closely; begin treatment if temperature starts to fall to 32oF or below and is at or below dew point
28 to 35°F, remaining in range or falling to 32oF or below, and equal to or below dew point	Traffic rate less than 100 vehicles per hr	Apply dry or prewetted solid material	120	25-65	Reapply dry or prewetted solid material as needed	120	100	1) Monitor pavement closely; if pavement becomes wet or if thin ice forms, reapply material at higher indicated rate 2) Do not apply liquid chemical on ice so thick that the pavement cannot be seen
	Traffic rate greater than 100 vehicles per hr	Apply dry or prewetted solid material	120	25-65	Reapply dry or prewetted solid material as needed	120	100	
20 to 28°F, remaining in range, and equal to or below dew point	Any level	Apply dry or prewetted solid material	150	65-130	Reapply dry or prewetted solid material when needed	150	120	1) Monitor pavement closely; if thin ice forms, reapply material at higher indicated rate 2) Applications will need to be more frequent at higher levels of condensation; if traffic volumes are not enough to disperse condensation, it may be necessary to increase frequency 3) It is not advisable to apply a liquid chemical at the indicated spread rate when the pavement temperature drops below 23°F
15 to 20°F, remaining in range, and equal to or below dew point	Any level	Apply dry or prewetted solid material	200	150-200	Reapply dry or prewetted solid material when needed	200	150	1) Monitor pavement closely; if thin ice forms, reapply material at higher indicated rate 2) Applications will need to be more frequent at higher levels of condensation; if traffic volumes are not enough to disperse condensation, it may be necessary to increase frequency
Below 15°F, steady or falling	Any level	Apply abrasives			Apply abrasives as needed			It is not recommended that chemicals be applied in this temperature range

Notes

TIMING: (1) Conduct initial operation in advance of freezing. Apply liquid chemical up to 3 h in advance. Use longer advance times in this range to effect drying when traffic volume is low. Apply pre-wetted solid 1 to 2 h in advance. (2) In the absence of precipitation, liquid chemical at 75 gal/lane-mi has been successful in preventing bridge deck icing when placed up to 4 days before freezing on higher volume roads and 7 days before on lower volume roads.

Table 12.
Weather event: Freezing Rain Storm

[All application rates are based on a single travel lane, double rate for centerline treatments]

PAVEMENT TEMPERATURE RANGE AND TREND	INITIAL OPERATION		SUBSEQUENT OPERATIONS		COMMENTS
	maintenance action	material spread rate, lbs/snow lane-mi	maintenance action	material spread rate, lbs/snow lane-mi	
Above 32°F, steady or rising	See comments		See comments		1) Monitor pavement temperature closely for drops toward 32°F and below 2) Treat icy patches if needed with prewetted solid material at 75-100 lb/lane-mi
Above 32°F, 32oF or below is imminent	Apply dry or prewetted solid material	125	Reapply dry or prewetted solid chemical as needed	125	Monitor pavement temperature and precipitation closely
20 to 32°F, remaining in range	Apply dry or prewetted solid material	125-325	Reapply dry or prewetted solid chemical as needed	125-375	1) Monitor pavement temperature and precipitation closely 2) Increase spread rate toward higher indicated rate with decrease in pavement temperature or increase in intensity of freezing rainfall 3) Decrease spread rate toward lower indicated rate with increase in pavement temperature or decrease in intensity of freezing rainfall
15 to 20°F, remaining in range	Apply dry or prewetted solid material	250-400	Reapply dry or prewetted solid chemical as needed	250-400	1) Monitor precipitation closely 2) Increase spread rate toward higher indicated rate with increase in intensity of freezing rainfall 3) Decrease spread rate toward lower indicated rate with decrease in intensity of freezing rainfall
Below 15°F, steady or falling	Apply abrasives		Apply abrasives as needed		It is not recommended that chemicals be applied in this temperature range

Notes

MIX RATIO:

APPLICATIONS: (1) Time initial and subsequent material applications to prevent glaze ice conditions. (2) Apply material ahead of traffic rush periods occurring during storm.

Table 13.
Weather event: Sleet Storm

[All application rates are based on a single travel lane, double rate for centerline treatments]

PAVEMENT TEMPERATURE RANGE AND TREND	INITIAL OPERATION		SUBSEQUENT OPERATIONS		COMMENTS
	maintenance action	material spread rate, lbs/snow lane-mi	maintenance action	material spread rate, lbs/snow lane-mi	
Above 32°F, steady or rising	None, see comments		None, see comments		1) Monitor pavement temperature closely for drops toward 32°F and below 2) Treat icy patches if needed with prewetted solid material at 125 lbs/lane-mi
Above 32°F, 32°F or below is imminent	Apply dry or prewetted solid material	125	Plow as needed, Reapply dry or prewetted solid chemical when needed	125	Monitor pavement temperature and precipitation closely
28 to 32°F, remaining in range	Apply prewetted solid material	125-325	Plow as needed, Reapply dry or prewetted solid chemical when needed	125-325	1) Monitor pavement temperature and precipitation closely 2) Increase spread rate toward higher indicated rate with increase in sleet intensity 3) Decrease spread rate toward lower indicated rate with decrease in sleet intensity
15 to 28°F, remaining in range	Apply dry or prewetted solid material	250-400	Plow as needed, Reapply dry or prewetted solid chemical when needed	250-400	1) Monitor precipitation closely 2) Increase spread rate toward higher indicated rate with decrease in pavement temperature or increase in sleet intensity 3) Decrease spread rate toward lower indicated rate with increase in pavement temperature or decrease in sleet intensity
Below 15°F, steady or falling	Plow as needed		Plow as needed		1) It is not recommended that chemicals be applied in this temperature range 2) Abrasives can be applied to enhance traction

Notes

MIX RATIO APPLICATIONS: (1) Time initial and subsequent material applications to prevent the sleet from bonding to the pavement. (2) Apply material ahead of traffic rush periods occurring during storm.

Appendix I - Taper Log

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COUNTY TRUCK TRACKING SHEET

DATE: _____ Shift: AM PM

OPERATOR: _____ Work Start Time: _____

TRUCK NO: _____ Work Stop Time: _____ FOREMAN: _____

STOCKPILE: _____ Total Work Hours: _____

FOR OFFICE USE ONLY

Taper Log ID Number: _____

ROUTES	TIME OUT	SURFACE TEMP	TIME IN	614 Miles Beginning Odometer	614 Miles Ending Odometer	SERVICE TYPE	MIX CODE	MATERIAL USED (TONS)	LIQUID TYPE	LIQUID USED (GAL)	Stockpile Material Came From	STORM TYPE	RCRS ROAD COND.	COMMENTS
1														
2														
3														
4														
5														

SERVICE TYPE	
AI	Pretreat / Anti-Ice
DI	De-Icing
CL	Cleanup/Widening After Storm
PO	Plow Only (Tandem Team)
PS	Plow & Spread
SO	Spread Only
PA	Patrolling
SS1	Spot Spreading 25%
SS2	Spot Spreading 50%
SS3	Spot Spreading 75%

MIX CODES					
A	100 % A	G	25 A / 75 S		
B	90A / 10S	H	100% S		
C	75A / 25S	J	80 A / 20 S		
D	67A / 33S	W	SALT BRINE		
E	50A / 50S	Y	CA. CL.		
F	33A / 67S	Z	MAG. CL.		

STORM TYPE	
1	Snow
2	Frost/Black Ice
3	Freezing Rain
4	Pre Storm
5	Drifting/Post Storm

RCRS ROAD CONDITIONS	
1	Clear and Dry
2	Clear and Wet
3	Snow and/or Slush Covered Tracks Exposed
4	Snow and/or Slush Covered
5	Icy
6	Impassable/Closed

EQUIPMNET CHECKLIST	
Verify All Lights OK	
Chains On/Off	
Plow Inspected (Pre-Trip)	
Plow Inspected (Pre-Trip)	

SPREADER INFO				
Mix				
Spread Lbs				
Miles Driven				
% in Auto				
Avgs. Lbs/Mile				

NOTE:
A NEW SHEET MUST BE STARTED IF YOU WORK PAST MIDNIGHT