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Winter Weather Response Guide

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Cooperative Research Program

PRAIRIE VIEW A&M UNIVERSITY
PRAIRIE VIEW, TEXAS

TEXAS A&M TRANSPORTATION INSTITUTE
COLLEGE STATION, TEXAS

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WINTER WEATHER RESPONSE GUIDE

by

Judy A. Perkins, Ph.D., PE
Professor
Prairie View A&M University

Jodi Carson, Ph.D., PE
Research Engineer
Texas A&M Transportation Institute

Judith Mwakalong, Ph.D., EIT
Post Doctoral Researcher
Prairie View A&M University

Kwaku Obeng-Boampong
Assistant Research Engineer
Texas A&M Transportation Institute

Debbie Jasek
Research Specialist
Texas A&M Transportation Institute

Geza Pesti, Ph.D., PE
Associate Research Engineer
Texas A&M Transportation Institute

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PRAIRIE VIEW A&M UNIVERSITY
PRAIRIE VIEW, TEXAS 77446

TEXAS A&M TRANSPORTATION INSTITUTE
COLLEGE STATION, TEXAS 77843

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Chapter 1
How to Use This Guide

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Section 1
Overview

The Texas Department of Transportation (TxDOT) is responsible for the planning, design, construction, operation, and maintenance of the State Highway System. With few new highways being constructed, the operation and maintenance of existing facilities has become more important. Increasing traffic volumes and higher public expectations challenge effective highway operations and maintenance in Texas. The *Winter Weather Response Guide* is intended to encourage consistent, cost-effective practices that proactively respond to dynamic weather conditions and maximize the use of the State's limited assets.

Scope

The purpose of this guide is to develop consistent practices that focus on a proactive approach to snow and ice control across the state. In addition to responding in a timely manner to a snow and ice event, best management practices highlighted in this guide will aid maintenance personnel in developing the best snow and ice control strategies.

General Guidance

The *Winter Weather Response Guide* includes general guidance related to effective winter weather response and provides an opportunity for TxDOT personnel to supplement with District-specific information. The general guidance provided in the *Winter Weather Response Guide* can be categorized into the following three activity timelines:

- Preparedness activities including the collection of incoming weather-related information, coordination and pre-planning within and outside TxDOT, and asset (equipment and personnel) management.
- Response during a weather event including coordination within and outside TxDOT and recommended preventative, advisory, control, and treatment actions.
- Recovery activities including reporting and after-action reviews.

The general guidance provided in the body of the *Winter Weather Response Guide* is not, however, sufficient in addressing the unique needs of each TxDOT District. Each locale experiences different types and durations of adverse weather events. Furthermore, personnel in each TxDOT District manage a unique network of roadways, interact with a distinctive set of State and local agency personnel, and have varied sets of resources to utilize during winter weather events.

As such, personnel in each TxDOT District should supplement the *Winter Weather Response Guide* with detailed District-specific plan to meet their particular winter weather response needs. District personnel are encouraged to insert (1) a regional map of the roadway network designating priorities for response, (2) a list of personnel/agency contacts within and outside TxDOT, (3) a list of available equipment and materials (or other assets), and (4) other supporting

information into a template found in Appendix A such that both general and District-specific information directing winter weather response are wholly contained within the *Winter Weather Response Guide.* Examples of these additional District-specific informational items are provided in Appendices B and C.

Identifying State of the Practice

Throughout the guide examples of best practices for that specific topic are found in highlighted sidebar boxes. Each best practice box is highlighted by the symbol of a winter weather precipitation cloud.

Section 2
Organization of the Guide

The *Winter Weather Response Guide* is organized as follows:

Chapter 1, How to Use the Guide: Provides the intent, scope, and organization of the Guide.

Chapter 2, Introduction: Provides an overview and highlight of the guide.

Chapter 3, Winter Weather Typical Trends and Forecasting: Provides an overview of winter weather in Texas, State and District level trends and patterns in winter storms.

Chapter 4, Organization: Provides information about organizational responsibilities of responders and the command, control, communications, and coordination efforts at the Region, District, Area, and Maintenance Sections Levels.

Chapter 5, District Level and Maintenance Section Operations Guidance: Provides information about operations during all phases of a winter weather event (preparedness, response, and recovery).

Chapter 6, Multi-District Operations: Provides information for multi-district operations including information about operations during all phases of a winter weather event (preparedness, response, and recovery), deployment and redeployment plans are also emphasized.

Chapter 7, Winter Weather Equipment and Maintenance Considerations: Provides an overview of considerations regarding equipment and maintenances needed to successfully combat winter storms including regional support services, equipment inventory reporting, and equipment visibility. The chapter also discusses district level assets and equipment calibration considerations.

Chapter 8, Winter Weather Chemicals and Materials: Provides information about the different types of chemicals and materials used in snow and ice control, as well as chemical inventory reporting, recommendations for their use, the types of testing (if any) necessary for each, and the environmental considerations to keep in mind when using chemicals.

Chapter 9, Bridge Maintenance Needs: Provides information on the special maintenance needs of bridge decks, joints, beams, caps, and columns following the use or storage of anti/de-icing materials.

Chapter 10, Safety Considerations: Provides information on safety considerations regarding personnel and equipment. The chapter discusses tracking employees, crew work hours, protective clothing and equipment, provisions for sleeping and facility accommodations, as well as equipment visibility.

Chapter 11, Training Considerations: Provides information on training at various levels including area offices, district level, maintenance sections, and multi-district level. The chapter includes discussion of manager, supervisor, and operator training as well as cross training for personnel that may be transferred to participate in events away from home district.

Chapter 12, Reporting Requirements and Considerations: Provides information on requirements for federal, state, district, multi-district, and local reporting.

Chapter 13, Alternative Methods: Provides information on connecting with the community and emerging technologies and trends. The chapter discusses methods of preventing or combating snow and ice formation or accumulation on highways and bridges, including snow fences, thermal mapping, heated bridge decks, and various anti-icing and de-icing systems.

Appendix A, Components to a Snow and Ice Plan Template, provides information for snow and ice plans at District and Multi-District level.

Appendix B, Example of 2011 Snow and Ice Plan- Urban District: Provide an example of a snow and ice plan for an urban district.

Appendix C, Example of 2011 Snow and Ice Plan- Rural District: Provide an example of a snow and ice plan for a rural district.

Chapter 2
Introduction

Contents:

Section 1
Overview

The Texas Department of Transportation (TxDOT) has been given statutory authority for the planning, design, construction, operation, and maintenance of the State Highway System. With few new highways being constructed, the operation and maintenance of existing facilities has become more important. Increasing traffic volumes and higher public expectations challenge effective highway operations and maintenance in Texas.

A key highway maintenance responsibility is winter weather response. Under adverse weather conditions—including rain and flooding, snow and ice, low visibility, hurricane, and high winds—TxDOT maintenance personnel strive to balance traveler mobility and safety.

Snow and ice control is performed as necessary to facilitate the safe, effective, and efficient movement of people and goods in accordance with best management practices. What are best management practices for effective snow and ice control? Although many factors are involved, timing is critical. The time and effort required plowing or clearing roadways dramatically increases once snow and ice bond to the roadway. TxDOT must prepare in advance and make a timely response to snow and ice event with trained personnel, fully functioning and well-maintained equipment, adequate supplies of sand, salt, or other materials, and methods for communicating with one another as well as the traveling public.

Section 2
Priorities

Snow and Ice Operations Priorities

The maintenance of Texas highways is increasingly challenged in that higher public expectations and increasing traffic are complicating operations. To maintain satisfactory service levels, TxDOT must strive for maximum effectiveness from its crews, equipment, and materials. The snow and ice program is no exception.

The priorities for snow and ice operations are:

1. Known trouble spots, such as bridge decks, steep grades, sharp curves, intersections, and approaches to railroad crossings.
2. Heavily traveled sections of streets and highways.
3. Lighter traveled sections of streets and highways.

Road Closures

When it becomes apparent that a road section will need to be closed because of snow or ice, the Department of Public Safety (DPS) or local law enforcement jurisdiction should be asked to officially close the road. Notice should be given to all news media and appropriate officials. For highways crossing district(s) or state line(s), the closure should be coordinated with the appropriate counterparts.

Where practical, signs should be erected to advise traffic. After road closure signs are erected, a trip should be made through the closed area to ascertain that no one is stranded in the closed section.

Railroad Grade Crossing

When plowing the highway, piles of snow should not be left at railroad grade crossings. After plowing, the rail should be cleaned of the snow pack, ice, gravel, or dirt.

Chapter 3
Winter Weather Trends and Forecasting

Contents:

Section 1

Importance of Accurate Weather Information

Effective snow and ice control operations require a good understanding of state- and district-level weather patterns and trends, access to reliable weather forecasts, and the availability of accurate real-time weather information.

Knowledge of state- and district-level weather patterns and trends is useful in preparing long-term snow and ice control plans, effectively allocating available resources, and making purchasing decisions for anti- and de-icing materials, major and minor equipment, and parts. This information can also be used by district maintenance offices to coordinate the movement of personnel and equipment to areas that are expected to be the hardest hit based on historical storm data.

The decision to begin snow and ice treatment requires weather forecast information for your area. Access to reliable forecast, including temperature and various forms of precipitation, is extremely important, because it influences to a large degree the type of treatment, material choice and application rate. Maintenance supervisors have a number of alternative sources where they can find accurate weather forecasts to help determine when to begin snow and ice control measures.

Local news stations' daily broadcasts generally provide the initial warning that adverse conditions are expected. Monitoring these broadcasts can provide vital information on when to begin preparations.

This chapter provides information on available weather data sources, state- and district level winter weather trends and patterns, and definitions of National Weather Service (NWS) advisories and warnings.

Section 2
Winter Weather Information

Weather Forecast Information

The most up-to-date weather forecasts and real-time storm data information can typically be obtained from the NWS. Additionally, weather information is also provided by or can be gathered from other sources such as the media, law enforcement, and/or other government agencies, typically those dealing with emergency management, private companies, individuals, etc.

NWS Products and Services

The NWS is a good source for regional and national information on approaching adverse weather conditions. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community. The NWS home page can be found at http://weather.gov. Weather forecasts, radar and satellite images, tabulated and graphical weather information are available here. Caution should be taken when using any radar or satellite images, since training and education are required to know exactly what is being shown.

While NWS offices cover larger areas and tend to be regional, a good working relationship with their office and personnel can be helpful. They have trained expert staff and will provide more specific information upon request.

Both the NWS and local news stations target a wide gamut of weather users, including agricultural, marine, and aviation interests. Consequently, the NWS may not be specific enough for some maintenance supervisors who have more advanced equipment available to use in their snow and ice control efforts. For example, districts equipped with Roadway Weather Information System (RWIS) stations and deicing and anti-icing capabilities require more specific weather forecasts.

Internet Websites

Internet websites are becoming more advanced as technology becomes available. It is important to become familiar with what is available for advance preparations as the winter months approach. Knowing how and where to access these sites may be of benefit during other times of the year, as well. Some of the more common sites and the information they provide are listed below:

http://www.roadweather.com - Surface road conditions from participating states.
http://www.accuweather.com/wx/index.htm - Accuweather - Forecasts, radar & satellite.
http://www.intellicast.com - Intellicast – Forecasts, radar & satellite.
http://www.wunderground.com - Underground Weather – Forecasts, radar, satellite.
http://www.rap.ucar.edu/weather/radar - Real-Time Weather Data – Forecasts, radar, satellite.

These sites require Internet access and are free of charge.

Private Forecasting Services

There are also weather forecast services available through private companies. While these services are used in other parts of the country, generally they have not proven effective for TxDOT. If private forecasting services are deemed necessary, they should be contracted through established contracting procedures.

Archived Weather Data

To determine regional weather patterns as well as short- or long-term trends, historical weather data are needed. The National Climatic Data Center (NCDC) is a widely used source for historical weather events in the US. The NCDC storm data, published by the National Oceanic and Atmospheric Administration (NOAA), documents:

- The occurrence of storms and significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce.
- Rare, unusual, weather phenomena that generate media attention.
- Other significant meteorological events, such as record maximum or minimum temperatures or precipitation that occur in connection with another event.

Best Practice
Historical weather data can be used to determine weather patterns and trends.

Note that storms are reported not by county, but weather zones defined by NWS. In Texas there are 254 counties and 262 weather zones. Although most weather zones follow county boundaries, it is possible for a county (or a District) to be in multiple zones. The largest variation between weather zone and county boundaries are found in the El Paso and Odessa Districts as shown in Figure 3-1.

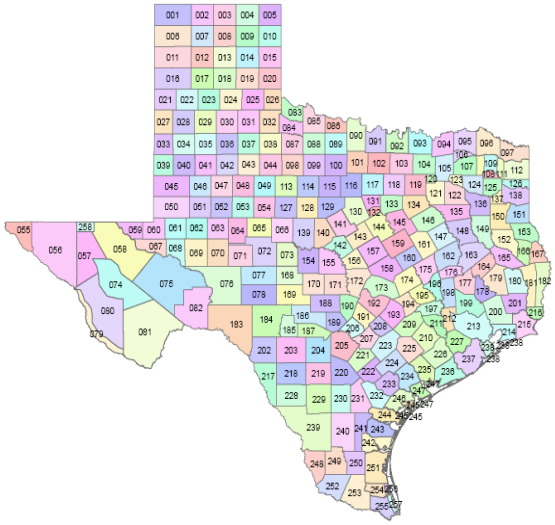
Texas Counties	NWS Weather Zones
	

Figure 3-1. Comparison of NWS Weather Zones and Texas Counties.

Storm Classification

The NCDC classifies winter storms and ice storms into 14 categories. The definitions of each of the 14 categories along with the source are outlined in Table 3-1. Some of the definitions were extracted from NOAA and some from the American Meteorological Society's (AMS) Glossary of Meteorology.

Table 3-1. Storm Types and Definitions.

No	Storm Type	Description	Source
1	Winter Storm	Winter weather event that has more than one significant hazard (i.e., heavy snow and blowing snow; snow and ice; snow and sleet; sleet and ice; or snow, sleet and ice) and meets or exceeds locally/regionally defined 12 and/or 24 hour warning criteria for at least one of the precipitation elements, on a widespread or localized basis.	NOAA website
2	Winter Weather Mix	Refers to a mixture of freezing rain, ice pellets, and snow.	AMS
3	Ice Storm	Ice accretion meeting or exceeding locally/regionally defined warning criteria (typical value is 1/4 or 1/2 inch or more), on a widespread or localized basis. The *Storm Data* preparer should include the times that ice accretion began, met criteria, and accretion ended.	NOAA website
4	Heavy Snow	Snow accumulation meeting or exceeding locally/regionally defined 12 and/or 24 hour warning criteria, on a widespread or localized basis. This could mean such values as 4, 6, or 8 inches or more in 12 hours or less; or 6, 8, or 10 inches in 24 hours or less. In some heavy snow events, structural damage, due to the excessive weight of snow accumulations, may occur in the few days following the meteorological end of the event.	NOAA website
5	Freezing Rain	Rain that falls in liquid form but freezes upon impact to form a coating of glaze upon the ground and on exposed objects.	AMS
6	Blizzard	A winter storm that produces the following conditions for 3 hours or longer: (1) sustained winds or frequent gusts 30 knots (35 mph) or greater, and (2) falling and/or blowing snow reducing visibility frequently to less than 1/4 mile, on a widespread or localized basis.	NOAA website
7	Winter Weather	A winter precipitation event that causes a death, injury, or a significant impact to commerce or transportation but does not meet locally/regionally defined warning criteria. A Winter Weather event could result from one or more winter precipitation types (snow, or blowing/drifting snow, or freezing rain/drizzle), on a widespread or localized basis.	NOAA website
8	Ice/Snow	A storm mechanism involving ice and snow cover.	AMS
9	Freezing Drizzle	Drizzle that falls in liquid form but freezes upon impact to form a coating of glaze. The physical cause of this phenomenon is the same as that for freezing rain.	AMS
10	Glaze	(Also called glaze ice, glazed frost, verglas.) A coating of ice, generally clear and smooth, formed on exposed objects by the freezing of a film of super cooled water deposited by rain, drizzle, fog, or possibly condensed from super cooled water vapor.	AMS
11	Sleet	Grains of ice, generally transparent, globular, solid grains of ice that have formed from the freezing of raindrops or the refreezing of largely melted snowflakes when falling through a below-freezing layer of air near the earth's surface.	AMS
12	Sleet Storm	The majority of the precipitation is sleet (frozen precipitation, consisting of small transparent ice pellets) and it falls for several hours.	Weather Prediction website
13	Freezing Fog	Fog that freezes on contact with exposed objects and forms a coating of rime and/or glaze, on a widespread or localized basis, resulting in an impact on transportation, commerce, or individuals. Freezing fog can occur with any visibility of 6 miles or less.	NOAA website
14	Frost/Freeze	A surface air temperature of 32 degrees Fahrenheit (F) or lower, or the formation of ice crystals on the ground or other surfaces, over a widespread or localized area for a period of time long enough to cause human or economic impact, during the locally defined growing season.	NOAA website

Section 3

Winter Weather Trends and Patterns

This section provides recent information on state- and district-level weather patterns and trends. The information is based on the analysis of all winter weather events that occurred in Texas over the 10 year period of 2000–2010. All storm data were gathered from the NCDC database.

State-Level Trends and Patterns

Storm Distribution

During the period of 2000–2010, a total of 642 winter weather events were recorded in the NCDC database for Texas. Their distribution, depicted in Figure 3-2 and Table 3-2, shows that winter weather event has the highest frequency followed by heavy snow. Winter weather, winter storm, and heavy snow events account for more than 80 percent of the total storms. Only one event was recorded in each of the freezing rain, freezing fog, sleet storm, and ice/snow categories, and no freezing drizzle or glaze was reported. The very low percentages in these categories do not imply that, the state had none or only one of these storm types. It rather means that some events are either not reported or reported in another storm category. For example, freezing rain may be incorporated into "winter weather" and "winter weather mix."

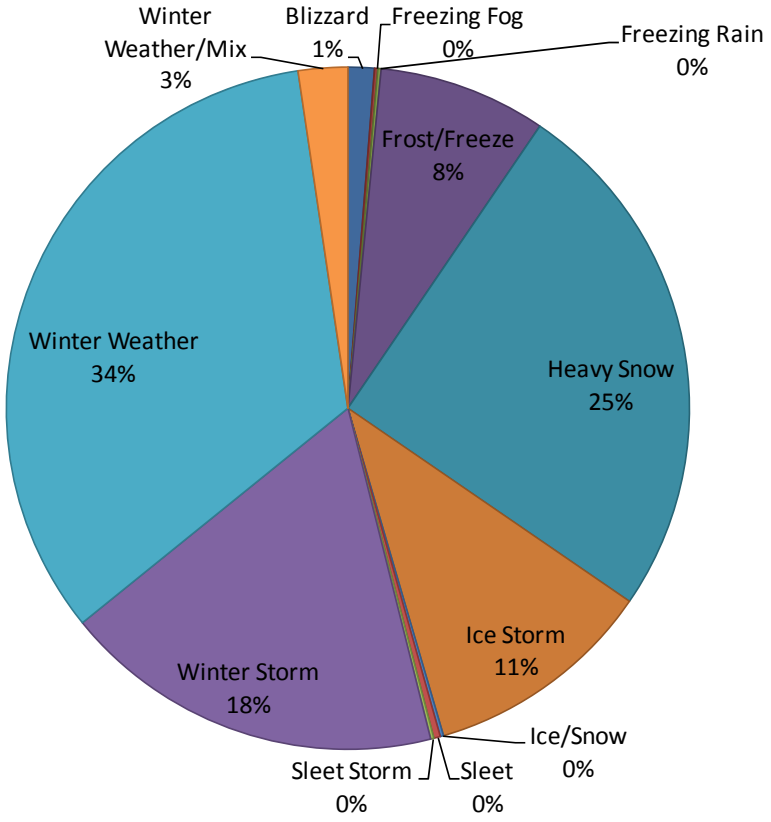


Figure 3-2. Distribution of Reported Winter Weather Events in Texas (2000–2010).

Table 3-2. Frequencies of Reported Winter Weather Events in Texas (2000–2010).

Storm Type	Year											Total
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Blizzard	0	0	0	0	0	0	1	0	0	7	0	8
Freezing Rain	0	1	0	0	0	0	0	0	0	0	0	1
Heavy Snow	5	7	4	2	20	7	28	24	2	9	53	161
Ice Storm	8	1	1	0	1	4	3	41	1	8	2	70
Ice/Snow	0	0	1	0	0	0	0	0	0	0	0	1
Winter Storm	7	6	6	3	6	6	11	35	8	24	4	116
Winter Weather	0	0	0	0	0	0	30	46	44	56	39	215
Winter Weather/Mix	0	0	0	1	10	2	2	0	0	0	0	15
Freezing Fog	0	0	0	0	0	0	0	1	0	0	0	1
Frost/Freeze	0	0	0	0	0	0	0	0	4	9	38	51
Sleet	0	0	0	0	0	0	0	1	0	0	1	2
Sleet Storm	0	0	0	0	1	0	0	0	0	0	0	1
Total	20	15	12	6	38	19	75	148	59	113	137	642

Time of Day when Storm Is Likely to Occur

Information on the time of day when different storm types are likely to occur is useful for maintenance supervisors who oversee battling of the storm. If most storms occur during nighttime then the District needs to prepare adequate visibility tools to insure crew safety and proper operation. Further, this helps determine the need and duration of shifts for maintenance crews.

Best Practice

Storm duration and time of day information can help estimate the time that a crew may spend battling a storm within their own jurisdiction or helping other counties/districts.

Time of day can be categorized into early morning (12AM-6AM), mid-morning (<6AM-12PM), afternoon (<12PM-6PM), and night (<6PM-12AM). Storms can be classified by these four categories depending on when the storm begins. Based on the storm data from 2000 through 2010, most storms are expected to occur in the morning. For example, 50 percent of blizzard events occurred in the early morning. In general, 60 percent of most storm types are likely to begin during the early or late morning.

Storm Duration Distribution

Distribution of storm duration measured in hours from the beginning to the end of the storm is also important to both maintenance supervisors and crews. It assists supervisors in estimating the time that a crew may spend battling a storm within their own jurisdiction or helping other counties and districts. Further, knowing expected storm durations may help in planning for necessities that maintenance crews need while in the field battling storms. Figure 3-3 shows the average storm duration in descending order for the analysis period. The results indicate that ice

storms have the longest expected duration (more than 31 hours) whereas sleet storm has the shortest (1 hour).

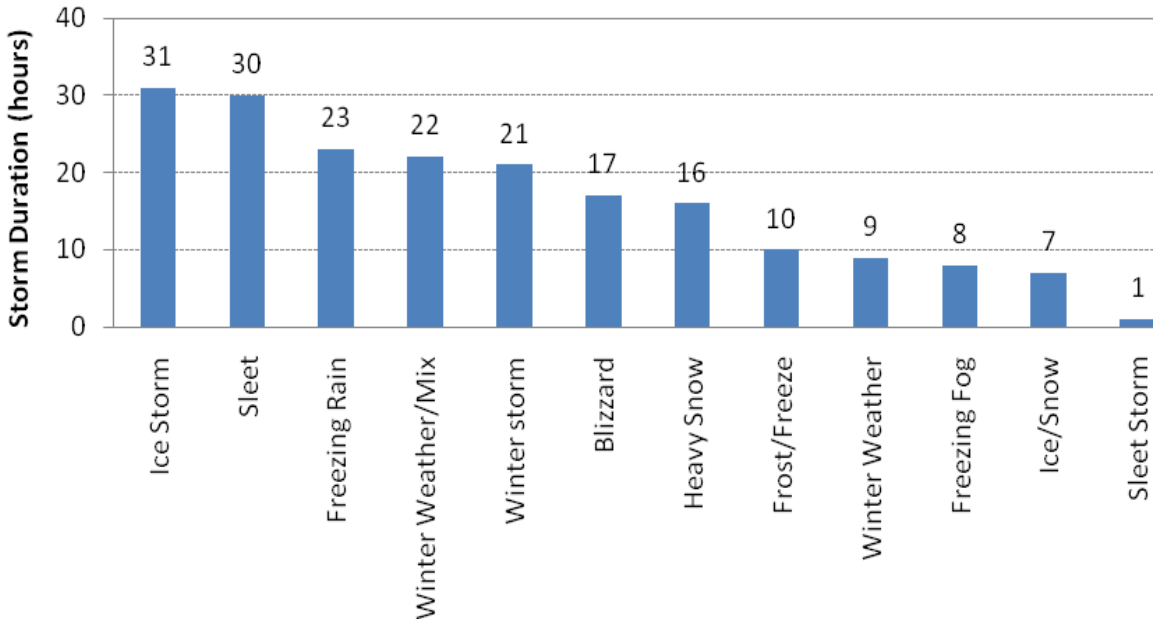


Figure 3-3. Average Storm Duration in Texas (2000–2010).

Number of Counties Affected

The number of counties affected by a storm is a data element that is available in the NCDC database. It may be used for estimating the expected spatial coverage of each storm type based on the analysis of historical storm data. This information may help TxDOT Districts determine the appropriate or optimal allocation and positioning of winter weather equipment and materials. This may, in turn, save hauling time between storage and treatment areas.

Best Practice
Information on the expected number of counties affected by the storm may help determine the appropriate or optimal allocation and positioning of winter weather equipments and materials.

Figure 3-4 shows the average number of counties affected by each storm type based on storm data during the period of 2000 through 2010. These results indicate that winter weather mix is expected to have an effect on the largest area, whereas sleet storms involve the smallest area.

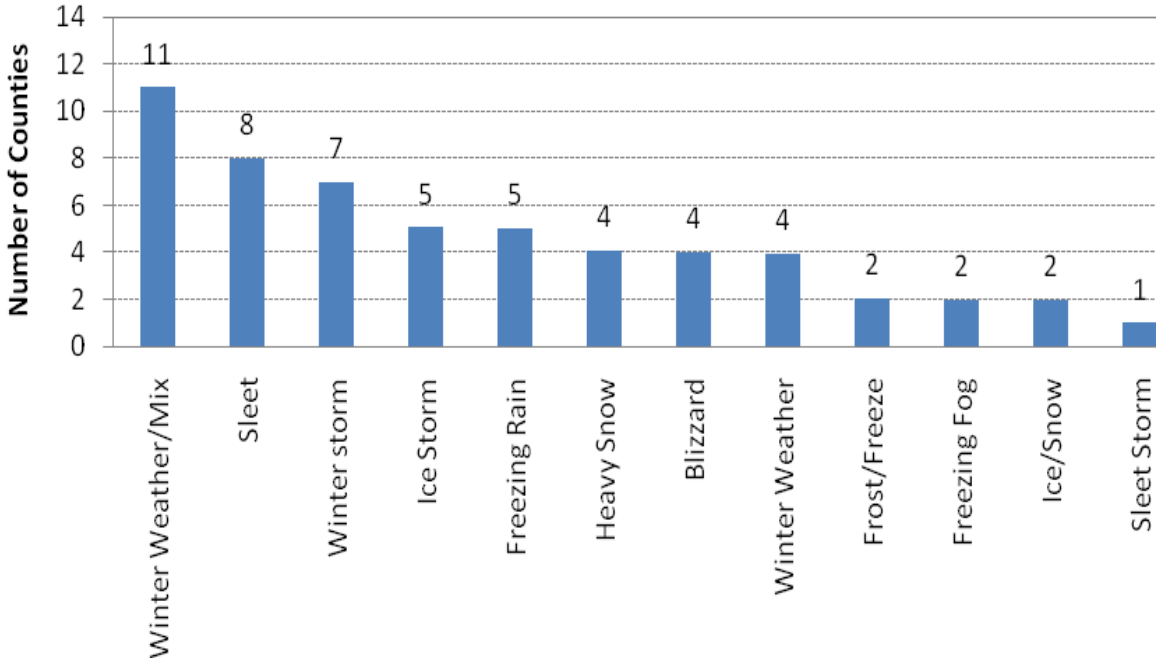


Figure 3-4. Average Number of Counties Affected by Storms in Texas (2000–2010).

District-Level Trends and Patterns

The relative frequency of different storm types within each of the 25 TxDOT Districts is depicted in Table 3-3. This information can assist Districts in developing plans for storm types that are most likely to impact their area, and identify the required resources to battle such storms. For example in Amarillo, heavy snow constitutes more than 60 percent of the total storm events for the analysis period. In Austin, winter storm constitutes more than 90 percent of the total storm events for the analysis period and more than 5 percent constitutes winter weather.

Best Practice
Storm type distributions help develop plans for the most likely storm events in the district, and identify required resources to battle such storms.

From a regional perspective, the west region accounts for more than 54 percent and the north region accounts for more than 33 percent of all storms in the state.

Table 3-3. Relative Frequencies of Storm Types in Percent (2000–2010).

	Winter storm	Winter Weather Mix	Ice Storm	Heavy Snow	Freezing Rain	Blizzard	Winter Weather	Ice/Snow	Frost/Freeze	Sleet	Sleet Storm	Freeze Fog
Abilene	25	4	13	23			32				3	
Amarillo	12	5	13	63			4					3
Atlanta	2	14	37	11		5	32					
Austin	96						4					
Beaumont	38		3	10			48					
Brownwood	38	6	18	15			17				5	
Bryan	33	6	36	16			4				4	
Childress	23	3	9	25			38					1
Corpus Christi				36			54				11	
Dallas	39	9	16	19			17				1	
El Paso	17	8	25	50								
Fort Worth	49	7	15	12			16				1	
Houston	13	6	38	31			13					
Laredo	39			22			28				11	
Lubbock	22	1	7	22			48					
Lufkin		19	27	19			35					
Odessa	24	34	7	18			17					
Paris	41	6	23	17			13					
Pharr		9	1								89	
San Angelo	26	3	22	20			18				10	
San Antonio	80	2	2	9			4				2	
Tyler	27	11	19	27			16					
Waco	38	10	18	18			15				1	
Wichita Falls	31	7	19	14	4		23	1			1	
Yoakum	35		13	23			26				3	

Winter Season by Districts

The winter season is defined as the time period between the first fall and the last spring freezing dates. The length of the winter season is the number of days between these two dates. Reliable estimates on the expected length of a winter season as well as the dates of the first and last freezing days in the season are valuable information that can help TxDOT maintenance supervisors develop effective snow and ice control operations plans. Winter seasons significantly vary by TxDOT Districts, and also by years. To account for the stochastic nature of parameters that determine a winter season, the season boundaries (first and last freezing dates) and season lengths can be predicted based on a time series analyses of historical temperature data.

Table 3-4 provides probabilistic estimates for the length and the dates of when the season begins and ends in the 25 TxDOT Districts. These estimates are based on an analysis conducted by Texas Tech University using temperature time series over the period of 1971 through 2000. The three columns under the "50 percent probability" heading include the median values for winter season length and boundaries. The estimates under the 10 percent probability are more conservative. They include the 90th percentile winter season length (i.e., the probability of a longer season than the estimated length is 10 percent), and the 90th percentile season boundaries (i.e., the probability of freezing before the estimated start date or after the estimated end date of the season is 10 percent). These probabilistic estimates on the onset and duration of winter seasons make it possible to develop effective snow and ice control plans with a specified level of risk tolerance (e.g., 10 percent risk of underestimating winter season length).

Best Practice
Probabilistic estimates on the onset and duration of winter seasons make it possible to develop effective snow and ice control plans with a specified level of risk tolerance.

Spatial Distribution of Typical Winter Storms

Based on interviews with maintenance supervisors and personnel from all 25 TxDOT Districts, the most typical storm categories that the respective Districts have to deal with are the following:

- Mostly Snow.
- Snow and Ice.
- Mostly Ice.
- Ice and Freezing Rain.

Based on its characteristics, freezing rain can be treated as ice, and the last two storm categories may be combined as "Ice and Freezing Rain." The list in Table 3-5 and the map in Figure 3-5 show the spatial distribution of the resulting three typical storm categories among TxDOT districts. The map is useful for TxDOT maintenance personnel for planning, training, and strategizing for winter weather operations.

Best Practice
Storm category maps are useful planning and training tools in winter weather operations.

Table 3-4. Winter Season Data Estimates by District (1971–2000).

TxDOT District	With 50% probability			With 10% probability		
	Length of winter season exceeds (days)	First Fall freeze is before	Last Spring freeze is after	Length of winter season exceeds (days)	First Fall freeze is before	Last Spring freeze is after
Abilene	133	Nov 12	Mar 24	167	Oct 26	Apr 10
Amarillo	181	Oct 20	Apr 18	211	Oct 3	May 1
Atlanta	127	Nov 14	Mar 20	166	Oct 27	Apr 10
Austin	73	Dec 6	Feb 17	121	Nov 15	Mar 15
Beaumont	85	Dec 2	Feb 25	134	Nov 11	Mar 24
Brownwood	135	Nov 11	Mar 25	167	Oct 26	Apr 10
Bryan	94	Nov 29	Mar 2	136	Nov 10	Mar 25
Childress	147	Nov 6	Apr 1	176	Oct 20	Apr 13
Corpus Christi	42	Dec 23	Feb 3	109	Nov 25	Mar 13
Dallas	99	Nov 25	Mar 3	145	Nov 4	Mar 28
El Paso	135	Nov 8	Mar 22	170	Oct 25	Apr 12
Fort Worth	128	Nov 14	Mar 21	163	Oct 28	Apr 8
Houston	92	Nov 30	Mar 1	146	Nov 5	Mar 30
Laredo	66	Dec 5	Feb 9	119	Nov 12	Mar 10
Lubbock	154	Nov 1	Apr 3	180	Oct 17	Apr 14
Lufkin	119	Nov 15	Mar 13	157	Oct 29	Apr 3
Odessa	139	Nov 12	Mar 30	172	Oct 26	Apr 15
Paris	125	Nov 14	Mar 18	161	Oct 28	Apr 6
Pharr	30	Dec 25	Jan 24	91	Nov 25	Feb 24
San Angelo	136	Nov 13	Mar 28	168	Oct 29	Apr 14
San Antonio	95	Nov 25	Feb 28	134	Nov 8	Mar 21
Tyler	146	Nov 7	Apr 1	182	Oct 20	Apr 19
Waco	115	Nov 19	Mar 13	157	Nov 1	Apr 6
Wichita Falls	140	Nov 9	Mar 28	172	Oct 23	Apr 12
Yoakum	87	Dec 2	Feb 27	138	Nov 8	Mar 25

Table 3-5. District Level Storm Events for 2000–2011.

Mostly Snow	Snow & Ice	Mostly Ice & Freezing Rain
Atlanta (*Bowie*) Amarillo Childress El Paso (*Brewster, Presidio*) Lubbock (*Parmer, Castro, Swisher*) Paris (*Grayson, Fannin, Lamar, Red River*) Wichita Falls	Abilene Atlanta Brownwood Bryan (*Freestone, Leon, Madison, Milam, Robertson*) Dallas El Paso Fort Worth Lubbock Paris San Angelo Waco	Austin Beaumont Bryan Corpus Christi Houston Laredo Lufkin Odessa Pharr San Antonio Tyler Yoakum

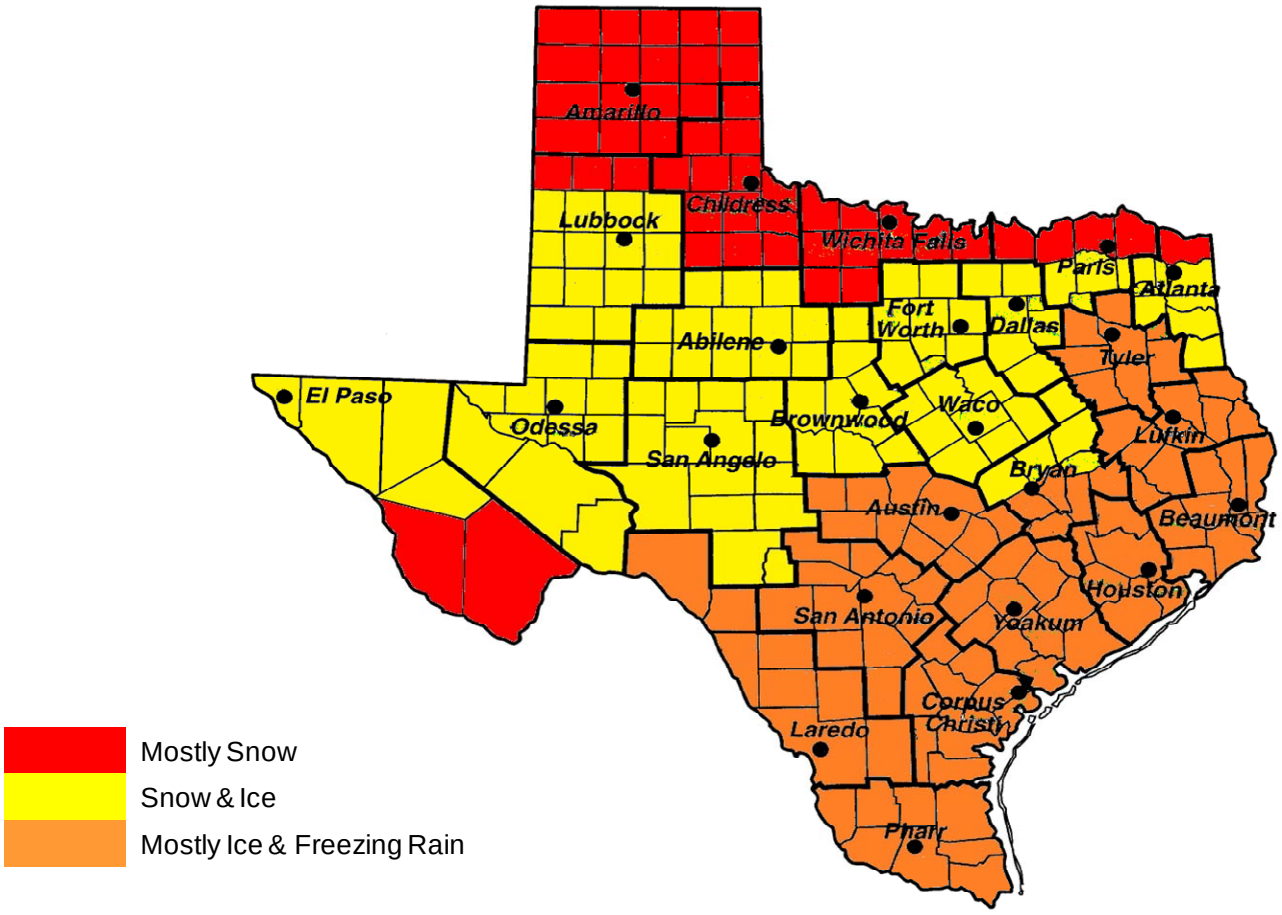


Figure 3-5. Texas Winter Storms Based on Site Visits Conducted in 2011.

Section 4
Advisories and Warnings

Definitions

The National Weather Service is a good source for regional and national information on approaching storms and adverse weather conditions. The NWS system provides the following winter weather related advisories and warnings:

1. Warning

   A weather condition that is life threatening to those caught outdoors.

2. Advisory

   A weather condition that is an inconvenience to people outdoors or can produce difficulty in travel.

3. Winter Storm Watch

   - Issued when conditions are favorable for the development of hazardous winter weather.
   - These conditions may occur singularly, or in combination with others.
   - Usually issued 24 to 48 hours in advance.

4. Winter Storm Warning

   - Issued when life threatening winter weather conditions are imminent or very likely.
   - Includes the occurrence of combinations of snow, ice, wind, and cold.

5. Blizzard Warning

   - Sustained wind or frequent gusts of 35 mph or more.
   - Considerable falling snow and blowing snow frequently reducing visibility to one-quarter mile or less.
   - Conditions last three hours or more.

6. Winter Weather Advisory Issued for Sleet, Snow, Freezing Drizzle/Rain or Blowing Snow

   - Sleet accumulations are expected to be less than one half of an inch.
   - Snowfall of 2 to 5 inches in 12 hours.
   - Light accumulations of freezing drizzle or freezing rain.
   - Blowing snow intermittently reducing visibility to one quarter of a mile.

Section 5
Other Weather Tools

Thermal Mapping for Road Condition Prediction

Another tool used in other parts of the country to predict road conditions is thermal mapping. A combination of local features and how they react to prevailing weather conditions generate a unique signature of each highway. Thermal mapping is used to assist the maintenance supervisor to locate and quantify temperature variations across a roadway network.

Thermal mapping is used in conjunction with RWIS stations and pavement sensors to predict and estimate road temperatures and identify areas that may require advance treatments. Thermal mapping establishes a relationship between variables and how they interact under different weather scenarios. There are a number of private vendors capable of providing this service.

Chapter 4
Organization

Contents:

Section 1

Organizational Structure

The organizational structure consists of activities such as task allocation, coordination, and supervision, which are directed toward the achievement of organizational aims. There are various levels of organizational structure within TxDOT: Division, Region, District, and Area.

Incident Command System

The Incident Command System (ICS) is a standardized, on-scene, all-hazards incident management approach that (1):

- Allows for the integration of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure.
- Enables a coordinated response among various jurisdictions and functional agencies, both public and private.
- Establishes common processes for planning and managing resources.

Whiles the Organizational Structure provides the roles and responsibilities across an agency, the Incident Command System (ICS) provides a more direct structure for dealing with emergencies such as winter weather events. As a system the ICS is extremely useful; not only does it provide an organizational structure for incident management, but it also guides the process for planning, building, and adapting that structure. Using ICS for every incident or planned event helps hone and maintain skills needed for the large-scale incidents (1).

Four levels of ICS should be established within TxDOT for responding to winter weather response. These four levels are:

- Regional.
- District.
- Area Office.
- Maintenance Section.

Section 2

Region

TxDOT's four regional service centers provide administrative and project management support to the Department's 25 Districts. Internal support includes facility, information technology, purchasing, and accounting. For project management, the regions aid in environmental planning, scheduling, metropolitan planning organization coordination, administering Transportation Improvement Program (TIP), and Right-of-Way (ROW) acquisition (2). The four regions are:

- West Region: Abilene, Amarillo, Childress, El Paso, Lubbock, Odessa, San Angelo.
- North Region: Atlanta, Brownwood, Dallas, Fort Worth, Paris, Tyler, Waco, Wichita Falls.
- South Region: Austin, Corpus Christi, Laredo, Pharr, San Antonio, and Yoakum.
- East Region: Beaumont, Bryan, Houston, and Lufkin.

Organizational Structure

Each Region has an organizational structure. Figure 4-1 shows an example organization chart of functional descriptions for the South Region.

Key Personnel

Key personnel involved in winter weather response:

- **Head of ARD Operations**: Oversees several key areas of regional interaction with districts in the event of a winter storm. These areas include fleet management and equipment sharing within the region, equipment purchasing, and training.
- **Fleet Manager**: Coordinates fleet (equipment) management activities between the various districts in the Region.
- **Purchasing:** Coordinates purchases for the Districts materials and supplies to support winter storm operations.

Command and Control

A regional ICS needs to be established to coordinate a region's response to winter weather response. Such an ICS should clearly establish the hierarchy and interaction required to maintain the flow of information between the District and the regional office.

The Region provides the Districts with:

- Fleet Management Support.
- I/T Support.
- Purchasing Support.
- Accounting Support.
- Budget Support.
- Back-up and Relief Support of District Functions.

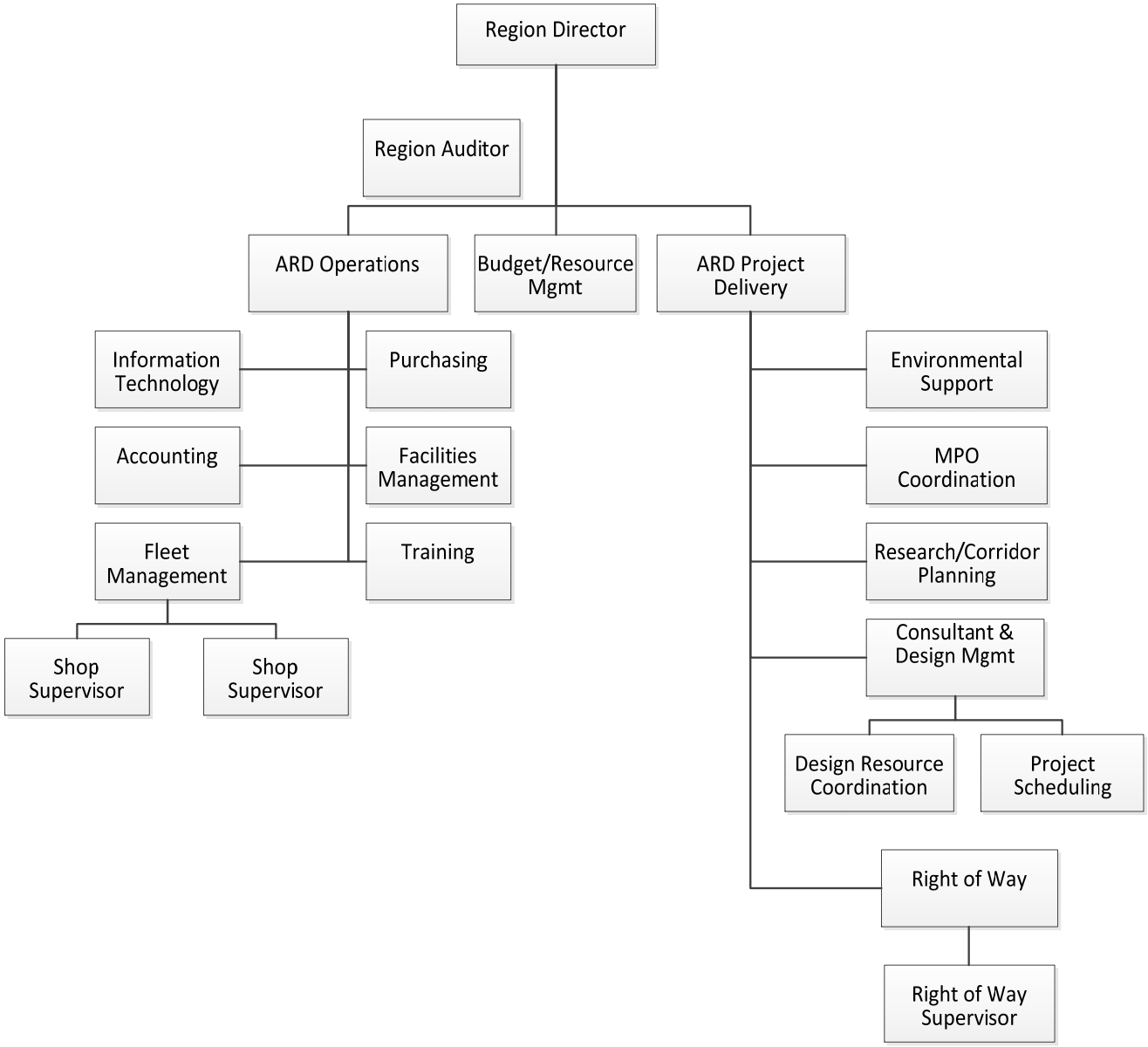


Figure 4-1. Example of a Region Support Center Organizational Chart – South Region.

Communication and Coordination

An example of a general response and coordination processes among district, region, and division personnel for winter weather events and other planned or forecasted emergencies are depicted in Figure 4-2 for the West Region Districts and West Region Support Center (3). The Maintenance Division (MNT) provides logistical and communication assistance to the Regions. They coordinate the statewide operating center (SOC) if needed, for large scale emergency events. More often than not, the MNT is not involved in typical winter weather at the Districts level. Figure 4-3 shows an example of a general response and coordination process that includes the maintenance section and how the section coordinates with the district and the region. For more localized winter weather events, communication and coordination may be wholly contained

within a single District. As the severity and geographic impact of the winter weather event increases, additional communication and coordination at regional and district levels is required.

While the District assignment to a region is based on geographic location, during winter weather operations some Districts can operate more closely with other districts not necessarily in their Region. For instance, the Yoakum District often times coordinates more closely with the Houston District during winter weather events than other districts within the South Region.

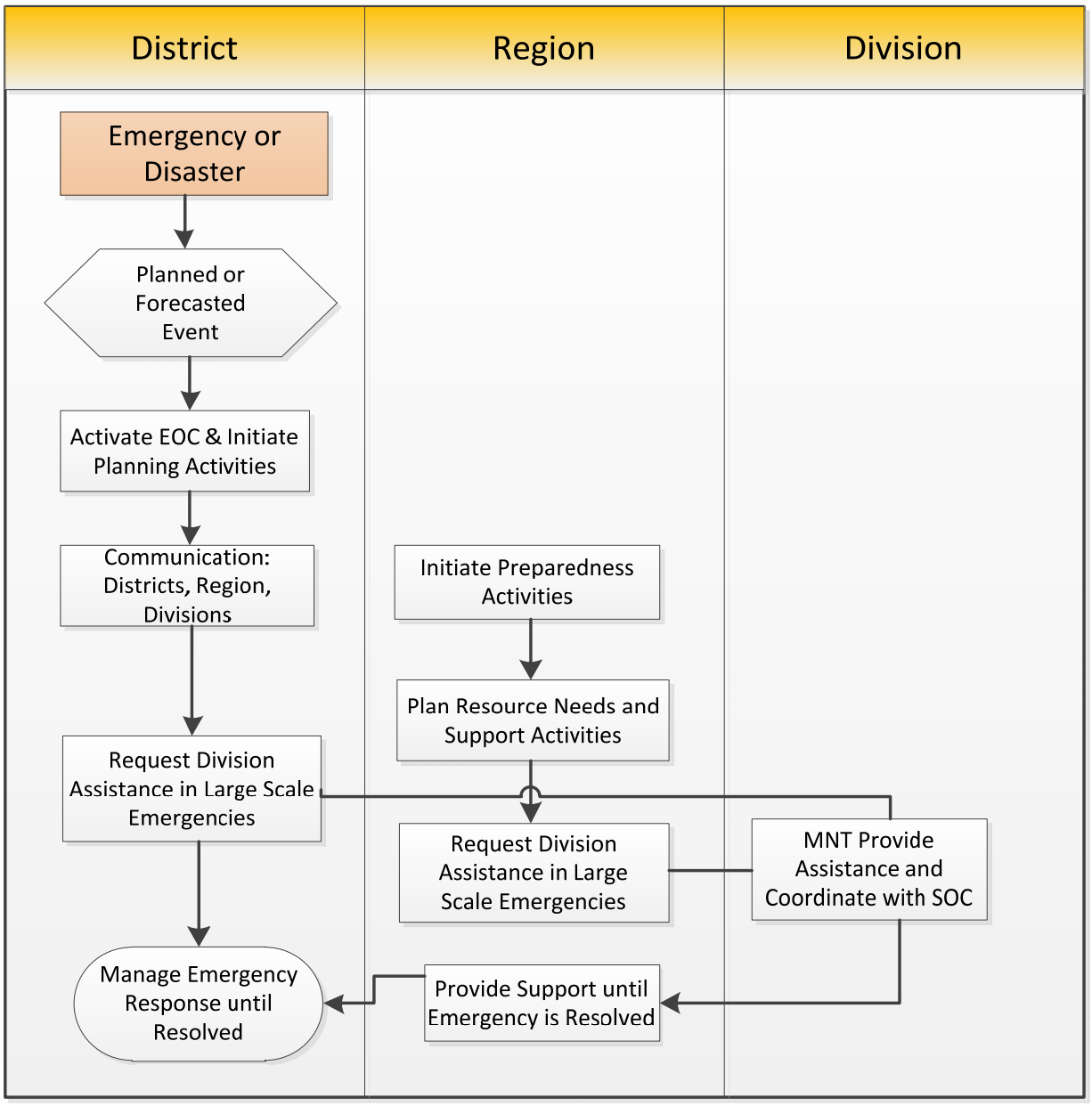


Figure 4-2. Response and Coordination Process among District, Region, and Division Levels (3).

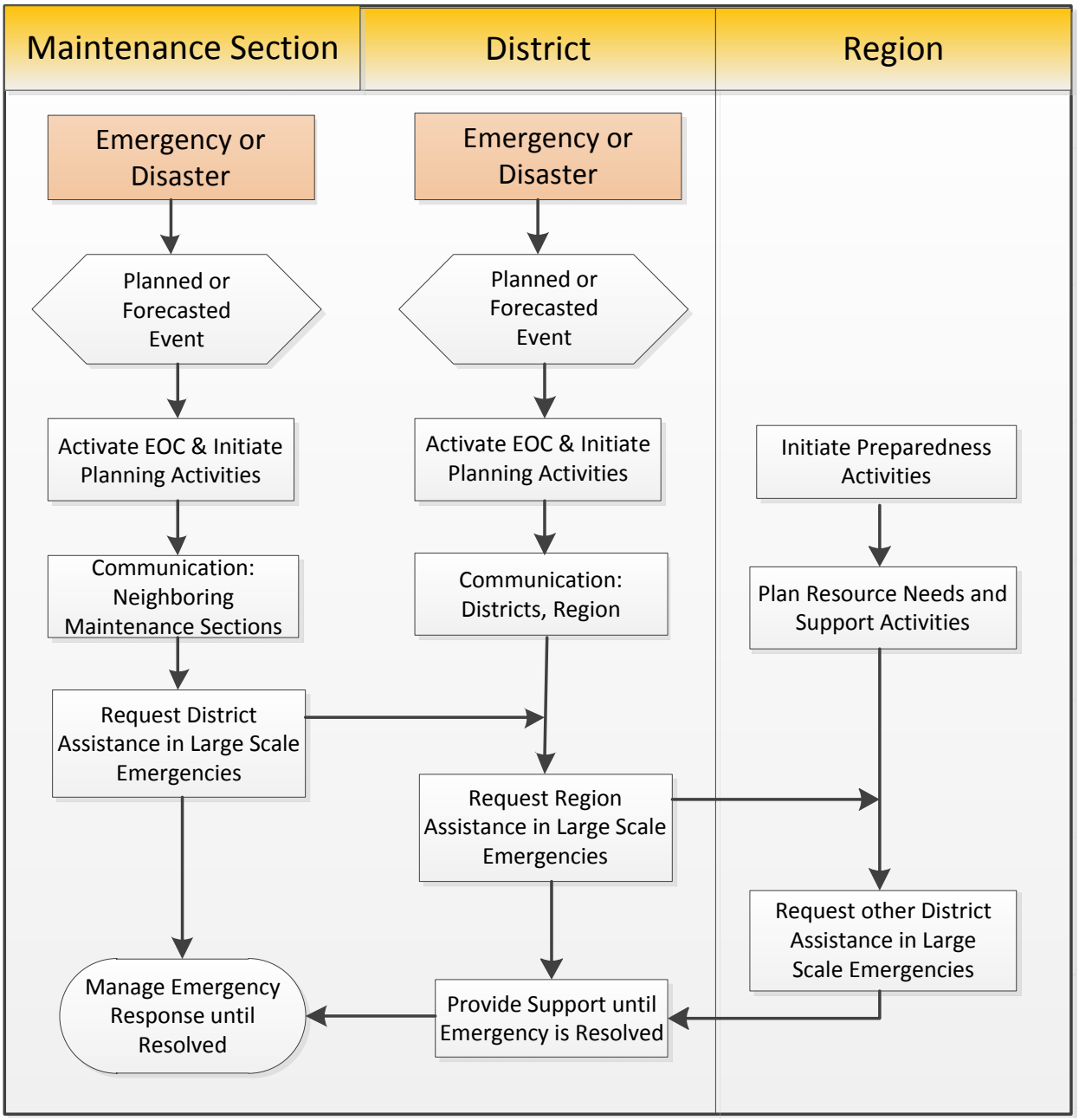


Figure 4-3. Response and Coordination Process among Maintenance Section, District, and Region.

Section 3
District

Organizational Structure

An example of a functional description of a District organizational chart is shown in Figure 4-4 for the Austin District (4). All Districts have an organizational chart and all key personnel are depicted on it. Additionally, each Maintenance Section should have copies of their respective District organizational chart.

Key Personnel

Typical roles and responsibilities for critical district staff involved in winter weather response are identified below.

- **Director of Maintenance**—Coordinates district response including movement of personnel and equipment between areas as required and informs the District Engineer when this is done; coordinates with other agencies and responds to requests for assistance under the direction of the Texas Department of Public Safety (DPS) Disaster District Committee Chairman; and activates and operates the District Emergency Operations Center (EOC) when necessary.
- **Director of Transportation Operations**—Coordinates placement of portable changeable message signs (PCMSs) and appropriate messaging on PCMSs and Dynamic Message Signs (DMS) throughout the district.
- **District Emergency Coordinator**—Coordinates communication between the maintenance section and District office; and could assist the Director of Maintenance or Director of Transportation Operations in their duties.
- **Public Information Officer**—Responds to media requests, issues press releases, and distributes information via e-mail and other methods as appropriate.
- **District Engineer** (or Designee)—Coordinates with other Districts including requesting or responding to requests for outside assistance (personnel, equipment, etc.).

Command and Control

A separate ICS needs to be developed for each District that identifies key roles and responsibilities for responding to emergencies at the district level. An example of a District ICS is shown in Figure 4-5 for the Amarillo District. Such an ICS facilitates the coordination of winter weather responses, in particular for large scale events.

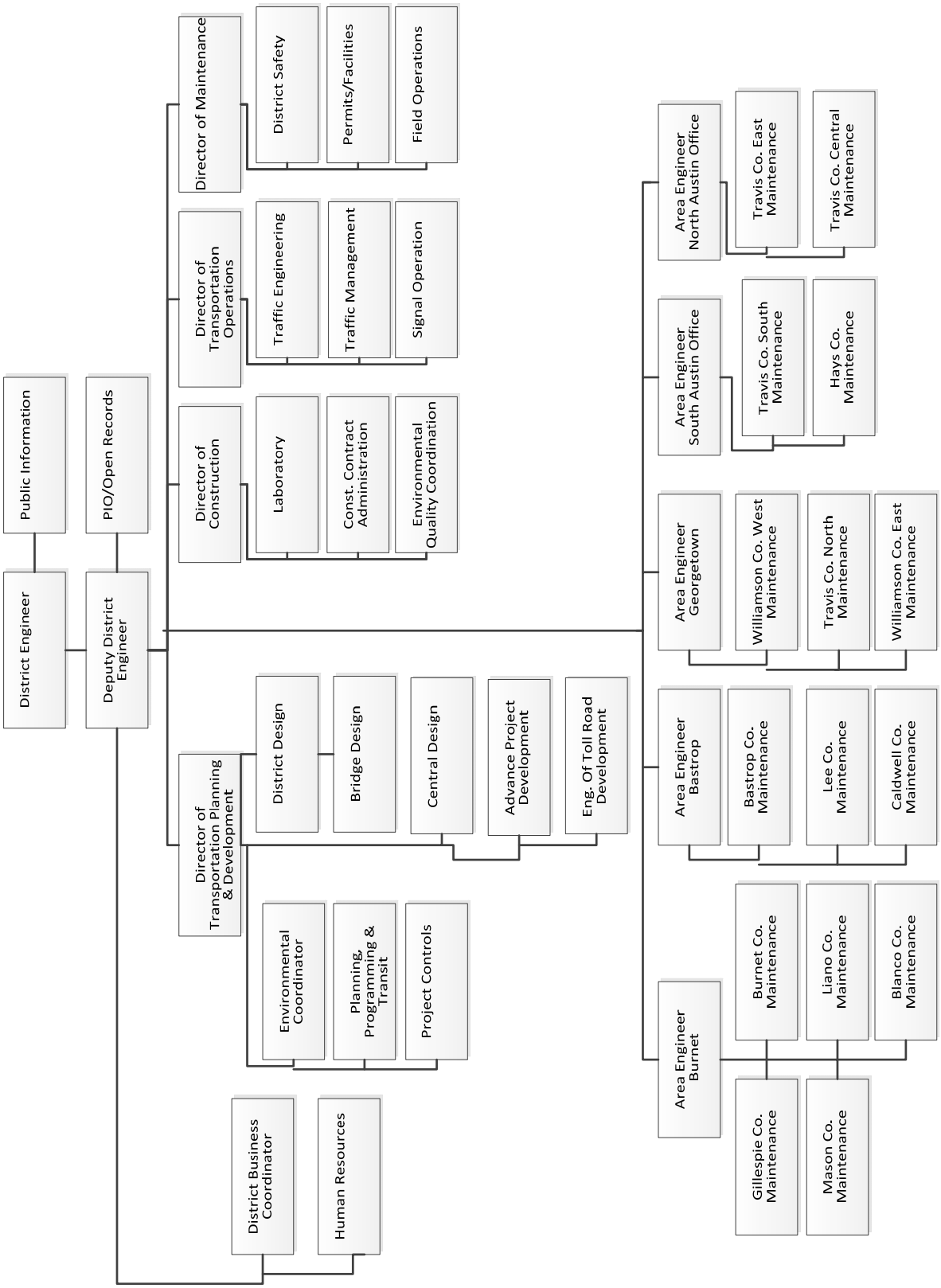


Figure 4-4. Example of District Organizational Structure – Austin District (4).

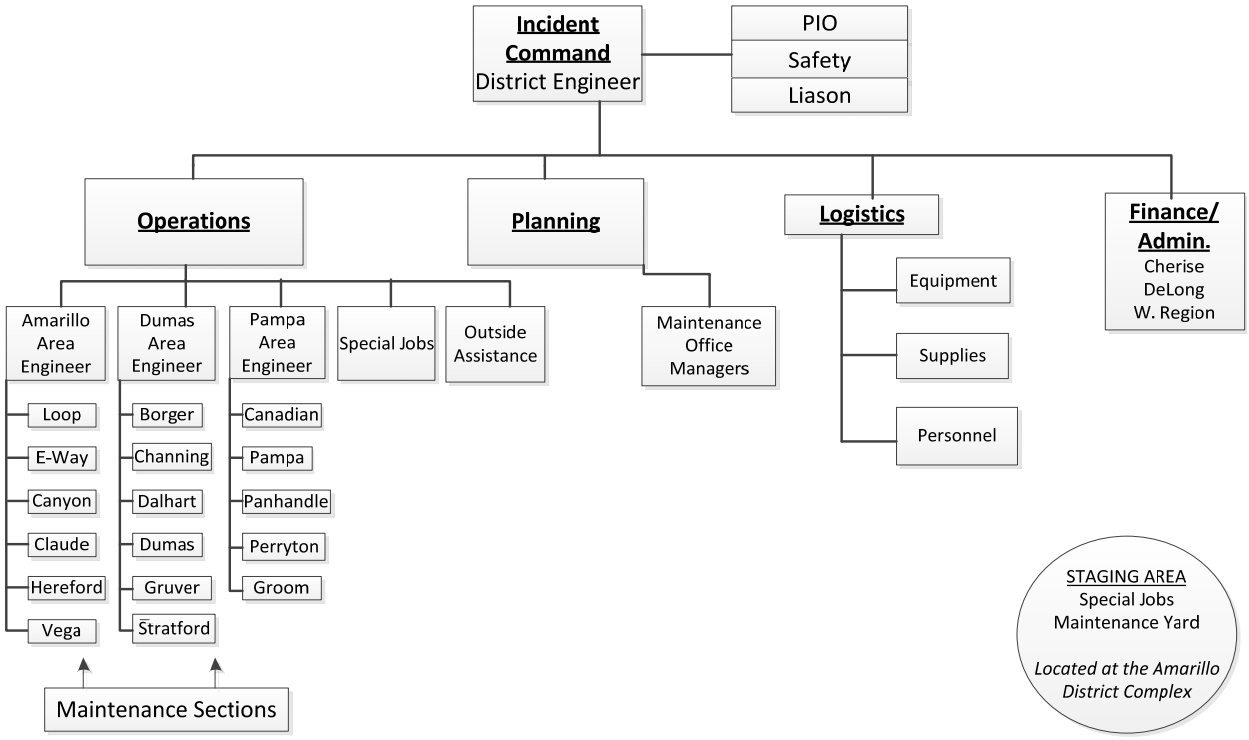


Figure 4-5. District Incident Command System – Amarillo District (5).

Section 4
Area Office

Organizational Structure

An example of a functional description of an Area Office organizational chart is shown in Figure 4-6 for the Houston District Central Houston Area Office.

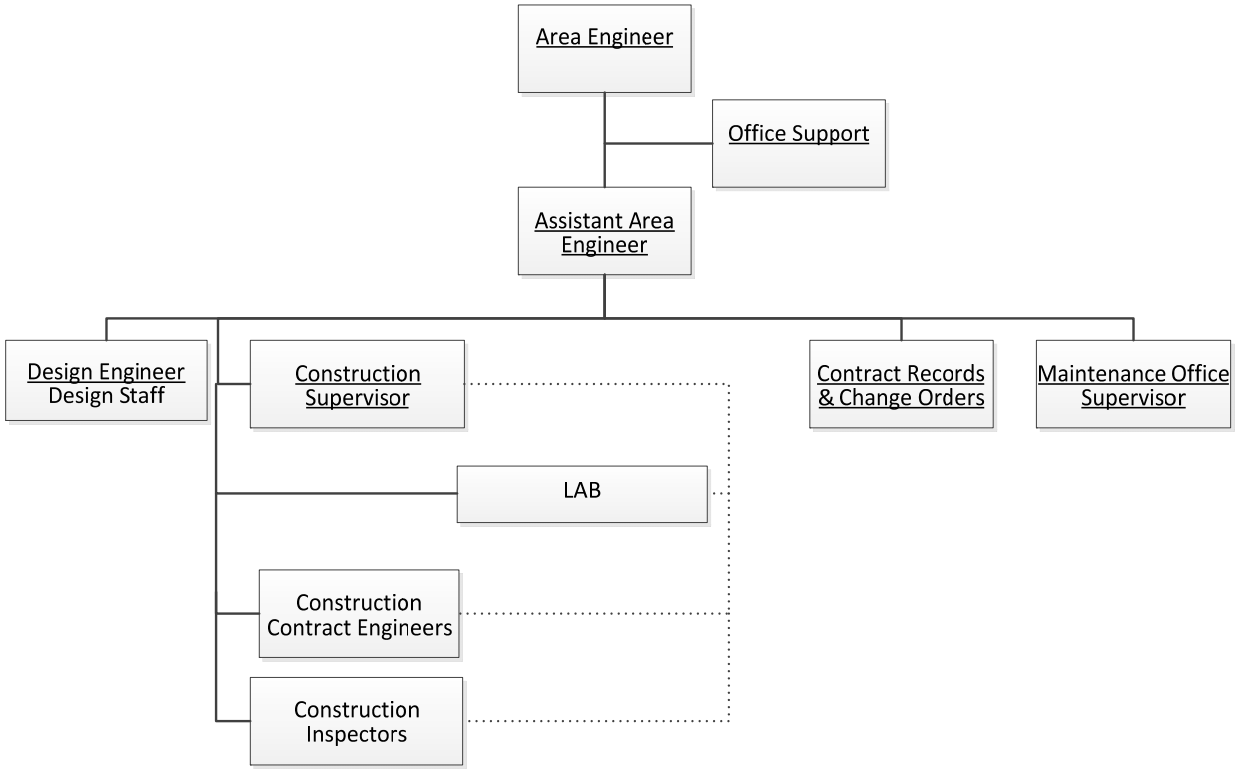


Figure 4-6. Example of Area Office Organizational Structure – Houston District.

Key Personnel

Key roles and responsibilities of staff at the maintenance section:

- **Area Engineer**—Coordinates area response including movement of personnel and equipment as required and informs the Director of Maintenance when this is done.

Section 5
Maintenance Sections

The Maintenance Section Supervisor is responsible for all winter weather response operations at the section level. He has control over all issues pertaining to the preparedness, response, and recovery actions for winter weather. He oversees the maintenance of equipment, management of supplies and handles all personnel involved in the maintenance winter weather operations and is supported by the office managers.

Organizational Structure

Key Personnel

Key roles and responsibilities of staff at the maintenance section:

- **Maintenance Section Supervisor**: Activates and commands winter weather response within their section.
- **Maintenance Office Managers**: Updates the HCR system periodically and maintains communication with district maintenance administrator (or other district maintenance staff).
- **Crew/Technicians**: Responsible for maintenance activities of winter equipment.

Command and Control

Figure 4-7 shows a typical structure of operations at the maintenance sections. Note, that a critical element of the organizational structure is the interaction between the Maintenance Section Supervisor and neighboring counties as well as with the District Office.

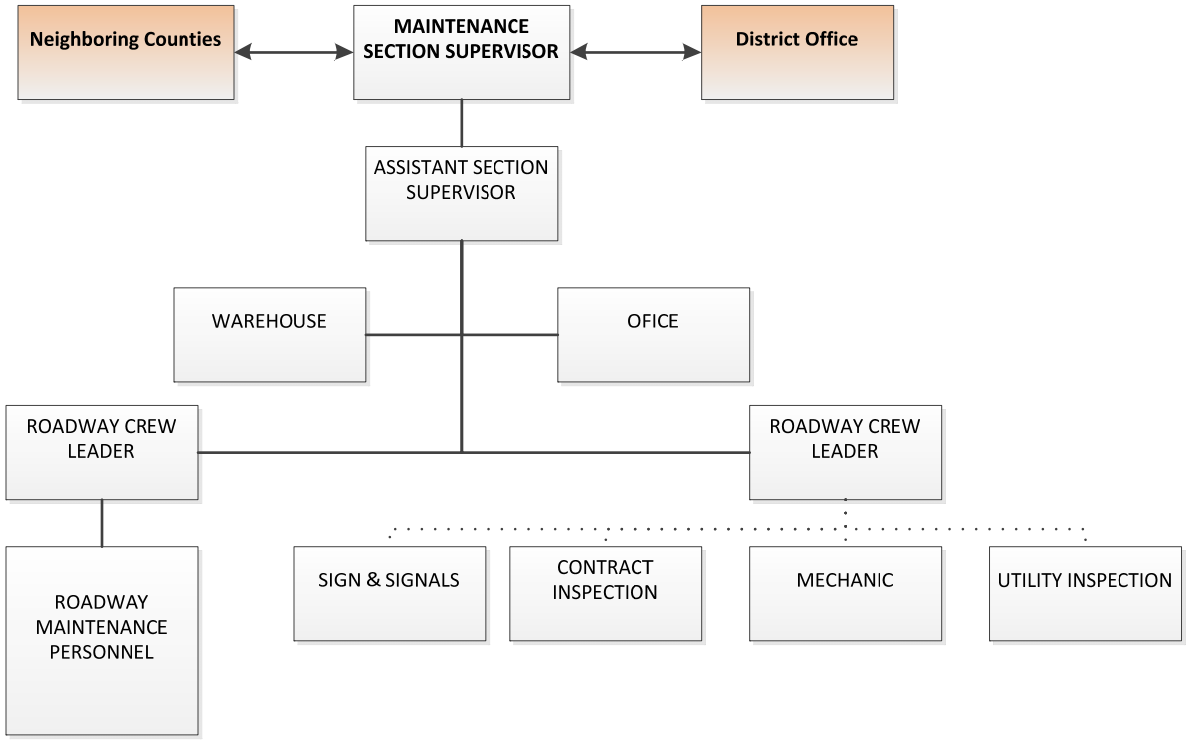


Figure 4-7. Example of District Organizational Structure.

Section 6

References

1. Website for the Federal Emergency Management Agency (FEMA). http://www.fema.gov/emergency/nims/IncidentCommandSystem.shtm. Accessed on October 1, 2011.

2. Website for TxDOT Regional Service Centers. http://www.dot.state.tx.us/local_information/regions/default.htm. Accessed on October 1, 2011.

3. *West Region Districts and West Region Support Center – Emergency Response Protocol*. Texas Department of Transportation. January 1, 2010.

4. *2010-2011 Austin District Winter Storm Plan*. Austin District, Texas Department of Transportation, January 2011.

5. *Amarillo District Ice and Snow Control Plan – FY 2011*. Amarillo District, Texas Department of Transportation. December 2010.

Chapter 5

District Level and Maintenance Section Operations Guidance

Contents:

Section 1
Phases of the Event

Phases of Events

Winter weather response requires an extraordinary level of communication and coordination between the maintenance sections (at the forefront of battling winter weather) and the District office (with the capability of coordinating among various maintenance sections). In some cases, this level of effort involves other TxDOT District offices as noted in the following section. This section identifies, describes, and assigns responsibilities to several operational items during the response to winter weather at both the district and maintenance section levels.

There are generally three phases involved with winter storm management. These three phases, when adequately identified and addressed, provides a District with a comprehensive approach to responding to a winter storm event.

Preparedness

This phase is often times referred to as "Pre-Storm" or "Pre-Event" activities. It is a critical component of an agency's winter storm management plan. A diligent approach to this stage will ensure that an agency is adequately positioned to respond to a winter storm event. Typical activities include handling incoming weather information, coordinating between various districts, maintenance sections, and external agencies; and managing of district and regional assets.

Response

This phase identifies actions that happen during the winter event. Major items to consider include the following:

- Establish EOC.
- Coordination and Communication.
- Implement Deployment and Redeployment Plans.
  - Crews.
  - Equipment.
  - Safety.
  - Control Actions.
  - Treatment Actions.
- Risk Management.
- Reporting.

Recovery

This Phase identifies post-winter event actions that provide an overview of the lessons learned for each winter season.

Section 2
Preparedness

Increasing traffic volumes and higher public expectations, coupled with advances in weather forecasting technologies, require a proactive winter weather response approach from TxDOT. Traditional response only after a storm event is no longer acceptable. Instead, TxDOT personnel are expected to plan and prepare for adverse weather well in advance of any event. Recommended pre-event activities—including the collection of incoming weather-related information, coordination and pre-planning within and outside TxDOT, and asset (equipment and personnel) management—are described below.

Definition of District Level and Maintenance Section Operations

These are operations that occur within the jurisdictional boundaries of the District and/or Maintenance Section area of responsibility. The integrated organizational structure of the District and/or Maintenance Section will match the needs of single or multiple winter weather events.

Incoming Information

Knowledge of local weather trends and the ability to accurately forecast weather are essential for directing effective winter weather response actions. A number of information sources—including personnel within and outside of TxDOT, technology-based detection and verification field devices, and weather forecasting and reporting agencies—can be used singularly or in combination to direct decision-making related to winter weather response actions.

TxDOT and Other Agency Personnel

Field personnel or remote personnel relying upon surveillance technologies can provide valuable information related to adverse weather events.

- **TxDOT Maintenance Personnel.** TxDOT maintenance personnel typically operate in the road environment, are familiar with area "trouble spots," and can provide direct verification and reporting of weather conditions in the field.
- **Other Agency Personnel.** Similar to TxDOT's maintenance personnel, State or local public safety or local transportation agency personnel can provide direct verification and reporting of weather conditions in the field. Established coordination and cooperation is required to ensure that these non-TxDOT personnel proactively report adverse weather conditions to TxDOT.
- **TxDOT Traffic Operations Personnel.** In areas where surveillance technologies are available, TxDOT traffic operations personnel can alert TxDOT maintenance personnel of a potential weather-related event based on traffic flow patterns and/or visual cues. Verification can occur either in the field by maintenance personnel or remotely by traffic operations personnel using closed-circuit television (CCTV) cameras (described below).

Technology-Based Field Devices

In lieu of or to supplement direct personnel observation, technology-based detection or verification field devices providing weather-related information include (CCTV) cameras, road weather information systems (RWIS), fog/flood warning systems, and thermal mapping.

- **Closed-Circuit Television (CCTV) Cameras**. CCTV cameras provide limited-access video images for broader traffic and roadway monitoring purposes. Improvements in picture quality, pan and zoom capabilities, and video data transmission rates have made CCTV a useful remote verification tool for any event disrupting the normal flow of traffic, including select adverse weather events (e.g., flooding, drifting snow). The effectiveness of CCTV cameras in providing weather-related information is dependent upon the extent and adequacy of camera coverage.
- **Roadway Weather Information Systems**. With a narrowed focus on detecting adverse weather conditions, roadway weather information systems (RWIS) utilize various gauges and meters to record and monitor real-time air and dew temperatures, humidity, rainfall, wind speed and direction, pavement temperatures, ground temperatures, visibility, and more. RWIS can be used as a stand-alone weather station or can be configured to support specialized anti-icing and de-icing equipment and applications.
- **Thermal Mapping**. Thermal mapping can be used in conjunction with RWIS to locate and quantify temperature variations across a roadway network. Across a roadway system, some sections will be warmer or colder than others. Thermal mapping predicts where these warm and cold sections will occur and helps identify areas that are likely to freeze. Thermal maps are influenced by the surrounding physical environment, such as cuts and fills, embankments, urban heat, trees and buildings and the prevailing weather patterns. Thermal maps can be used in several ways, such as: determining the location for ice detection sensors, extrapolating temperature trends over a thermal mapped network from a few measured sites or aiding in the design of pretreatment routes. The long term goal of thermal mapping is to establish an ice prediction system, which will cover an entire maintenance section. Figure 5-1 shows an example of a geothermal map showing heat flow across the United States.
- **Flood Warning Systems**. Specific to flood events, flood warning systems typically utilize pressure transducer flood sensors implemented at critical existing water crossings to detect unsafe water levels. Water level information is provided continuously from the field sensors to the responsible agency. If a flood threat is present, the responsible agency would remotely activate in-field warning beacons (using wireless communication technologies) and issue a high water warning. In some instances, flood warning systems can be supplemented with CCTV to provide verification of a flood threat.
- **Fog Warning Systems**. Similar to flood warning systems, fog warning systems rely upon field sensors, communication of adverse weather conditions to the responsible agency, and in-field warning devices to ensure the safety of motorists. Fog warning systems commonly utilize "smart road studs" that contain microprocessor technology capable of detecting fog and loss of visibility. Once fog is detected, the studs emit a flashing LED display that is approximately four times the light intensity of most current road reflective markers to assist motorists with lane-tracking.

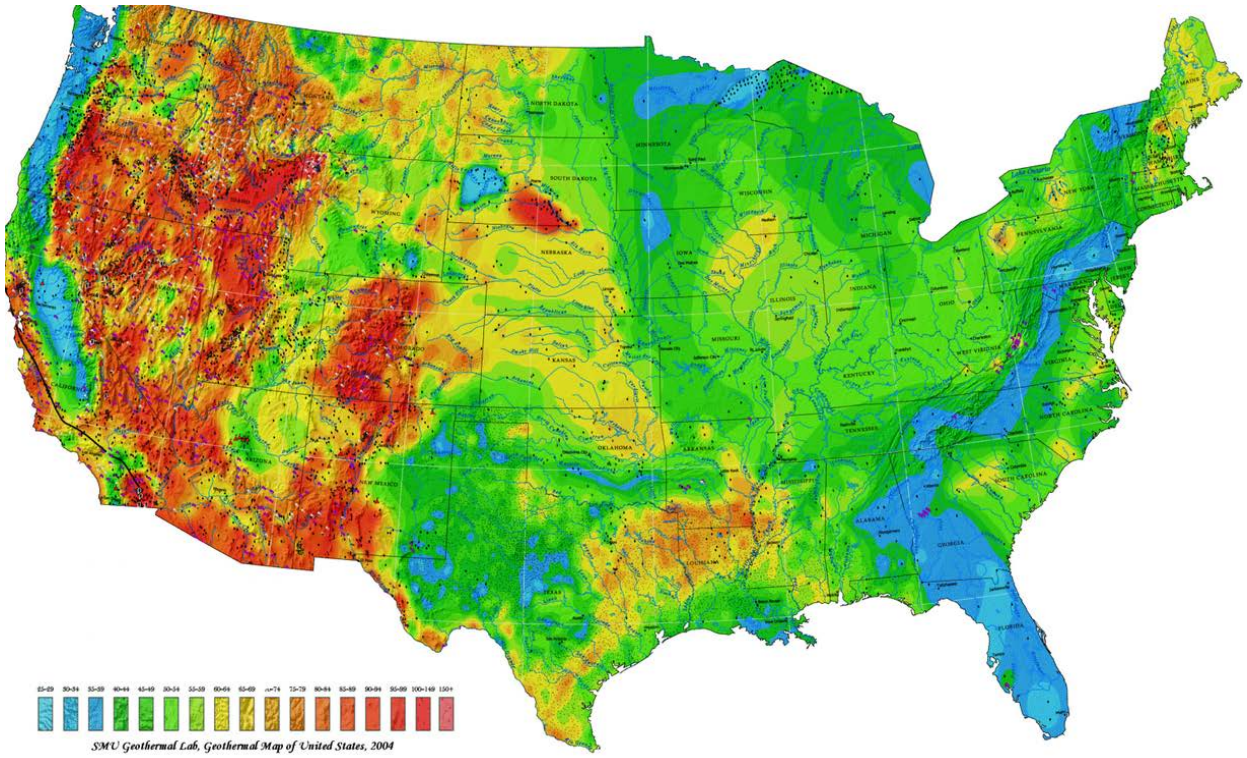


Figure 5-1. Geothermal Map of the United States (1).

Weather Forecasting and Reporting Agencies

A number of weather forecasting and reporting sources—including the National Weather Service, various private forecasting agencies, and various Internet websites—provide weather-related information in support of winter weather response.

- **National Weather Service.** The National Weather Service (NWS) typically has a broad regional weather focus that may lack sufficient detail to support TxDOT's winter weather response actions. Forecasts and radar, satellite, and graphical images are available at the NWS home page, http://weather.gov. Caution should be taken when using any radar or satellite picture, since training and education are required to know exactly what is being shown. Trained expert staff from NWS will often provide more specific information upon request to better support winter weather response decision-making.
- **Private Forecasting Services**. Various private companies offer similar weather forecasting services. Use of these private services has not proven cost-effective historically in Texas. However, if private forecasting services are deemed necessary, established contracting procedures should be followed.
- **Internet Websites.** Internet websites are providing increasingly comprehensive and detailed weather-related information as technology continues to advance. Common websites are as follows:

- http://www.roadweather.com/
- http://www.accuweather.com/wx/index.htm
- http://www.intellicast.com/
- http://www.wunderground.com/
- http://www.rap.ucar.edu/weather/radar/

These sites require Internet access but are otherwise free of charge.

Coordination and Communication

Routine pre-event coordination should involve personnel within and outside of TxDOT. Personnel at both the maintenance field response staff and district administrative levels should be involved. Maintenance section field response personnel can work cooperatively to enhance winter weather response operations. District administrative personnel can help to identify and secure necessary supporting resources and/or approve changes in operational policy related to winter weather response. Coordination and communication activities should be done both within TxDOT and between TxDOT and relevant stakeholders in the State's emergency response process.

It is important to recognize the distinctive role that each agency or organization can play in winter weather response activities. State and local law enforcement agencies, local transportation agencies, and private towing organizations can assist in managing traffic and maintaining traveler mobility during an adverse weather event. Local fire and rescue and EMS agencies can attend to those injured as a result of the adverse weather event, but must also maintain mobility and access to attend to the health and safety of those unaffected by the weather event. The news media can relay traveler advisories to a broad audience through a variety of different commercial media.

Activities Internal to TxDOT

The following activities are suggested to improve and maintain adequate communication and coordination within TxDOT Districts:

Best Practice

Regular coordination meetings should occur between neighboring TxDOT Districts, and Districts that share a common key transportation corridor through the State.

- Coordination meetings should occur between a TxDOT District and adjacent Districts or Districts sharing a common key transportation corridor through the state. This meeting is at the administrative level, to discuss cross-district issues such as personnel and equipment movement, personnel and equipment sharing, and joint Emergency Operations Center (EOC) set-ups.
- On a quarterly, semi-annual, or annual basis, personnel from adjacent or corridor Maintenance Sections should convene to discuss any changes to response boundaries, response procedures, appropriate personnel contacts, available equipment (or other assets), resource needs, or other salient topics related to winter weather response. This

is also to establish good working relationships between maintenance staff from neighboring districts.

- Pre-event coordination meeting(s) should occur between a TxDOT District Office and the Maintenance Section Supervisors. Discussions should address supervisor concerns for upcoming winter season, lessons learned from prior season, and additional items relevant to improving response to winter weather conditions.

Activities with External Agencies

The following activities are suggested to improve and maintain adequate communication and coordination between TxDOT Districts and other stakeholder agencies involved in winter weather response:

- Identify key stakeholder agencies involved in the management of or response to adverse weather events including State and local law enforcement agencies, local fire and rescue agencies, local EMS agencies, local transportation agencies, private towing organizations, and the news media.
- Develop a detailed contact list for key staff involved in winter weather management in the stakeholder agencies identified, and make copies available to both the District office and all maintenance sections. This list should be updated each year immediately prior to the start of the winter season.
- Conduct coordination meetings between TxDOT District office administrative representatives and administrative representatives of State and local law enforcement agencies, local fire and rescue agencies, local emergency medical services (EMS) agencies, local transportation agencies, private towing organizations, the news media, and other personnel involved in the management of or response to adverse weather events. Discussions should focus on improving communication among these agencies and other high-level topics relevant to winter weather response.
- On a quarterly, semi-annual, or annual basis, coordination meetings should be held between District Maintenance Supervisors and representatives from these varied agencies to discuss any changes to response boundaries, response procedures, appropriate personnel contacts, available equipment (or other assets), resource needs, or other salient topics related to winter weather response.
- TxDOT maintenance supervisors should establish a communications and coordination protocol with neighboring Departments of Transportation.

Best Practice

Maintain an up-to-date list of key staff at stakeholder agencies involved in winter weather operations management.

Deployment and Redeployment Planning

In preparation for a winter weather event, comprehensive deployment and redeployment plans that consider deploying resources (personnel, equipment, materials, and supplies) to assist other Districts, the availability of resources within TxDOT and procedures for accessing additional resources outside of TxDOT should be developed. Additionally, the redeployment of forces to their respective home stations is reviewed as well.

Equipment

During weather events, TxDOT utilizes a variety of equipment to respond on short notice to adverse weather events. Such equipment includes dump trucks; motor graders; front end loaders, V-box and tailgate spreaders; snow plows, wings, and blowers; herbicide rigs and pickup applicators. Supplemental equipment includes emergency traffic control trailers stocked with traffic barrels, cones, barricades, necessary signs, and materials for road closures and portable changeable message signs (PCMS).

Such equipment may originate wholly within the affected TxDOT District or area, be "borrowed" from an adjacent TxDOT District or area, or be made available through a short-term lease from a non-TxDOT provider.

- Deployment and use of equipment available wholly within the affected TxDOT District or area requires only a basic understanding of the equipment's location, status, and point of contact for dispatch.
- Deployment and use of equipment from an adjacent TxDOT District or area may also be accomplished through this basic process or may require a formalized agreement that establishes a priority for equipment use (for significant weather events, adjacent TxDOT Districts or areas may be reliant upon this equipment to service their own roadways).
- In such instances, leased equipment may prove to be a viable option. Equipment can be leased either with or without an operator. Equipment may be leased with operator only to supplement State forces. In order for the lease to be considered a purchase of services, State forces must perform a minimum of 51 percent of the work. If the work performed by the contractor will exceed 49 percent, the work must be performed under a routine maintenance contract (2). Standard terms and conditions that apply to the lease of equipment with and without an operator are available on the General Services Division (GSD) website. An alternative fuel waiver must be obtained prior to the lease of vehicle.

Purchasing Equipment

Major equipment—defined as any wheeled or tracked equipment, trailers, or other items generally used in the support of the construction and/or maintenance functions of highways and rights of way—are purchased by GSD for all of TxDOT as part of its fleet management function. Districts and divisions cannot purchase major equipment directly from the Texas Building and Procurement Commission (TBPC) automated system. Major equipment is funded from the GSD capital equipment budget and should not be purchased using overhead, minor equipment, or any account other than those designated for major equipment. Snow plows and other expensive equipment for rapidly moving large amounts of snow should only be considered for areas that experience frequent snowstorms. Selected items of major equipment are available on term contract. Emergency purchases are not allowed for acquiring major equipment (2). See Chapter 7 *Winter Weather Equipment and Maintenance Considerations*, for more details on winter weather equipment.

Replacement Parts and Equipment

Replacement parts and equipment may be required to support effective equipment operation. Parts through a distributor are the appropriate method of purchase to obtain original equipment manufacturer (OEM) repair parts that are needed for immediate use. This method cannot be used to purchase labor or parts for stock. The parts must be purchased from an OEM dealer or distributor and put into use within approximately a week to 10 days of receipt. There is no limit on the dollar amount of a distributor purchase, but prior approval of GSD may be required. Districts must include the equipment number(s) of the major equipment unit(s) for which the repair parts are being purchased in the accounting data on the APS User Request. When immediate repairs are needed and new parts are not readily available, Districts may purchase used repair parts under small purchase or emergency authority (as appropriate). The file must be thoroughly documented to indicate the reason used parts are purchased. In APS, use the F6 [Justification] or F9 [Item Description] function as applicable (see Section 8 Used Equipment/Supplies, Parts of the Purchasing Manual).

Materials and Supplies

Materials and supplies to support winter weather response commonly include replacement parts, ancillary personnel supplies, and anti- or de-icing bulk materials.

Materials

- **Purchasing**: Anti or de-icing materials are obtained using a blanket bid master and the open-market method of purchase. GSD will survey districts and initiate annual statewide blanket purchases of anti/de-icing materials. Statewide blanket purchases include rock salt, calcium magnesium acetate (CMA), and magnesium chloride (liquid and solid). In situations where the open-market method of purchase is not appropriate, Districts may use small purchase procedures. An example is potassium acetate—these types of materials are considered proprietary (sole source) and must be purchased through GSD. If an emergency situation requires the purchase of anti/de-icing material, districts will follow the procedures for an emergency purchase.
- **Inventory**: Conduct inventory of in-stock snow and ice control materials including
    - Granular chemical materials (both stockpile and palletized).
    - Liquid chemical materials.
    - Abrasives.
- **Procurement:** Snow and ice control materials should be ordered, tested, and stockpiled prior to a pre-determined date each year.
- **Storage and Loading Area:** Adequate storage facilities should be provided for both granular and liquid snow and ice control chemicals. These should include covered storage buildings for bulk granular materials as well as storage tanks with secondary containment (if needed) for bulk liquids. Ensure loading and delivery areas are adequate; consider the size of doors and openings to accommodate loading and unloading; comply with state and federal regulations governing spills and environmental discharge concerns.

See Chapter 8 *Winter Weather Chemicals and Materials,* for information on the various chemicals available to use during winter weather treatment operations.

Ancillary Personnel Supplies

Additional ancillary personnel supplies intended to keep them safe and their equipment functional should not be overlooked in preparing for winter weather response. Appropriate quantities of items such as gloves, storm suits, other personal protective equipment, flashlights and batteries, windshield de-icer, wiper blades, and other should be kept on hand to adequately respond to each event. If a winter weather event is expected to result in TxDOT personnel working outside their Area or in another District, maintenance supervisors should request DART cards for their employees to pay for rooms and meals.

Reporting Equipment, Material, and Supplies

Recommended guidelines for reporting District equipment, materials, and supplies both within the District and to the Region are shown in Table 5-1.

Table 5-1. Recommended Equipment Inventory Reporting Schedule.

Item	Report From	Report To	Due Dates
Equipment Inventory	Maintenance Section Supervisor	Director of Maintenance	October 1 January 1 April 1
	Director of Maintenance	Region Fleet Manager	
Materials Inventory	Maintenance Section Supervisor	Director of Maintenance	October 1 January 1 April 1
	Director of Maintenance	Region Purchasing Manager	
Supplies Inventory	Maintenance Section Supervisor	Director of Maintenance	October 1 January 1 April 1
	Director of Maintenance	Region Purchasing Manager	

Personnel Training and Safety

Effective personnel training and safety programs are integral to winter weather response operations.

Training

TxDOT employees have varying degrees of experience with snow winter weather response. It is important to recognize levels of individual employee experience when assigning work activities.

Formalized Training: All personnel should be trained in proper procedures prior to being assigned to winter weather response duties. Maintenance supervisors are responsible for the proper training of all crew members. Some of the key steps in scheduling formalized training include the following:

- Maintenance Section Supervisor should identify formal training needs for crew in maintenance section.
- Coordinate training needs for maintenance section – Maintenance Section Supervisor and District Maintenance Administrator (or designee) should coordinate the identification and procurement of formal training programs for maintenance section staff.
- District of Maintenance or District Maintenance Administrator (or designee) should identify training needs for District administrative and management personnel involved in winter weather operations management.

All formal training should be completed as part of pre-winter season activities. The National Highway Institute (NHI) in conjunction with the Federal Highway Administration (FHWA) provides several training programs for maintenance personnel involved in winter weather operations (3).

On the Job Training: In addition to formalized training, recommended on-the-job training practices specific to winter weather response include the following:

- Pair experienced and inexperienced personnel to allow the inexperienced crew member time to become familiar with winter weather response operations.
- Allow new personnel to inspect their route prior to a winter weather event to note any hazards or changes to the roadway that may not be visible during a winter storm.
- Allow new operators time to become familiar with a piece of equipment—this can be beneficial during night operations, blowing snow, and other low-visibility conditions.
- Operating a snow plow is a unique activity for even the most experienced truck drivers who may be new to TxDOT. New operators should complete orientation training prior to being assigned plowing duties, with an emphasis on proper plowing techniques, operating speed, plowing in high-volume traffic, and plowing near railroad crossings.
- Where possible, send district maintenance section staff for training in other types of winter conditions in other districts.

Best Practice

Pair experienced and inexperienced personnel to allow the inexperienced crew member time to become familiar with winter weather response operations.

See Chapter 11 *Training Considerations* for more details on training needs, and suggestions for training of TxDOT staff on winter weather operations and management.

Safety Measures

The safety of all crew members and the traveling public is the highest priority during a winter weather event. Work during periods of adverse weather is by nature a potentially hazardous operation but various safety measures are recommended to protect response personnel.

- Prior to a winter weather event, a safety meeting should be held in every maintenance section to discuss weather-related safety issues. The meeting should address new and refresher training topics for equipment operators and standard operating procedures during a winter weather event.
- Prior to the winter season, ensure that all winter weather equipment is in good working condition for the upcoming winter season. Conduct thorough equipment safety checks and have them reviewed.
- District should have adequate ancillary personnel equipment for maintenance crews such as boots, gloves, and communication apparatus.
- Provide information to the public on safe driving tips during winter weather conditions. Tips should include driving around staff-operated winter weather equipment, such as motor graders, dump trucks, and snow plows.

Preliminary Risk Management

Risk management is the process of identifying, assessing, and controlling risks arising from operational factors and making decisions that balance risk costs with mission benefits. A preliminary risk assessment should be performed to identify the risks posed to the following groups of people:

- **Step 1. Identify hazards**: Outline the hazards posed by the incoming winter storm. Each type of winter storm will have its own hazards. For instance, the hazards associated with snow weather is different from one associated with sleet.
- **Step 2. Assess hazards to determine risks**: Outline the risks associated with each hazard. For instance the risks posed by snow weather vary significantly in a District that is unfamiliar with snow weather as compared to one that regularly deals with snow.
- **Step 3. Develop controls and make risk decisions**: Identify the controls (tools) available to the District to deal with the incoming weather. Again this depends on several factors including the number, skill, and expertise of personnel; the available winter weather equipment; and the communication sophistication of the EOCs.
- **Step 4. Implement controls**: This involved deploying the planned winter weather management procedures in the District Snow and Ice Control Plan.
- **Step 5. Supervise and evaluate**. Constant monitoring of winter weather operations is critical in ensuring a success of the response operations to winter weather.

Various risks associated with any winter storm should be critically evaluated including:

- **Level of risk to traveling public**: Outline the level of risk posed by an incoming storm to the safety of the traveling public.
- **Level of risk to safety of maintenance crew**: Outline the level of risk posed by an incoming storm to the safety of maintenance field crew. Include the potential for handling hazardous materials.
- **Level of risk to safety of other emergency personnel**: Outline the level of risk posed by an incoming storm to the safety of first responders. Include the potential for handling hazardous material.

- **Level of risk to economy**: Outline the level of risk posed by an incoming storm to the local economy of Region, District, or County.
- **Level of risk to environment**: The potential impacts to the environment posed by not only a particular storm but also the response operations in particular the use of chemical materials and abrasives should be evaluated.

Assess the risks based on each incoming storm event. The risk escalates based on the level of the incoming storm. Figure 5-2 is an example of a risk assessment worksheet (9).

RISK MANAGEMENT WORKSHEET

(CDTCMD Reg 385-10; proponent agency is Cadet Command Safety)

1. Organization and Unit Location:	2. Page		of	

3. Mission/Task:	4. Begin Date:	5. End Date:	6. Date Prepared:

7. Operational Phase in which the Mission/Task will be conducted:

8. Tasks	9. Identify Hazards	10. Initial Risk Level	11. Develop Controls	12. Residual Risk Level	13. Implement Controls ("How To")	14. Who/How Supervised

15. Determine Overall Mission/Task Risk Level After Countermeasures Are Implemented:
(Circle Highest Remaining Risk Level) ™ **LOW (L)** **MODERATE (M)** **HIGH (H)** **EXTREMELY HIGH (E)**

16. Medical Support: Advanced Trauma Life Support (ATLS) is required within 1 hour. On-site Medical Support provided (Circle one): Medic Combat Lifesaver ARC/NSC First-Aid Responder None

17. Prepared by: (Rank, Last Name, Duty Position)	18. Reviewed by Action Officer/Commander: (Rank, Last Name, Duty Position and Signature):

19. Risk Decision Authority (Signature Block and Signature):	**Extremely High Risk:** Not Applicable for Cadet Command **High Risk:** CG or DCG **Moderate Risk:** Brigade Cdr (0-6). At Advanced/Basic Camp – Region Cdr or CofS **Low Risk:** Battalion Cdr. At Advanced/Basic Camp – Committee Chief or Regimental Cdr/TAC Officer

Figure 5-2. Example of Risk Management Worksheet

Sample Risk Management Worksheet

RISK MANAGEMENT WORKSHEET
(CDTCMD Reg 385-10, environment agency or Cadet Command Safety)

1 Organization and Unit Location	2 Page	of
ROTC Battalion	1	2

3 Mission/Task	4 Begin Date	5 End Date	6 Date Prepared
Conduct Rappel Training (include Transportation to and from Tower)			

7 Operational Phase or where the Mission/Task will be conducted
Throughout training phase

8 Tasks	9 Identify HAZARDS	10 Initial Risk Level	11 Develop Controls	12 Residual Risk Level	13 Implement Controls (How To)	14 Who/How Supervised
Transportation to tower	Driver Fatigue	M	Ensure driver gets adequate rest	L	AR 385-55, Prevention of Motor Vehicle Accidents	Driver – Self
	Traffic Congestion	M	Drive slower and defensively	L		Driver – Self
	Weather Conditions (rain/ice on road)	H	Drive slower than posted speed limit	M	AR 600-55, Army Driver and Operator Standardization Program	Driver – Self
Rappelling from a 34-ft Tower	Inexperienced cadets	H	Instruct and demonstrate: (1) Fundamentals of rappelling, (2) How to properly tie knots and (3) Safety requirements Always require use of helmets and gloves	M	TSP No 1, Basic Rappelling TC 21-24, Rappelling	Qualified Rappel Master will supervise
	Equipment failure resulting in falls	H	Conduct a safety inspection of tower and all rappelling equipment prior to training exercise Conduct annual safety inspection of tower	M M	TC 21-24, Rappelling AR 385-10, Safety Program DA Pam 385-1, Unit Safety	Rappel Master will inspect Army Safety Officer CDSO, Unit Safety
	Heat Injury/ Dehydration	H	Monitor Heat Index, advise all to drink sufficient volumes of water at frequent intervals, carry canteen(s) and know location of water points	M	TB MED 507 Water Buffaloes on site GTA 8-6-50	Cadre monitor weather
	Wildlife, insects and plants	M	Brief cadets to avoid wildlife, insects and plants. Use insect repellent. Have bee sting kits available	L	FM 21-10 GTAs based on area	Cadre monitor Heat Index Use buddy system

15 Determine Overall Mission/Task Risk Level After Countermeasures Are Implemented (Circle Highest Remaining Risk Level): LOW (L) **MODERATE (M)** HIGH (H) EXTREMELY HIGH (E)

16 Medical Support: Advanced Trauma Life Support (ATLS) is required within 1 hour — On-site Medical Support provided (Circle one): Medic / Combat Lifesaver / **EMT-A/AC Paid-Aid Responder** / None

17 Prepared by (Rank, Last Name, Duty Position)

18 Reviewed by Action Officer/Commander (Rank, Last Name, Duty Position and Signature)

19 Risk Decision Authority (Signature Block and Signature)

Extremely High Risk: Not Applicable for Cadet Command
High Risk: CO or DCS
Moderate Risk: Brigade Cdr (O-6), Al Advanced/Basic Camp - Region Cdr or Cert
Low Risk: Battalion Cdr, Al Advanced/Basic Camp - Commitee Chief or Regional Cdr *AC Officer

CDTCMD Form 385-1-R-E, Apr 01 — Risk Assessment and Risk Management Countermeasure Worksheets in CC Reg 143-3 are OBSOLETE

Work Sheet Instructions

Blocks

1 – 8. Self explanatory

9. **Identify Hazards** – Review METT-T factors for the mission or task. Additional factors include historical lessons learned, experience, judgment, equipment characteristics and warnings, and environmental considerations.

10. **Initial Risk Level** – Assess hazard and determine initial risk for each hazard by applying risk assessment matrix.

11. **Develop Controls** – Develop one or more controls for each hazard that will either eliminate the hazard or reduce the risk (probability and/or severity). Specify who, what, where, why, when, and how for each control.

12. **Residual Risk Level** – Determine the residual risk for each hazard by applying the risk assessment matrix, assuming the controls are implemented.

13. **Implement Controls** – Decide how each control will be put into effect or communicated to the personnel who will make it happen (written or verbal instruction; tactical, safety, garrison SOPs, rehearsals).

14. **Who/How Supervised** – Who and how will each control be monitored (continuous supervision, spot-checks). Evaluate frequently and pass on lessons learned.

15. **Determine Overall Mission/Task Risk** – Select the highest residual risk level and circle it. This becomes the overall mission or task risk level. The commander decides whether the controls are sufficient to accept the level of residual risk. If the risk is too great to continue the mission or task, the commander directs development of additional controls or modifies, changes, or rejects the COA.

16. **Medical Support** – Select type of on-site medical support provided and circle it.

17 & 18. Self explanatory

19. **Risk Decision Authority** – The decision to accept or not accept the risk(s) associated with an action is made by the appropriate commander or leader responsible for performing that action.

Need to Risk Manage a METT-T Hazard

Hazards not adequately controlled are likely to cause loss of combat power. Answer the following questions about each hazard to determine if it is adequately controlled. If not, hazards needs to be risk managed.

Are the Controls Adequate?	Yes	No
Support – Is type/amount/capability/condition of support adequate to carry out the mission? • Personnel • Supplies • Equipment/Material • Services/Facilities		
Standards – Is guidance / procedure adequately clear / practical /specific to control hazard?		
Training – Is training adequately thorough and recent to control hazard?		
Leader – Is leadership ready, willing, and able to enforce standards required to control hazard?		
Individual/Unit Self-Discipline – Is performance and conduct sufficiently self-disciplined to control hazard?		

If all "yes", no further action required (subject to commander's risk guidance). If one or more "no ", risk manage this hazard

Risk Assessment Matrix

SEVERITY	PROBABILITY				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

PROBABILITY – The likelihood that an event will occur.

FREQUENT – Occurs often, continuously experienced.

LIKELY – Occurs several times.

OCCASIONAL – Occurs sporadically.

SELDOM – Unlikely, but could occur at some time.

UNLIKELY – Can assume it will not occur.

SEVERITY – The expected consequence of an event in terms of degree of injury, property damage, or other mission-impairing factors.

CATASTROPHIC – Death or permanent total disability, system loss, major damage, significant property damage, mission failure.

CRITICAL – Permanent partial disability, temporary total disability in excess of 3 months, major system damage, significant property damage, significant mission degradation.

MARGINAL – Minor injury, lost workday accident, minor system damage, minor property damage, some mission degradation.

NEGLIGIBLE – First aid or minor medical treatment, minor system impairment, little/no impact on mission accomplishment.

* FM 101-5, 31 May 1997

Reporting Requirements

It is recommended that reports be provided at the maintenance section to detail various activities performed during the deployment of equipment. Sample reports include the following:

- **Operator's Daily Report**: a daily report of an equipment operator's activities including the start of equipment use and end time, type of equipment, and the amount of material used during operation.
- **Supervisor's Report**: status report of winter weather event provided by the Supervisor.
- **Taper Log:** summary report on weather conditions and the administration and impact of materials**.**
- **Snow and Ice Tickets**: report detailing work performed by maintenance crew.

Figures 5-3 through Figure 5-6 show examples of these forms, modified from samples used in New York (4).

				Start time	End time
Date	Org	Sup No.	Operator's name		
			Assistant's name		

Task			Accomplishments			Hours					
Job	Code	Description	Amount (odometer)	Amount (Spreader)	Unit	Regular	Overtime	Work order	Load point	Beat	Other code
	J01	OPP			miles						
	J02	OPP			miles						
	J21	TPP			miles						
		SPOT - OPP			miles						
		SPOT - OPP			miles						

Material					Equipment				
Job	Code	Description	Amount	Unit	Job	Code	Description	ID no	Hours
	M10			Tons		B23	Large dump truck		
	M15			Gallons		H91	Hopper spreader		
	M22			Gallons		E31	Front end loader		
	M25			Gallons		D83	Self-propelled		
	M30			Gallons					
	M50			Tons					

Odometer reading		Tons				Spreader-J miles			
			Salt	Sand	$MgCl_2$		Salt	Sand	$MgCl_2$
Ending		Ending				Ending			
Beginning		Beginning				Beginning			
Total miles		Total				Total Miles			

Figure 5-3. Example of Operator's Daily Report

Supervisor's Report

Reporting date
xx/xx/2011

Reporting Period
00:01 xx/xx/2011 to 24:00 xx/xx/2011

Type of event and accumulation			Present road conditions (Put checkmark in column)			Event							
Shop	(A) Type	(B) Amount accumulated	(C) Snow cover	(D) Slush	(E) Icy/pack	(F) Wet	(G) Dry	(H) Time start	(I) Time ended	(J) Additional duration expected	# of trucks used	# of hours covered
AM												
PM												
AM												
PM												

Comments:
Road
closures
Significant hard pack
Other situations impacting traffic
Trucks down

Figure 5-4. Example of Supervisor's Report

Road Name	Highway 123		Section End	Exit 1 to Exit 4 (NB)			
Start Date			Date				
Ta	T		A		P	E	R
1:00 AM	34 F	1 C	15	35	30% MgCl 2	3" fcst	
5:00 AM	32 F	0 C	0	0	30% MgCl 2	Trace	
10:00 AM	28 F	-2 C	20	47	30% MgCl 2	1.5"	
12:30 PM	26 F	-4 C	15	35	30% MgCl 2	.5"	Clear

Column Codes	
Ta	Time of Perception
Ta	Low temperature since last application
A	Application rate - Gallons/lane mile (GPLM)
	Liters per lane kilometer (LPLKm)
P	Product used
E	Event
R	Results

Alternative Notes
Pretreat - 3" (7.6 cm) snow, low 26 F (-4 C) forecasted
The total applications of 35 GPLM (82 LPLkm) after 12:30 PM entry, with 2" (5.1 cm) of snow at 26 (-4) degrees. An application of 15 GPLM (35LPLkm) was made and this cleared roadway for passage of vehicles.

Figure 5-5. Example of Taper Log

Spray Route: Route 1
Temperature: ..... Day: S M T W Th F S
Weather Condition: .....
Mileage In: .....Date: .....
Mileage Out:.....Truck #:.....
Time Out:.....Time In:.....
Driver: .....Helper: .....

Roadway	Miles	Plowing	Salt	$MgCl_2$
Interstate Highways				
IH12	5.68			
Totals	**5.68**			
State Highways				
SH123	4.5			
SH 234	4.5			
Totals	**9.0**			
FM Roads				
FM 123	3.01			
FM 234	2.51			
Totals	**5.52**			
County Roads				
CR234	1.22			
CR345	1.30			
Totals	**2.52**			

Total salt used (tons): .....

Total $MgCl_2$ used (gal): .....

Figure 5-6. Examples of Snow and Ice Tickets

Codes **Ticket No**.....

County ID .....

Date .....

Route No .....

Equipment No .....

Work code .....

Print code .....

Temp (pavement) .....

Materials

- ☐ Salt
- ☐ Sand/Chat Rock
- ☐ MgCl (liquid)
- ☐ MgCl (granular)
- ☐ CMA

67.0 Plowing
68.1 Remove ice, pavement
68.2 Remove snow, ROW
69.1 Ice cond., abrasives
69.2 Ice cond., chemicals
70.0 Snow fence
80 D Dispatching
80 P Patrolling
80 C Clerical/Administration
80 S Sweeping

Comments: _____

Interstate #s _____

State Highway #s _____

Misc – Labor & Equipment: _____

Misc – Materials _____

Start mileage _____ Stop mileage _____ Trip miles: _____

Miles materials applied: _____ Tons of material: _____

	Employee No	Start Time	Stop Time	Reg Hrs	OT Hrs	Reg Shift
Operator						
Wing						

_____ Operator

_____ Approval

Figure 5-6. Examples of Snow and Ice Tickets (cont'd)

Checklist for Preparedness for Winter Events

Table 5-2 and Table 5-3 serve as a checklist for districts and their maintenance sections, respectively, on various aspects of pre-winter season events to conduct. Note that the checklist is to provide a general overview of pertinent items to consider prior to the actual start of the winter season and is not meant to be a detailed analysis of required actions. Also note that some of these action items are best considered following a winter season in order to provide enough time for completion prior to the upcoming winter season. For instance, in order to ensure proper training for personnel, training arrangements need to be made well in advance of winter, to determine the appropriate training programs, identify the relevant personnel, and arrange for funds to pay for the training program.

Table 5-2. District and Regional Checklist for Preparedness Activities.

PREPAREDNESS ACTIONS	KEY PERSONNEL							
	Region			District				
	Region Director	Regional Purchasing Manager	Fleet Manager	District Engineer	Director of Maintenance s	Director of Operations	District Maintenance Administrator	Public Information Officer
Incoming Information								
Identify and confirm sources of incoming weather information							X	
Coordination								
Establish regular meetings with neighboring District administrative personnel				X	X	X	X	X
Establish regular meetings with other agencies involved in winter weather operations management (include news media)				X	X	X	X	
Develop, update and confirm regional emergency contact list							X	
Develop, update and confirm district-wide emergency contact list							X	
Establish, update and confirm ICS for Region	X			X				X
Establish, update and confirm ICS for District					X	X	X	
Establish Regional EOC based on threat level	X			X				
Establish District EOC based on threat level				X	X	X	X	X
Communication								
Develop and update Playbook for Winter Storms and make available to public							X	
Implement and update District Playbook for Winter Storms*							X	X
Check for interoperability of communication system					X	X	X	
Check for redundancy in communication system					X	X	X	
Deployment and Redeployment Planning								
Assess deployment plan for equipment and materials across District					X		X	
Assess deployment plans for equipment and materials across Region		X	X		X		X	
Equipment								
Identify district-wide equipment needs					X		X	
Procure necessary winter equipment for District		X	X				X	
Materials and Supplies								
Identify district-wide materials and supply needs					X		X	
Identify district-wide needs for ancillary personnel equipment					X		X	
Procure needed snow and ice control materials for District		X			X		X	
Procure needed ancillary personnel equipment		X			X		X	
Provide adequate storage facilities for granular and liquid snow and ice control chemicals at District reserve storage							X	

Table 5-2. District and Regional Checklist for Preparedness Activities (Continued).

PREPAREDNESS ACTIONS	KEY PERSONNEL							
	Region			District				
	Region Director	Regional Purchasing Manager	Fleet Manager	District Engineer	Director of Maintenances	Director of Operations	District Maintenance Administrator	Public Information Officer
Ensure loading and delivery areas are adequate for District storage facility							X	
Reporting Equipment, Materials and Supplies								
Report equipment inventory by pre-set deadlines			X		X		X	
Report materials and supplies by pre-set deadlines		X			X		X	
Safety and Training								
Develop and implement training programs for management and field crew							X	
Provide training on use of HCR system for relevant District staff							X	
Risk Management								
Develop risk assessment and management strategy	X				X	X		
Reporting Requirements								
Outline District reporting requirements							X	
Provide guidance on reporting requirements at the District					X		X	

* Each District should develop a playbook for winter storms

Table 5-3. Maintenance Section and Area Office Preparedness Activities.

PREPAREDNESS ACTIONS	KEY PERSONNEL				
	Area Office	Maintenance Section			
	Area Engineer	Supervisor	Assistant Supervisor	Office Manager	Crews/Equipment Technicians
Incoming Information					
Identify and confirm sources of incoming weather information	X	X	X	X	
Coordination		X			
Confirm regional emergency contact list		X			
Confirm district-wide emergency contact list		X			
Confirm ICS for Region		X			
Confirm ICS for District		X	X		
Confirm District EOC point contact(s)		X	X	X	
Establish EOC for maintenance section					
Implement and confirm ICS for Area and Maintenance Section	X	X		X	
Conduct pre-season meeting(s) with neighboring districts	X	X			
Conduct pre-season meeting(s) with local stakeholder agencies		X			
Communication					
Check for interoperability of communication system		X			
Check for redundancy in communication system		X			
Deployment and Redeployment Planning					
Assess deployment plan for equipment and materials across the Section	X	X			
Equipment					
Complete equipment maintenance checks in Chapter 7*		X	X		X
Identify maintenance section equipment needs		X	X		X
Procure the necessary winter equipment		X			
Establish process for coordination of equipment movements between maintenance sections	X	X			
Materials and Supplies					
Conduct inventory of in-stock snow and ice control materials			X		X
Identify maintenance section materials needs			X		X
Initiate procurement procedures for snow and ice control materials		X			
Calibrate all material spreaders					X
Identify maintenance section ancillary personnel equipment needs			X		X
Procure needed ancillary personnel equipment		X			
Provide adequate storage facilities for granular and liquid snow and ice control chemicals		X			
Check adequacy of loading and delivery areas		X	X		X
Pre-treat sand/abrasives stockpiles to keep materials flowable		X	X		X
Establish process for coordination of materials movements between maintenance sections	X	X			

Table 5-3. Maintenance Section and Area Office Preparedness Activities (Continued).

PREPAREDNESS ACTIONS	KEY PERSONNEL				
	Area Office	Maintenance Section			
	Area Engineer	Supervisor	Assistant Supervisor	Office Manager	Crews/Equipment Technicians
Reporting Equipment, Materials, and Supplies					
Report equipment inventory by pre-set deadlines		X			
Report materials and supplies by pre-set deadlines		X			
Safety and Training					
Identify training needs for maintenance section		X	X	X	X
Coordinate training needs with District		X			
Provide training on use of HCR system for relevant District staff		X		X	
Risk Management					
Identify risks to section and county with different types of winter storms		X			
Confirm risk assessment with District		X			
Reporting Requirements					
Provide guidance on reporting requirements		X			

Section 3

Response

Response activities are geared toward ensuring a smooth operation of winter operations during the winter storm and immediately after the winter storm subsides. Activities typically continue as long as there is either snow or ice or other winter weather precipitation on travel lanes.

Emergency Operations Center

The Emergency Operations Center (EOC) is a centralized command center (or facility) for carrying out the principles of emergency preparedness and emergency management, or disaster management functions. The EOC allows for these principles to be carried out at a strategic level in an emergency situation, and ensures the continuity of operation of the State, Region, or District. The EOC provides a central location from which government at any level can provide interagency coordination and execute decision-making in support of the incident response.

For winter weather response, three main levels of EOC can be established in the event of a winter storm. The level of an EOC activated during a winter storm event depends on the scale of the storm event. The four levels are:

- Statewide EOC.
- Regional EOC.
- District EOC.
- Maintenance Section EOC.

The statewide disaster emergency management is spelt out in the Texas Division of Emergency Management website (4). The Texas State Emergency Deployment Plan outlines roles and responsibilities for various state agencies within the overall incident command structure.

Communication Requirements

Two basic requirements should exist in any communications system during winter weather events.

- **Interoperability:** This is the ability of public safety service and support providers to communicate with staff from other responding agencies and to exchange voice and/or data communications on demand and in real time (5). To determine the interoperability requirements for setting up communication at an EOC:
    - Identify communication requirements by function or position, not by name.
    - Consider communications needs both inside and outside of the EOC.
    - Prioritize information sensitivity based on routine information, priority information, and classified or sensitive information.
    - Consider all types of communication (e.g., radio, telephone, fax, pager).

- **Redundancy:** This ensures a backup if the primary means of communication breaks down. The need to consider redundancy is critical especially with winter weather events where communication lines can be disrupted by the weather.

    - All agencies involved in the response should be able to switch to a backup system when required.
    - A system may work in one situation but not in another, hence the need to plan for multiple backup systems. Thus, the agencies involved need to design a proper procedure for switching to the backup systems to ensure that everyone who needs to communicate can.
    - Backup systems must accommodate secure communications where necessary.

Public Information

Delivering timely information to the public is an important function of an EOC. Typically, the District PIO supports the Incident Command of the EOC in this role. Public information, education strategies, and communications plans help ensure that various audiences receive timely, consistent messages about lifesaving measures, evacuation routes, threat and alert system notices, and other public safety information related to a winter storm.

EOC Facility Type

The type and size of facility utilized for conducting EOC operations is largely dependent on the scale and type of winter storm event encountered. For large scale events that affect a significant portion of a Region (or State), there will be a need for a larger physical facility with more sophisticated communication equipment availability. Such facilities can be developed by combined resources of cooperating agencies involved with incident response (such as the Combined Transportation, Emergency, and Communications Center (CTECC) in Austin, DalTrans Transportation Management Center in Dallas, TransVISION Traffic Management Center in Fort Worth, Houston TranStar in Houston, and TransGuide Advance Transportation Management System in San Antonio). If an urban or rural area is not equipped with state of the art transportation facilities and they do have a Traffic Management Center, it is recommended that they convert the TMC into an EOC during a winter event of a larger scale.

Regional EOC

At a regional level, an EOC should be set up to help direct large scale winter weather response operations that affect multiple districts. At a minimum the following individuals should be actively involved in the EOC:

- Regional coordinators involved with winter weather equipment.
- District Maintenance Administrators.
- Directors of Maintenance of various districts within the region.
- Directors of Transportation Operations of various districts within the region.

The Regional EOC should be held at a facility that provides capabilities for communication among all stakeholder agencies in emergency winter operations. Suggested locations include the

TMC for an urban area, the Department of Public Safety command and control facility, or the State Operations Center (SOC).

District EOC

District level EOC is at a lower level than regional EOCs and should involve key district staff involved with winter weather response. At a minimum, the EOC should involve the Director of Maintenance, Director of Operations and the District Maintenance Administrator or other designated staff involved in the high levels of maintenance operations at the District. District EOCs should serve as the central point for communication and coordination between TxDOT and State and local law enforcement agencies, local fire and rescue agencies, local emergency medical services (EMS) agencies, local transportation agencies, private towing organizations, the news media, and other State Departments of Transportation during a winter weather event. Representatives from each of the various primary response agencies should report to the EOC, allowing TxDOT to remain in constant contact with both City and County transportation representatives as well as representatives from law enforcement and fire fighting. Particularly during winter weather events, this level of coordination greatly enhances the District's ability to quickly respond to trouble spots. This centralized communication also allows for decisions to be made in coordination with the local agencies. District PIOs should rotate shifts so that at least one TxDOT employee is available at all times during a storm event to conduct media interviews.

Each district must develop and distribute standard operating procedures for emergency preparation, response, and recovery. All employees must be trained in the standard operating procedures (6).

Maintenance Section EOC

This EOC is typically less formal and could be activated via mobile devices. The Maintenance Section Supervisor is responsible for activating emergency procedures within a section. Snow removal and ice control take precedent over all other maintenance operations during a snow event. Often during snow removal operations it becomes necessary to move manpower and equipment from one supervisor's area to another. The district maintenance administrator should be contacted to coordinate the movement of equipment from one area to another. This allows a district-wide coordination effort and a district-wide tracking effort of where the equipment and manpower are located. If a maintenance section receives a request for TxDOT to assist with the removal of snow or ice on off-system roadways, the maintenance section supervisor should follow established procedures for this type of request.

Coordination and Communication

The coordination and communication between response personnel internal to TxDOT and external to TxDOT is essential to the success of these winter weather response actions.

Internal to TxDOT

- Maintenance Supervisor—Activates and commands winter weather response within their section.
- Area Engineer—Coordinates area response including movement of personnel and equipment as required and informs the Director of Maintenance when this is done.
- Director of Maintenance—Coordinates district response including movement of personnel and equipment between areas as required and informs the District Engineer when this is done; coordinates with other agencies and responds to requests for assistance under the direction of the Texas Department of Public Safety (DPS) Disaster District Committee Chairman; and activates and operates the District Emergency Operations Center (EOC) when necessary.
- Director of Transportation Operations—Coordinates placement of portable changeable message signs (PCMSs) and appropriate messaging on PCMSs and Dynamic Message Signs (DMS) throughout the district.
- Public Information Officer—Responds to media requests, issues press releases, and distributes information via e-mail and other methods as appropriate.
- District Engineer (or Designee)—Coordinates with other Districts including requesting or responding to requests for outside assistance (personnel, equipment, etc.).

District EOCs (often concurrent with TMCs in urbanized areas), should be the central point for internal communication and coordination between maintenance sections, with other Districts, and with TxDOT headquarters, as required. The EOC remains activated as long as is believed necessary to effectively respond to the winter weather event.

For significant winter weather events, recommended coordination procedures within TxDOT—utilizing District EOCs to support centralized communications—are as follows:

- Four hours prior to the anticipated winter weather event and subsequent compromise in public safety (e.g., onset of freezing pavement conditions), the EOC should be fully staffed and equipped to perform its role in coordinating winter weather response operations.
- All Maintenance Section offices should update their operational status at least every 4 hours or as major events such as—vehicular crashes or increased storm intensity—result in significant changes to their planned operations.
- At each 12 hour shift change, each Maintenance Section office should update their shift roster and equipment and materials inventory. It is understood that during the winter weather event, the accounting for materials used will be estimated; an accurate accounting will be made as part of post-storm procedures.
- If at any point during the response, any Maintenance Section office is in need of additional materials, personnel, or equipment, a request should be submitted to the EOC. The District EOC staff with the assistance of their respective

Best Practice

All Maintenance Section offices should update their operational status at least every 4 hours or as major events result in significant changes to their planned operations.

Regional Support Center will locate whatever additional resource necessary and task those resources with assisting the requesting maintenance office.

- The EOC should be contacted when it becomes apparent that a road section will need to be closed because of unsafe weather-related conditions. The EOC will then notify DPS or local law enforcement jurisdictions of the pending closure. The EOC will also advise TxDOT's PIO. For highways crossing district lines, the closure should be coordinated with the appropriate neighboring district counterparts.
- Each Maintenance Section office should report to the EOC when winter weather response operations have ceased in their area. As each office reports the cessation of winter weather operations, the EOC will make a determination if the reporting office's resources are needed in another location. If they are not, the reporting office will be authorized to stand down. Once all offices have ceased winter storm operations, the EOC will be deactivated.
- If possible use one point of contact at the District for communication with maintenance sections to provide better coordination of information across the District.

External to TxDOT

Several key steps should be taken to improve the communication and coordination between TxDOT and external agencies involved with winter weather management.

- For larger scale events, activate District and/or Regional EOC and implement ICS involving stakeholder agencies involved with winter weather operations management.
- Activate maintenance section EOC and implement ICS at the maintenance section; initiate communication protocol between maintenance section and local law enforcement and other local stakeholder agencies involved with winter weather operations management.
- Maintain communication with key stakeholder agency representatives throughout the duration of winter storm event.

Figure 5-7 shows a simple example of a communication flow chart during a typical winter weather event. Note that there may be slight variations for each District.

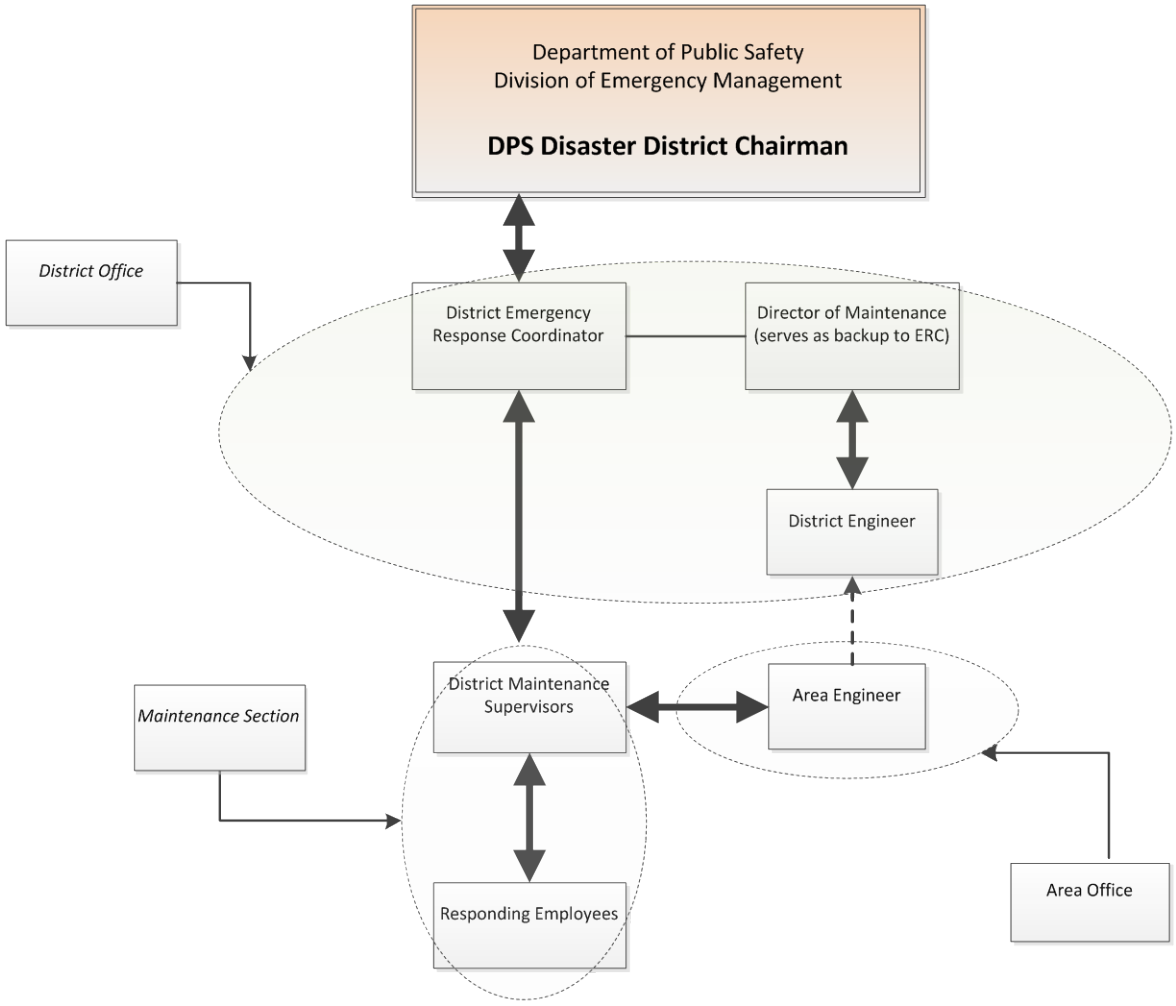


Figure 5-7. Communication Flow Chart during Typical Winter Weather Event.

Incoming Information

Continuous monitoring of incoming weather information is critical to the success of winter weather operations particularly during an ongoing winter storm event. The various sources of information (described under *Preparedness* in the previous section) should be monitored regularly to ensure that Maintenance Supervisors are armed with the latest weather forecasts to make the best decisions regarding the deployment of equipment, materials, and personnel. This also allows for any control actions such as road closures to be considered at the appropriate time.

Best Practice
Continuous monitoring of incoming weather information is critical to making good decisions in the field.

Advisory Actions

When all available preventative measures have been taken and the winter weather event still threatens public safety, notification or advisory actions are required. Providing a common set of definitions and terminology to ensure a consistent understanding of the severity of the event, the NWS distinguishes different severity levels for winter weather event notification:

- Winter Storm Watch—Issued when conditions are favorable for the development of hazardous winter weather these conditions may occur singularly, or in combination with others, usually issued 24 to 48 hours in advance.
- Advisory—A weather condition that is an inconvenience to people outdoors or can produce difficulty in travel.
- Winter Weather Advisory—Issued for sleet, snow, freezing drizzle/rain or blowing snow, sleet accumulations are expected to be less than one half of an inch snowfall of 2 to 5 inches in 12 hours light accumulations of freezing drizzle or freezing rain blowing snow intermittently reducing visibility to one quarter of a mile.
- Warning—A weather condition that is life threatening to those caught outdoors.
- Blizzard Warning—Sustained wind or frequent gusts of 35 mph or more, considerable falling snow and blowing snow frequently reducing visibility to one-quarter mile or less, conditions last three hours or more.
- Winter Storm Warning—Issued when life threatening winter weather conditions are imminent or very likely includes the occurrence of combinations of snow, ice, wind, and cold.

Notification or advisory actions are directed toward (1) other personnel involved in the management of or response to adverse weather events, including State and local law enforcement, and (2) the motoring public. These two audiences require different procedures, sets of information and levels of detail regarding the winter weather event to appropriately respond.

Response Personnel

The first responder made aware of an observed or anticipated winter weather event is responsible for notifying or advising response personnel from other agencies. For example, if a DPS officer discovered an icy bridge deck or a low water crossing that was at or near flood-stage, the officer would notify DPS dispatch who in turn would notify TxDOT's dispatch or TMC and other affected agencies. Notification methods among field response personnel generally include the use of radios, pagers, facsimiles, or landline, cellular, or satellite telephones.

To effectively respond to a winter weather event, field response personnel within and outside of TxDOT rely upon detailed information regarding the nature and extent of the event, other response personnel and agency involvement, and the current status of the event.

- **Event Description**. To ensure that the most appropriate personnel and resources are dispatched to the scene, response agencies require information regarding the type of winter weather event (e.g., flooding, snow, and ice), the exact location and anticipated geographic impact, the anticipated duration, and any recommended or established alternate routes. If members of the motoring public have already been impacted by the winter weather event, response agencies require information about the nature and extent

of traffic impacts, any vehicle types involved, and the presence of any injuries or fatalities.

- **Other Personnel and Agency Involvement**. To ensure an optimal level of response—without dispatching too few/inappropriate or excess personnel or equipment to the affected area—notification procedures among response agencies should include a description of other personnel and agency involvement. Responders should be aware of the different information needs and capabilities of each agency.
- **Status Updates**. Because both the winter weather event and the corresponding response by transportation and public safety agencies is dynamic, status updates should be routinely provided to each agency's central dispatch and TxDOT's TMC (or EOC for large scale events). The frequency of these updates is dependent upon the nature of event and how quickly conditions are changing. Rapidly evolving winter weather events will require more frequent updates.

Effective winter weather notification among response agencies can improve access to the affected area for field responders, support appropriate personnel and equipment dispatch, and improve responder safety by alerting them to potentially dangerous conditions.
For larger winter weather event, agency administrators should also be notified—notification priorities consistent with the severity and extent of the winter weather event should be established. For example, localized winter weather events may require notification of only lower level administrators from TxDOT, DPS, or local law enforcement agencies, and local fire and rescue agencies. As the severity and extent of the winter weather event increases, involvement of higher level administrators may be required. Telephone contact lists for first (low-level administration), second (mid-level administration), and third (high-level administration) priority notifications are recommended.

Motoring Public

Notification or advisory actions are also required to ensure the safety of the motoring public. To ensure motorist cooperation, notification or advisory actions should:

- Advise motorists of the nature and extent of the problem so that they may make intelligent choices about alternative routes or delayed trip departures.
- Provide information on possible courses of action such as alternative routes.
- When motorists are required to take certain actions (e.g., change lanes, reduce speed, or divert), describe those actions clearly.

Target audiences include motorists who are in the affected area, approaching the affected area, or not yet departed from work, home, or other location. A number of different traveler information tools and strategies are available to relay critical winter weather event advisories to each of these audiences (see Table 5-4).

Table 5-4. Traveler Information Tools and Strategies by Audience.

TRAVELER INFORMATION TOOL/STRATEGY	MOTORISTS		
	In the Affected Area	Approaching the Affected Area	Not Yet Departed
Static Signs with Flashers	X		
DMS or PCMS	X	X	
Highway Advisory Radio (HAR)	X	X	
Telephone Hotlines	X	X	X
Highway Condition Reporting System (HCRS) Website	X	X	X
Commercial Media Broadcasts	X	X	X
Social Media (Facebook, Twitter)	X	X	X

- **Static Signs with Flashers**. Static signs with flashers are commonly used at localized winter weather problem areas (e.g., low water crossings, elevated bridge decks). The flashers should not be operated continuously but instead, should be activated (remotely or in the field) only when a safety risk is present. Static signs equipped with flashers provide a less costly alternative to DMSs or PCMSs but are capable of providing only limited information to drivers. Like other types of traveler information tools and strategies, the effectiveness of static signs with flashers depends upon a driver taking the appropriate response action.
- **DMS or PCMS**. Dynamic or changeable message signs can be permanently installed at fixed locations, or portable and mounted on a truck or trailer. DMSs and PCMSs are useful for providing dynamic information regarding unusual conditions, guidance information regarding diversion, and advance warning of conditions ahead. To ensure maximum effectiveness when communicating with the motoring public, the information should be accurate and timely, and the signs should be located carefully to support appropriate diversionary action. PCMSs must be able to be quickly mobilized and deployed to be effective.

  If a situation arises that requires the usage of a specific DMS or PCMS for more than one ongoing condition, message priority criteria should be used for displaying messages. For example, a common hierarchy of DMS or PCMS use includes the following priority: safety, roadway closures, delay information, emergency messages (including AMBER alerts), test messages, and public service announcements.

  Standard DMS and PCMS message sets help to ensure the posting of appropriate messages and reduce the need for TxDOT personnel to redraft unique messages for each event. To elicit the proper response from motorists, DMS and PCMS messages must be short enough to be read and understood by a passing motorist. Motorist comprehension can be improved if messages contain the same elements and presentation order. Recommended message elements include a brief description of the situation, the location

of the situation, the effect on travel, and the action that the motorist should take. Potential message sets for winter weather events are presented in Figure 5-8 (7).

- **HAR**. Highway advisory radio primarily broadcasts at 530 or 1610 kHz on the AM band; roadside signing is commonly used to advise motorists to tune to the HAR frequency "when flashing." Highway advisory radio has a larger area of coverage than DMSs and can reach motorists farther upstream. In addition, HAR can provide longer, more detailed messages, including bilingual messages. Both portable and permanently installed HAR systems are available, with a transmission range of up to 1 and 4 mi, respectively. Highway advisory radio is only effective if the motorist tunes the radio to the proper HAR frequency.

- **Telephones**. Travelers can call TxDOT to access current information for specific routes and roadways. Every effort will be made to answer telephones during a winter weather event at all TxDOT offices. If that is not possible, personnel should ensure that an answering machine is used to disseminate local roadway information when the office is not staffed. The information on the recording should be kept current and should reference the department's toll free number for statewide roadway conditions.

  You have reached the Texas Department of Transportation. It is <day, date>. There has been a <watch, advisory, or warning> issued for the <district>. Roadways are currently clear, however conditions can change rapidly. In the event of frozen precipitation, there is a possibility of black ice where moisture accumulates on the roadways. TxDOT maintenance crews will be monitoring and treating roadways as necessary. If travel is necessary, remember to reduce your speed for the current conditions and use caution at bridges, overpasses, and intersections.

  For up to date road conditions in the <district> and other areas of Texas, call <telephone> during regular business hours, or <telephone> after hours. You may also visit our website at www.txdot.gov and select Travel from the left side of the page. Select Road Conditions and then choose text or map for road condition information. If you are traveling in the <area> and become stranded due to extreme weather conditions and need information regarding local lodging or emergency shelter, please call 211 for immediate assistance.

  or

  You have reached the Texas Department of Transportation. Road conditions in the <area> are clear at this time. You can receive current road conditions for the <area> and other areas of Texas by calling <telephone> during regular business hours, or <telephone> after hours. You may also visit our website at www.txdot.gov and select Travel from the left side of the page. Select Road Conditions and then choose text or map for road condition information.

- **HCRS Website**. The Internet has allowed transportation agencies to widely disseminate traveler information such as real-time traffic congestion, incidents, updates on construction activities, and other transportation-related information to the public. The information is available 24 hours a day at a relatively low cost to the provider, and it can be accessed by users from home, from work, or en route if Internet access is available. The effectiveness of traveler information websites is dependent upon the nature and

extent of, and level of effort expended to maintain, the traveler information provided on the website.

- **Commercial Media Broadcasts**. Most traveler information is broadcast over commercial AM and FM radio or television. As an indication of the importance of providing traffic-related information, private traffic-reporting firms that collect, package, and "sell" traffic information to the broadcast media have developed in many urban areas. Cooperative media partnerships help to ensure that public-sector agencies are fully utilizing resource opportunities that exist. Effective media relationships require an understanding of media perspectives, needs, and limitations, as well as a media education effort to stress the importance of accurate and timely information. Multidisciplinary training may provide convenient forums for improving media relations.

- **Social Media**. Social media can be used to supplement traditional communication methods and help increase public involvement. TxDOT uses a variety of channels to inform the public, including Facebook™, Twitter™, Flickr™, and YouTube™. Twitter™—which is focused on extremely brief (140 characters) and timely updates exchanges—is perhaps most useful for supporting traveler information related to winter weather events.

TxDOT's PIO will be responsible for managing all communications with the media and the public. Traveler information should be provided as early in winter weather event process as possible and should continue until the threat has cleared.

DMS - 15 Character Messages (Stage 1 - 5)				PCMS- 8 Character Messages (Stage 1 - 5)			
Sign Type-->	**DMS**	**PCMS**	**STAGE 1**	**Sign Type-->**	**DMS**	**PCMS**	**STAGE 1**
1ST LINE	X		ICY CONDITIONS	1ST LINE		X	WINTER
2ND LINE	X		MAY EXIST	2ND LINE		X	WEATHER
3RD LINE				3RD LINE		X	EXISTS
1ST LINE	X		DRIVE WITH	1ST LINE		X	DRIVE
2ND LINE	X		CAUTION	2ND LINE		X	WITH
3RD LINE				3RD LINE		X	CAUTION

Sign Type-->	**DMS**	**PCMS**	**STAGE 2**	**Sign Type-->**	**DMS**	**PCMS**	**STAGE 2**
1ST LINE	X		ICY CONDITIONS	1ST LINE		X	WINTER
2ND LINE	X		MAY EXIST	2ND LINE		X	WEATHER
3RD LINE				3RD LINE		X	EXISTS
1ST LINE	X		EXPECT DELAYS	1ST LINE		X	EXPECT
2ND LINE	X		DRIVE WITH	2ND LINE		X	DELAYS
3RD LINE			CAUTION	3RD LINE			

Sign Type-->	**DMS**	**PCMS**	**STAGE 3**	**Sign Type-->**	**DMS**	**PCMS**	**STAGE 3**
1ST LINE	X		WINTER	1ST LINE		X	WINTER
2ND LINE	X		WEATHER	2ND LINE		X	WEATHER
3RD LINE			WARNING	3RD LINE		X	WARNING
1ST LINE	X		TRAVEL	1ST LINE		X	SEEK
2ND LINE	X		DISCOURAGED	2ND LINE		X	SHELTER
3RD LINE			SHELTER - DIAL 211	3RD LINE		X	DIAL 211

Sign Type-->	**DMS**	**PCMS**	**STAGE 4**	**Sign Type-->**	**DMS**	**PCMS**	**STAGE 4**	
1ST LINE	X		IH XX	1ST LINE		X	IH XX	Note: If this PCMS is not at an exit then use this Phase 2 message:
2ND LINE	X		CLOSED	2ND LINE		X	CLOSED	
3RD LINE				3RD LINE		X		
1ST LINE	X		SEEK	1ST LINE		X	ALL	SEEK
2ND LINE	X		SHELTER	2ND LINE		X	TRAFFIC	SHELTER
3RD LINE			211	3RD LINE		X	EXIT NOW	211

Sign Type-->	**DMS**	**PCMS**	**STAGE 5**	**Sign Type-->**	**DMS**	**PCMS**	**STAGE 5**
1ST LINE	X		ICY CONDITIONS	1ST LINE		X	WINTER
2ND LINE	X		MAY EXIST	2ND LINE		X	WEATHER
3RD LINE				3RD LINE		X	EXISTS
1ST LINE	X		EXPECT DELAYS	1ST LINE		X	EXPECT
2ND LINE	X		DRIVE WITH	2ND LINE		X	DELAYS
3RD LINE			CAUTION	3RD LINE			

Figure 5-8. DMS and PCMS Message Sets for Winter Weather Events (7).

Implement Deployment and Redeployment Plans

Effective winter weather response operations rely upon coordination and communication between response personnel within and outside of TxDOT and various preventative, advisory, control, and treatment actions. Most often these actions and associated equipment, materials and supplies, and personnel resources are dispatched according to a predetermined prioritization of the District or area roadway network. These lists are referred to as *spray routes*, *de-icing routes*, *snow plow priority list*, etc. An example of roadway prioritization is as follows:

- Priority 1—High-volume roadways such as Interstates, U.S. Highways, or other primary routes and known trouble spots such as bridges, steep grades, and sharp curves.
- Priority 2—State highways and high-volume Farm-to-Market (FM) roads.
- Priority 3—Low volume FM roads (some FM roads may be higher priority based on their importance to the local communities such as being an emergency route to these communities).

Responsibilities and Functions

Maintenance supervisors are responsible for coordinating all activities within their geographic area of responsibility, including the scheduling, dispatch, and care of qualified personnel.

Best Practice
As a safety precaution, no employee should work more than 16 consecutive hours without a minimum of 8 hours "off the clock" to avoid fatigue.

- In anticipation of a winter weather event, appropriate personnel should be placed on "On-Call" or "May-Call" status. All personnel vacations will be canceled, as required.
- During an event, rotation of crews is recommended and left up to the maintenance supervisor's discretion as to how shifts are divided. Whenever possible, a continuous operation with two crews rotated every 12 hours until all highways are clear should be used. As a safety precaution, no employee should work more than without a minimum of 8 hours "off the clock" to avoid becoming fatigued. Exceeding the 16 hour threshold is occasionally allowed for non-driving duties—the Area Engineer may authorize and approve more than 16 hours of shift time by submitting a detailed exception report, in writing, to the District Engineer after the event has ended.
- The location, arrival, and departure times of field employees should be tracked to ensure safety of employees and adequate response time to potentially unsafe conditions. Personnel dispatch can be expedited and accomplished without a supervisor giving individual assignments with each event, if pre-assigned routes are in place.
- When maintenance crews are not able to cover all roadways and additional manpower is needed, resources within the Area or District should be utilized first. TxDOT Area Office personnel who do not possess a Commercial Driver's License (CDL)—including engineers, inspectors, designers, and support staff—can assist with dispatching, manning barricades, or riding with operators during nighttime operations. The Area Engineer shall coordinate with the Maintenance Supervisor for the use of Area Office personnel, needed to work during winter weather response operations. If additional personnel within the District are required, the District Maintenance Office must be

contacted and informed of the movement of equipment and/or personnel from one maintenance section to another.

- The District Director of Operations (or Director of Maintenance or other designee) should be contacted if additional assistance is needed which requires moving personnel and/or equipment into or from another District. The Director of Operations may move equipment and personnel both within and out of the District to concentrate clearing efforts to higher priority routes. The movement of Department assets must be a District-wide coordinated effort. This includes tracking weather event movement, areas of least and greatest impact, and the location of the needed resources. The Director of Operations will have the authority and duty to activate the local EOC, when necessary, to coordinate the movement of assets between sections and across district lines. During major storms, the EOC will be activated and operate continuously 24-7 through the duration of the winter weather event under the ICS.
- If a maintenance section receives a request for TxDOT to assist with the removal of snow or ice on off-system roadways, the maintenance section supervisor should follow established procedures for responding to off-system disasters.
- In extreme instances, it may be necessary to outsource winter weather response activities to supplement TxDOT forces. In these instances, use of Routine Maintenance Contracts or Purchase of Services should be considered. The appropriate District and/or Division personnel should be consulted early in the process for these methods of outsourcing to be in effect in a timely manner.

Crew Sizes

In addition to the information provided in the preparedness section under *Personnel Training and Safety*, determine the crew sizes to use based on the following conditions:

- Type of storm (ice, snow, freezing rain, etc.).
- Travel distances for crew (critical for multi-district and multi-county operations).
- Available personnel.
- Experience of personnel (with equipment, materials, and general winter weather response process).

When determining crew makeup and sizes, consider the following:

- Pair experienced staff with inexperienced operators.
- Include equipment technicians with crews for long distance travel.
- For cross district travel (or other long distance travel), reduce convoy sizes to improve response time.

At a minimum, consider the issues discussed above in determining crew sizes. If the intensity of a storm increases, additional steps can be taken with regards to crew.

- Contact district administration coordinator to request district emergency staff to support maintenance section operations.

- Coordinate with the district to determine additional crew support from neighboring districts.

Equipment

Maintenance section supervisors have responsibility for deploying winter weather equipment as needed. Their deployment decision should be based on local weather conditions including current and predicted weather conditions; equipment type and quantities; available personnel including experience of personnel in various aspects of winter storm operations, and personnel;

The Area Engineer coordinates movement of equipment between maintenance sections. However, input from the District is required for any movement of equipment and personnel to neighboring Districts and counties.

Safety

The two groups of people to be considered during safety checks are the maintenance crew (including other agency staff involved in winter weather response process) and the traveling public. In addition to the safety (and training) measures outlined previously during pre-storm activities, the following measures should be taken to ensure the safety of maintenance staff as during any response process to winter weather events.

- During adverse weather, employees should communicate periodically with the dispatcher during operations and relay their location especially when changing roads.
- As noted previously, operator fatigue is a significant safety concern. The maintenance supervisor will be responsible for determining when an employee is to be relieved. The maintenance supervisor shall immediately relieve any employee that notifies him that he is in need of relief. Employees are expected to be honest in their assessment of their ability to continue to work safely, prior to beginning and for the duration of response.

Maintenance supervisors and the district maintenance administrator should evaluate the potential risk or benefit of the winter weather response and conduct operations accordingly. When conditions are so severe (e.g., extremely high winds with white outs) that attempting to improve road conditions is a hazard for both the public and equipment operators, response operations may be suspended temporarily until conditions improve.

Control Actions

Control Actions are designed to provide the District maintenance staff with a means of maintaining drivability on roadways whiles ensuring the safety of both first responders and District staff as well as the traveling public. Control actions include route prioritization (typically determined during Pre-Event planning), deploying alternate routes, and ensuring traffic signal operations are altered to accommodate re-routed traffic patterns.

- *Road Closures*

Districts should make it an objective to keep the roadways open for as long as is possible. Coordination between Districts, DPS, and local law enforcement is crucial in ensuring successful road closure actions and in reducing the threat of accidents due to slick roadway surfaces. Consider the following issues as part of a District's overall policy toward road closure.

- Impact to local economy: Determine the potential impact to the local economy for a particular roadway to be closed.
- District resources to combat winter weather: Consider available resources to combat winter weather, including the experience and number of maintenance staff available for responding to a storm.
- Miles of roadway affected by winter weather: The more miles of roadway a District has to cover, the more resources and funds are required to adequately treat iced roads or plow snow from roadways.
- Severity of storm: Determine the severity of the storm and the relevant resources needed to combat it to maintain safe roadway travel and preserve the safety of TxDOT staff and other first responders.

In the event that local authorities request that a state-maintained roadway be closed, the following procedures should be considered:

- The Department of Public Safety (DPS) or local law enforcement with jurisdiction should be responsible for closing a roadway with significant input from the District or Maintenance Section Supervisors. In situations where TxDOT is in disagreement with the DPS or local law enforcement on the road closure, DPS has the final say.
- For highways crossing district(s) or state line(s), the closure should be coordinated with the appropriate counterparts *in advance* of the storm and during winter weather response.
- The closed roadway should begin and end within city limits or at major intersections to ensure motorists are not stranded within the limits of the closed roadway.
- Where practical, signs should be erected to advise traffic.
- The closed roadway section should continue to be patrolled, plowed, and salted by maintenance section personnel according to established priorities and with the goal of reopening the roadway as soon as possible. This will also help ascertain that no one is stranded in the closed section.
- Notice should be given to all news media and appropriate officials.
- The road closure should be noted on HCR and removed when the roadway is reopened.

Best Practice

The decision to close a road should come from the Department of Public Safety with input from TxDOT.

Note: When plowing the roadway, windrows of snow should not be left at railroad grade crossings. After plowing, the railroad track should be cleaned of the snow pack, ice, gravel, or dirt. Snowplow operators should be instructed to open side road approaches that may be obstructed by windrows of snow. Failure to maintain access to side road approaches may effectively cut-off the movement of traffic onto state highways.

- *Alternate Routes*

Oftentimes, adverse winter weather affects a broad geographic area, limiting the availability of safe alternate routes. Certain roadway geometric design features, however, can make select roads in a region impassable during a winter weather event while others may continue to be safe. For example, at-grade roadway alternatives may be favored over routes with elevated direct connector ramps or bridges under adverse weather conditions.

Appropriate alternate routes intended for public use are often difficult to identify and require associated diversion plans to be effective. During a winter weather event, motorists may self-route or be directed to an alternate route by response personnel. Not all routes may be able to accommodate all traffic types, in particular heavy truck traffic can be a problem. The designation of alternate routes can be politically charged; buy-in from all affected jurisdictions is required. When county or city roadways are utilized as alternate routes, appropriate jurisdictions should be notified immediately so that they may adjust to accommodate the additional traffic flow.

When available, alternate routes have the potential to reduce traffic demand and subsequent crash exposure along affected routes and maintain mobility and reduce frustration for the motoring public. As part of the planning for winter weather response, Districts should designate appropriate alternate routes should there be a need for road closures and plan for associated diversion plans.

In considering alternate routes, the following should be taken note of:

- For interstate highway section closures, consider treating frontage roads and using them as alternate routes for highway travel.
- Consider at-grade roadway alternatives if elevated direct connector ramps or bridges are not adequately treated.
- Truck traffic requires sufficient infrastructure that can support heavy loads and accommodate larger vehicle dimensions. Bridge and overpass structures are commonly limiting factors along potential alternate routes. In such instances, distinct alternate routes may be identified for passenger car and truck traffic.

- *Traffic Signal Systems*

To accommodate detoured traffic along alternate routes, responsive traffic signal control (RTSC) systems or modified traffic signal timing plans can be used. RTSC systems use algorithms that perform real-time optimization of traffic signal splits, offsets, phase lengths, and phase sequences based on current traffic conditions, demand, and system capacity to minimize delay and reduce the number of vehicle stops. System technologies “sense” the

increased traffic demand using electronic loops, video imaging, or microwave sensors and automatically adjust the signal timings to improve traffic flow. The effectiveness of RTSC systems is dependent upon the geographic extent of the system, the performance of the algorithms in responding to real-time traffic conditions, and the effort expended in maintaining the system to ensure ongoing functionality.

In the absence of RTSC systems, the use of alternative or modified traffic signal timing plans during winter weather events can effectively improve traffic flow by providing additional green time along designated alternate routes. Most traffic signal controllers allow multiple programs to be set. Response personnel can override the normal program manually, or in some cases the timing may be set remotely from a TMC. Alternate route signal timing plans can be developed in conjunction with alternate route plans.

- *Treatment Actions*

There are two distinct snow and ice control strategies that have been gaining popularity and show promise in making use of chemical freezing-point depressants: de-icing and anti-icing. Anti-icing operations are conducted to prevent the formation or development of bonded snow and ice for easy removal, while de-icing operations are performed to break the bond of snow and ice and eliminate the buildup on the roads. See Chapter 8 *Winter Weather Chemicals and Materials* for information on the various chemicals available to use in these operations.

- *Pre-Wetting*

Pre-wetting of dry ice and snow treatment material before application on the road surface reduces the scattering of the dry materials off the roadway lanes. This can do two things:

  - If the material is chemical, it increases the potential for the material to stay on the road surface and remove the bonding between the ice/snow to the road surface.
  - For abrasives, it increases the friction caused by these materials by allowing abrasives to remain longer on the road surface. As a result, it also reduces the potential for skidding of vehicles.

- *Anti-Icing*

Anti-icing involves pre-treating a road **before** the freezing weather or storm arrives with the goal of limiting or preventing the buildup of ice. Successful anti-icing efforts require accurate timing and good judgment about when and where to treat, relying on weather forecasts, field sensors, and infield measurements or observations to predict when a storm will hit and its severity.

- **Benefits:** Studies by various agencies and institutions have identified several benefits of a sound anti-icing strategy:

    - By preventing snow or ice from bonding to pavement, removal, and control is much easier.
    - Material is applied ahead of the storm, making it safer for equipment and operators.
    - Lower material application rates compared to de-icing operations.
    - The need for sand or other abrasives is reduced.
    - Subsequent cleanup of sand or other abrasives is reduced, and
    - Reduced environmental impact.

Best Practice
Anti-icing is a pro-active approach that prevents bonding of ice or snow to pavement, making it easier to remove slush. Districts with active winter weather should consider anti-icing.

- **Use with RWIS:** Anti-icing can be more effective when coupled with a Roadway Weather Information System (RWIS). An RWIS helps to make informed decisions about when and where to deploy materials, crews, and equipment. While an anti-icing strategy coupled with an RWIS can be beneficial, there are some drawbacks associated with RWIS:

    - High initial cost.
    - Potential for premature and/or unnecessary application of materials.
    - Insufficient sensors/stations and the incompatibility of RWIS platforms.
    - Over-application of chloride-based chemicals can result in slick pavement.
    - High maintenance and upkeep costs.

Consider anti-icing if you have frequent ice and snow events during a typical winter season as the benefits are more prominent for such regions.

- **Types of Application Systems:** Anti-icing systems can be either mobile truck-mounted spray rigs, capable of covering large areas where needed, or fixed spray systems that will treat specific problem locations. Both use a chemical that can lower the freeze point of water, requiring a storage tank for the chemical. Generally, a 6,000-gallon capacity tank with agitation and circulation capabilities is used. However other sizes are acceptable, depending on specific local needs and conditions.

- **Mobile Application Systems:** The equipment for a mobile system consists of a truck-mounted tank with a spray boom and controls for accurate calibration. Cost-effective dual herbicide/anti-icing spray units have been designed and built. In such dual-use systems, it should be noted that the chemicals used for anti-icing can be corrosive and thorough cleaning between seasons is necessary. Commercial vendors can supply a large variety of types and size rigs suitable to the section's needs. GSD purchases major equipment for all snow and ice control methods.

- **Fixed Application Systems:** There have been marked advancements in the use of fixed anti-icing systems in the past few years. Fixed systems have been placed at toll plazas, super-elevated bridges, and steep hills where maintaining vehicle traction is critical. These systems use the same chemicals available for mobile anti-icing systems. They are designed and installed at problem locations and can be linked with RWIS to assist in predicting conditions favorable for treatment. Depending on the complexity of the RWIS equipment, the system can be activated remotely or automatically. The spray systems themselves vary in complexity, but will spray the anti-icing chemical from fixed points onto the road's surface. Traffic, in turn, will spread and track the chemical over the designed area providing the desired effect. Fixed systems can be installed during new road construction or added at existing problem locations. Vendors specializing in fixed anti-icing systems can be found on the Internet.

- *De-icing*

  De-icing methods generally involve the use of chemicals to speed the melting process after snow pack or ice has formed on a road. Liquid chemicals with similar spray equipment can be used for de-icing, provided they can be applied at sufficient pressure to cut though the ice or snow pack. Caution must be exercised during de-icing since spraying liquids on top of the pack may cause the road to become slick. The use of dry solid chemicals and pre-wetted abrasives in conjunction with de-icing will speed the melting of the snow and ice pack. This practice will improve the de-icing process and reduce the time it would take to melt naturally.

Perform Risk Management

Monitor the risks that were analyzed for the storm and make appropriate adjustments based on ongoing changes. Constant monitoring of winter weather operations is critical in ensuring a success of the response operations to winter weather.

Reporting

Aside advisory actions targeted at the general public, reporting timely information internally within a maintenance section, between the maintenance section and the district and statewide, is important from an operations standpoint. Three general types of reporting should occur:

- Internal TxDOT Reporting.
- Statewide Reporting.
- Federal Reporting.

The type of reporting is usually based on the nature and severity of the winter weather event. See Chapter 12 *Reporting* for more detailed information on reporting procedures required during winter weather events.

Internal TxDOT Reporting

Internal TxDOT reporting includes local status reports within the maintenance section and an updates report from maintenance sections to the district office. A well-organized system for internal reporting can make responding to District, State, and federal inquiries much easier.

- **Local Status Reports:** It is the responsibility of the maintenance section supervisor (or his designee) to ensure that status reports are provided by field crew on items such as pre-trip inspection reports for trucks, snow plows, spreaders, motor graders, etc. Such reports include daily activity reports tracking shift hours, mileage, equipment usage hours, and materials applied during treatment operations.
- **District Reporting from each Maintenance Section:** It is the responsibility of the maintenance section supervisor (or his designee) to contact the district maintenance administrator by phone or pager when snow or ice control measures begin. Periodic updated reports should be provided by the maintenance section supervisor (or his designee) on control operations to the district maintenance administrator or designated district contact at the EOC. The frequency and detail of these reports will depend on the severity and nature of the winter storm.

Statewide Reporting

- **Highway Condition Reporting (HCR) System**: HCR sign-on keys should be verified as "Active" for each maintenance employee who has reporting responsibilities (primary and back-up). It is important to keep a dispatcher on duty as a contact point for information requests, and for the safety of the crewmembers.

Federal Reporting of Storm Damage Costs

For significant and severe winter weather events (with damages typically in excess of $1 million,) districts may seek reimbursement through the Federal Emergency Management Agency (FEMA). Federal reimbursement is limited to damages from severe ice storms; damages due to snow storms are not eligible.

District Checklist for Winter Operations

Checklists for winter weather operations during the storm are provided in Table 5-5 and Table 5-6.

- Table 5-5 presents a checklist of winter weather response operations for the District.
- Table 5-6 presents a checklist of winter weather response operations for the maintenance section.

Table 5-5. District and Regional Checklist for Response Event Activities.

RESPONSE ACTIONS	KEY PERSONNEL							
	Region			District				
	Region Director	Regional Purchasing Manager	Fleet Manager	District Engineer	Director of Maintenance s	Director of Operations	District Maintenance Administrator	Public Information Officer
Incoming Information								
Monitor all incoming weather information							X	
Coordination								
Activate Regional EOC based on severity level of winter storm	X			X	X	X		
Activate District EOC based on severity level of winter storm				X	X	X		X
Monitor status reports from maintenance sections					X	X	X	
Communication								
Maintain communication with maintenance sections and area offices					X	X	X	
Provide updates to traveling public through news and social media								X
Deployment and Redeployment Plan								
Implement deployment and redeployment plan								
Equipment								
Monitor region-wide equipment resources		X	X					
Monitor district-wide equipment resources					X		X	
Coordinate movement of equipment between maintenance sections					X		X	
Coordinate movement of equipment to neighboring districts					X		X	
Materials and Supplies								
Monitor region-wide materials and supplies resources		X						
Monitor district-wide materials resources					X		X	
Coordinate movement of materials between maintenance sections					X		X	
Coordinate movement of materials to neighboring districts					X		X	
Safety								
Monitor status reports from maintenance sections and area offices					X		X	
Maintain reserve supply for materials, supplies, and equipment					X		X	
Control Actions								
Coordinate with DPS officials to close roadways					X			
Treatment Actions								
Make district reserve personnel and materials ready to be deployed					X		X	

Table 5-5. District and Regional Checklist for Response Event Activities (Continued).

RESPONSE ACTIONS	KEY PERSONNEL							
	Region			District				
	Region Director	Regional Purchasing Manager	Fleet Manager	District Engineer	Director of Maintenance s	Director of Operations	District Maintenance Administrator	Public Information Officer
Risk Management								
Perform ongoing risk management					X			
Reporting Requirements								
Provide relevant reporting to FEMA if necessary				X	X	X		

Table 5-6. Maintenance Section and Area Office Checklist for Response Event Activities.

RESPONSE ACTIONS	KEY PERSONNEL				
	Area Office	Maintenance Section			
	Area Engineer	Supervisor	Assistant Supervisor	Office Manager	Crews/Equipment Technicians
Incoming Information					
Monitor all sources of incoming weather information	X	X	X	X	X
Coordination					
Activate maintenance office EOC and initiate ICS roles	X	X			
Activate communication protocol with neighboring counties and districts		X	X		
Activate communication protocol with local stakeholder agencies		X			
Communication					
Provide periodic updates to district office on winter response operations		X			
Monitor progress of crew in field		X	X		
Implement Deployment and Redeployment Plan					
Equipment					
Monitor equipment resources and locations across maintenance section		X	X		X
Identify maintenance section equipment needs		X	X		X
Coordinate movement of equipment between maintenance sections	X	X			
Materials and Supplies					
Monitor materials and supplies resources and locations across maintenance section					
Identify maintenance section equipment needs					
Coordinate movement of equipment between maintenance sections					
Safety					
Monitor status reports from maintenance sections and area offices		X			
Monitor inventory of ancillary personal equipment		X			
Control Actions					
Coordinate with local DPS officials to close roadways		X			
Implement alternate routing procedures		X			X
Implement appropriate traffic signal operation changes	X	X			
Treatment Actions					
Pre-treat roadways if feasible					X
Deploy equipment based on pre-defined priority treatment routes			X		X
Use pre-wetting and other procedures to improve effectiveness of materials		X			X
Monitor inventory of snow and ice control materials		X	X		X
Continuously monitor roadways for current roadway surface conditions			X		X
Risk Management					
Perform ongoing risk management					
Reporting Requirements					
Update the HCR system periodically				X	

Section 4

Recovery

After Action Review – Maintenance Section Level

Following each significant winter weather event, the Maintenance Section Supervisor should call a meeting of all maintenance section field crew, technicians, and office management, to discuss the challenges and successes of the immediate past winter weather response operations. A typical after action review should contain the following topics for discussion:

- A description of the winter weather event, including the timeline, geographic extent, and any available pictures and/or video.
- A review of winter weather response objectives.
- A discussion on logistics of personnel (crew shift hours, meals, lodging, safety, etc.).
- A discussion of response outcomes (what was accomplished versus original intent).
- A discussion of lessons learned (sustain versus improve).
- An identification of future actions needed to correct any problems.

The Maintenance Section Supervisor should then prepare a detailed report to the District Director of Maintenance based, in part, on these internal Maintenance Section meetings.

After Action Review – District Level

Following each significant winter weather event, the Director of Maintenance should call a meeting of all maintenance supervisors and other key personnel shortly after the event to discuss procedures that worked and identify those that did not, so that changes may be implemented prior to the next winter weather event. The District-level meetings should occur after meetings at the maintenance section level are completed. The after action reviews at the District level will follow those discussed at the maintenance section level but will include additional items specific to District input in winter weather operations, such as the following:

- Sharing of maintenance personnel, equipment, and material resources across different sections.
- Communication and coordination between the District and maintenance sections.
- Support by District maintenance staff to winter weather operations.

For very active winter seasons, an in-depth District-level meeting may not be feasible and can be conducted at the end of the winter season instead of immediately after each winter storm event.

Table 5-7 and Table 5-8 show activities that should occur after winter weather events for the District and maintenance sections, respectively.

Table 5-7. District and Regional Recovery Event Activities.

RECOVERY ACTIONS	KEY PERSONNEL							
	Region			District				
	Region Director	Regional Purchasing Manager	Fleet Manager	District Engineer	Director of Maintenance	Director of Operations	District Maintenance Administrator	Public Information Officer
Incoming Information								
Review incoming weather information sources for reliability								
Documentation								
Develop comprehensive report of impact of winter season in district					X	X	X	
Coordination and Communication								
Review region EOC performance	X	X	X					
Review district EOC performance				X	X	X		
Conduct meeting with all maintenance section supervisors	X			X	X	X		
Conduct meeting with district administrative personnel in districts affected by storm in the region				X	X	X		X
Conduct meeting with stakeholder agencies involved in winter response operations including news media					X		X	X
Equipment								
Update status of region-wide equipment resources			X		X			
Update status of district-wide equipment resources					X		X	
Materials and Supplies								
Update status of region-wide materials resources and other supplies		X			X			
Update status of district-wide materials resources and other supplies					X		X	
Safety and Training								
Schedule upcoming training programs as needed					X		X	
Risk Management					X			
Review risk management					X	X		
Reporting Requirements								
Review reporting requirements					X	X		

Table 5-8. Maintenance Section and Area Office Recovery Event Activities.

RECOVERY ACTIONS	KEY PERSONNEL				
	Area Office	Maintenance Section			
	Area Engineer	Supervisor	Assistant Supervisor	Office Manager	Crews/Equipment Technicians
Incoming Information					
Review incoming weather information sources for reliability	X	X	X	X	X
Coordination					
Review maintenance section EOC performance					
Conduct meeting with all maintenance section staff	X	X			
Conduct meeting with neighboring districts involved in winter storm response operations	X	X			
Conduct meeting with neighboring maintenance sections involved in winter response operations	X	X			
Conduct meeting with local stakeholder agencies involved in winter response operations		X			
Communication					
Provide detailed report on winter weather operations to district office		X			
Review Control Actions					
Review all control actions including road closures, alternate routing, and traffic signal operations		X			
Equipment					
Perform necessary post season equipment cleaning		X	X		X
Perform inspection and repair of equipment as needed		X	X		X
Update maintenance section equipment inventory and needs		X	X		X
Materials and Supplies					
Remove aggregates from roadways		X	X		X
Store all unused materials if feasible		X			X
Update inventory of available materials		X	X		X
Update inventory of ancillary personal equipment		X	X		X
Review performance of chemical materials and abrasives to combat winter weather		X	X		X
Review Treatment Actions		X			X
Safety and Training					
Update training needs for maintenance section staff		X			
Risk Management					
Review risk management		X			
Reporting					
Update the HCR system				X	

Section 5

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Chapter 6
Multi-District Operations Guidance

Contents:

Section 1
Overview

Definition of Multi-District Operations

These are operations involves two or more Districts that integrate into a unified organizational structure for coordinating and supporting large scale winter weather events. The large scale events can occur within the boundaries of a single District or cut across the areas of responsibility of multiple Districts and/or Maintenance Sections. These operations also utilize a common framework that is supported by a combination of facilities, equipment, personnel, procedures, and communications capabilities.

Phases of Events

Conceptually, the preparedness, response, and recovery phases of events mentioned in Chapter 5 *District Level and Maintenance Section Operations Guidance* is the same for multi-district operations. While there is an additional layer of complexity that is inherently part of multi-district operations, the actions undertaken should be employed by a single, coordinated response entity.

Moreover, this chapter identifies and describes operational action items to use when battling winter weather events from a multi-district perspective. Also, information regarding deployment planning and implementation activities are discussed as well.

Section 2

Preparedness

During this phase, each TxDOT District and their respective Maintenance Sections will reference Chapter 5 *District Level and Maintenance Section Operations Guidance* and utilize Tables 5-2 and 5-3 to establish their level of readiness for the upcoming winter weather season. However, in preparing for multi-district operations, particular attention should be given to the familiarization of deployment and redeployment actions. Some specific action items that the each District and Maintenance Section should take under consideration are:

- Determine level of winter weather threat.
    - Protocols that determine the appropriate level of deployment response – local (within the District and/or Maintenance Section jurisdiction), regional (adjacent and non-adjacent District(s) within the same region), or statewide (outside of regional jurisdictional boundaries).
- Coordination.
    - Establish a general set of protocols for coordinating activities to align with the appropriate levels of a deployment response.
- Communication.
    - Establish basic lines of communication (LOC) to interact with organic forces and host (supported) District and/or Maintenance Section forces.
    - Establish a general communication protocol to determine the equipment and training necessary to the requirements for both internal and interagency communications.
    - Identify communication tools (e.g., sharepoint sites) to create an interoperable system for both internal and interagency communication.
- Designated assembly area(s) where personnel can gather to get ready for deployment.
- Deployments – duration, travel distance, and travel time are key planning factors.
    - Short-term: Defined as taking no more than 4 hours of travel time under winter weather conditions to arrive at a given destination.
    - Long-term: Defined as taking no more than 8 hours of travel time under winter weather conditions to arrive at a given destination.

Best Practice

Establish SharePoint sites to facilitate creating an interoperable system for both internal and interagency communication.

- Equipment Distribution.
    - Determine excess equipment that can be deployed and not leave the District and/or Maintenance Section vulnerable and unprepared to battle a storm event in their area of responsibility.
    - Radio watch procedures.

- Materials and Supplies.
    - Determine excess materials and supplies that can be deployed and not leave the District and/or Maintenance Section vulnerable and unprepared to battle a storm event in their area of responsibility.

- Personnel Distribution.
    - Determine the number of crews and crew composition that can deploy and not leave the District and/or Maintenance Section vulnerable and unprepared to battle a storm event in their area of responsibility.
    - Staffing rosters, duties, and responsibilities.
    - Tracking field employees. The location, arrival and departure times of field employees should be tracked to ensure safety of employees and adequate response time and adequate response time to potential roadway complaints. Examples of tracking field employees could be done utilizing personal digital assistant (PDAs) devices and/or global positioning system (GPS) enabled cell phones.
    - Color coding crew teams.
    - Contact information (chain of command, phone numbers, etc.).

Best Practice

Examples of tracking field employees could be done utilizing PDA devices and/or GPS enabled cell phones.

- Field operational protocols to respond to appropriate levels of deployment—local (within the District and/or Maintenance Section jurisdiction), regional (adjacent and non-adjacent District(s) within the same region), or statewide (outside of regional jurisdictional boundaries).
    - Implement LOCs.
    - Establish a general protocol to acquire knowledge regarding the host (supported) District and/or Maintenance Section area of responsibility.
        - Capabilities of the personnel and equipment.
        - Route prioritization and location.
        - Identification of major vulnerabilities (e.g., loss of communication equipment).

- Safety and Risk Management.

- Logistics and Administrative.
    - Acquiring equipment, materials, and supplies.
    - Travel Arrangements.
        - Coordination and schedule lift for loading and moving organic winter weather equipment.
        - Packing of equipment, materials, and supplies.
        - Fuel cards with sufficient line of credit to purchase gasoline.
    - Lodging Arrangements.
        - Establish agreements with external agencies (e.g., Texas National Guard, hotels, travel centers, adjacent state DOTs) for support during winter weather operations.
        - Determine potential lodging facility or facilities.
        - Coordinate and confirm lodging facility or facilities.
    - Strip maps outlining convey routes.
    - Reimbursement and incentives for personnel responding to storm events away from their normal duty station.
    - In extreme instances, it may be necessary to outsource snow and ice control to supplement TxDOT forces. In these instances, use of Routine Maintenance Contracts or Purchase of Services should be considered. The appropriate district and/or regional personnel should be consulted early in the process for these methods of outsourcing to be in effect in a timely manner.

- Redeployment.
    - Reporting and debriefing.
    - Travel Arrangements.
        - Coordination and schedule lift for loading and moving organic winter weather equipment.
        - Repacking of organic winter weather equipment, materials, and supplies.
        - Fuel cards with sufficient line of credit.
    - Lodging Arrangements.
        - Determine potential lodging facility or facilities.
        - Coordinate and confirm lodging facility or facilities.
    - Reconstitute Assets.
        - Equipment, materials, and supplies.
        - Redistribution of excess materials and supplies.
    - Conduct required equipment inspections.

Checklist for Preparedness for Winter Events

Table 6-1 serves as a general checklist for all entities that have a role to play in preparing for winter weather events. It is provide a guidance regarding action items to consider prior to the actual start of the winter season. Additionally, some of these action items are best considered following a winter season in order to provide enough time for completion prior to the upcoming winter season.

Table 6-1. Multi-District Checklist for Preparedness Activities.

PREPAREDNESS ACTIONS	Region	District	Area Office	Maintenance Section
Levels of Winter Weather Threats				
Establish protocols to determine appropriate levels of deployment to response to winter weather threats		X	X	X
Coordination				
Establish protocols for coordinating activities to align with various levels of deployment responses	X	X	X	X
Communication				
Establish basic LOCs for organic forces		X		X
Establish communication protocols for equipment and training requirements for internal and interagency interactions		X		X
Identify communication tools to create interoperable systems for both internal and interagency interactions		X		X
Deployment				
Assess deployment plan for short-term deployments		X		X
Assess deployment plans for long-term deployments		X		X
Equipment Distribution				
Identify excess equipment for deployment	X	X	X	X
Materials and Supplies				
Identify excess materials and supplies for deployment	X	X	X	X
Personnel Distribution				
Identify number of crews and crew compositions		X		X
Establish protocol for tracking personnel (e.g., color scheme for crews, PDAs, GPS enabled cell phones)		X		X
Field Operational Protocols		X	X	X
Safety and Risk Management	X	X	X	X
Understand and maintain safety requirements		X		X
Develop risk assessment and management strategy		X		X
Logistics and Administrative				
Coordination for acquiring equipment, materials and supplies	X	X	X	X
Travel arrangements protocol		X	X	X
Lodging arrangements protocol		X	X	X
Strip maps for convey routes		X		X
Reviewing outsource procedures for personnel, equipment, materials and supplies	X	X		X
Redeployment Requirements				
Reporting and debriefing procedures		X	X	X
Travel arrangements		X	X	X
Lodging arrangements		X	X	X
Reconstitution of assets		X		X
Inspect equipment		X		X

Section 3

Response

Engaging in a multi-district winter weather operation begins with the notification of one District Engineer (DE) to another that assistance (personnel and resources) is needed in battling a winter storm event. The winter storm event that escalates to this level is due to its intensity, duration, or both. Once it has been established that assistance from a "call up" is confirmed, it is at this point that the DE that initiated the notification assumes the role of the host (supported) District and the DE or DEs that agrees to assist will assume the role of the visiting (supporting) District. Establishing this chain of command is important because it helps to further define the roles, responsibilities, and functions of all components associated with responding to multi-district operations.

Command and Control

For winter storm events that have grown to the point of having forces and resources to be deployed in to fight it, the main command structure will now involve both the host (supported) District and visiting (supporting) District personnel. The host (supported) District DE will now command, control, manage, and be responsible for all resources and personnel operating in his/her respective District. The host (supported) District DE will activate a District level EOC and will involve key district staff involved with winter weather response. This District level EOC was described in detailed in Chapter 5 *District Level and Maintenance Section Operations Guidance* and will function similar during multi-district operations. The primary change is that the span of command and control has been extended to include additional temporary assigned forces and resources that may or may not be familiar with the host (supported) area and personnel.

Moreover, the Maintenance Section EOC will activate and operate as outlined in Chapter 5 *District Level and Maintenance Section Operations Guidance.* The host (supported) Maintenance Section EOC will receive personnel tasking, coordinating, and communicating guidance from the host (supported) District DE or Director of Maintenance. As a rule of thumb, the District and Maintenance Section EOCs remains activated as long as is believed necessary to effectively respond to the winter weather event.

Regarding the functional areas, Figure 6-1 provides an illustration of five major management functions that are vital to district and multi-district operations (2 and 5). They are:

- **Incident Commander (Host/Supported DE):** Establishes command, works to protect life and property, sets objectives and priorities, and directs overall management of emergency response activities. The Incident Command role can be transferred to another individual (example – Director of Maintenance) depending upon the event as they arrive on the scene.
- **Planning:** In small emergencies, the Incident Commander (IC) is responsible for leading the planning effort, but in a larger emergency, the IC establishes a Planning Section. Planning develops the action plan to accomplish the objectives, collects, and evaluates information as related to the development of an incident, and maintains status of resources.

- **Operations:** Operations directs all resources and are usually the respective Area Offices and Maintenance Sections responsible for carrying out response activities according to established District snow and ice control plans.
- **Logistics:** Is responsible for communications, as well as securing and providing needed materials, resources, services, and personnel. This section may take on a major role in extended storm events.
- **Administration/Finance:** The Administration/Finance section is critical for tracking storm event costs, providing procurement assistance, performing cost analysis, and for reimbursement accounting. This is especially important in tracking costs where a state or federal "disaster area" may be declared.

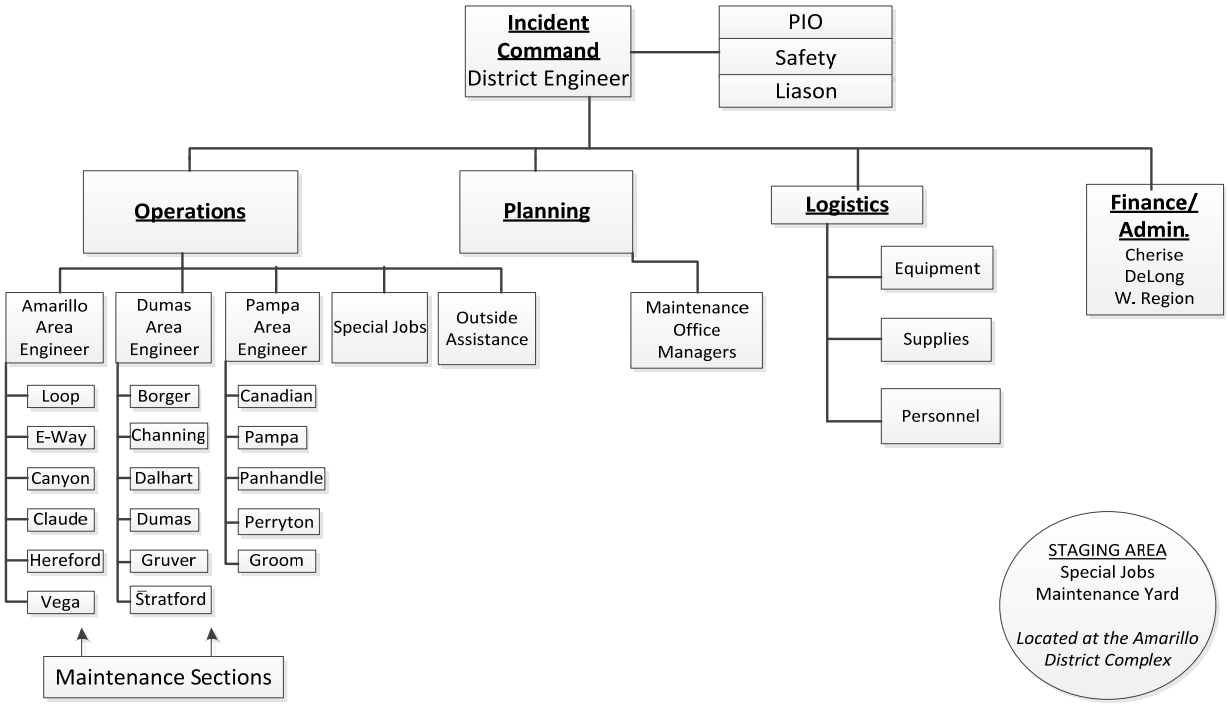

Figure 6-1. District Incident Command System – Amarillo District (1).

Coordination and Communication

The coordination and communication that must take place between response personnel internal to TxDOT and external to TxDOT is essential to the success of these winter weather response actions. During a multi-district operation, the host (supported) District EOC will serve as the central point for internal communication and coordination between maintenance sections, with other districts, and with TxDOT headquarters, as required. Also, the host (supported) District EOC will communicate and coordinate between TxDOT and external agencies involved with winter weather management. For significant winter weather events during multi-district operations, recommended coordination procedures internal and external to TxDOT—utilizing the host (supported) District EOC to support centralized communications—are similar to those of a

single District EOC, which is found in Chapter 5 *District Level and Maintenance Section Operations Guidance*. Figure 6-2 shows an example of the communication flow proposed for multi-district winter weather operations.

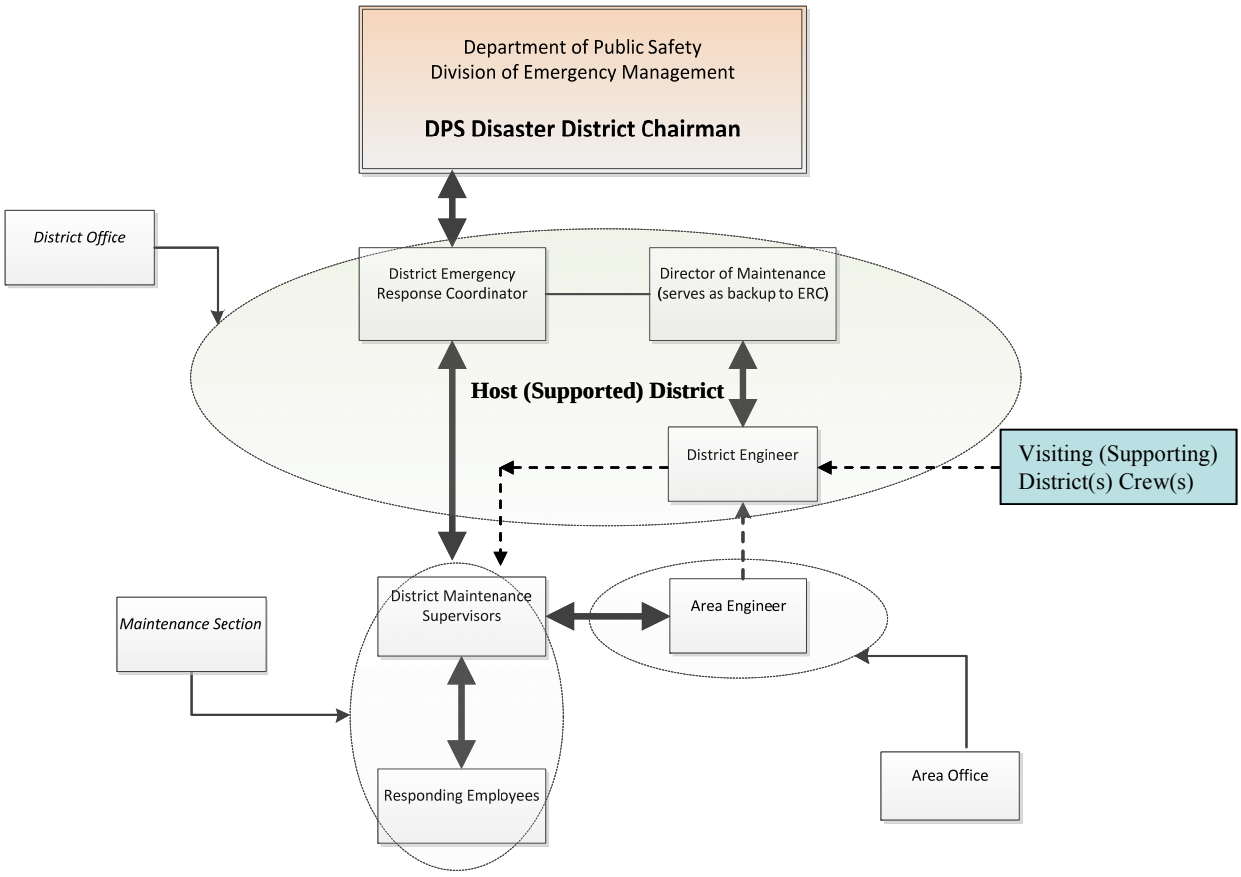

Figure 6-2. Communication Flow Chart for Multi-District Winter Weather Operations.

Again, referencing Chapter 5 *District Level and Maintenance Section Operations Guidance*, the incoming weather information is critical to the success of winter weather operations particularly during an ongoing winter storm event. The various sources of information should be monitored regularly to ensure that all decision-makers and personnel participating in winter weather operations are armed with the latest weather forecasts to make the best decisions regarding the use of equipment, materials, and personnel. Also, this will allow for any control actions such as road closures to be considered at the appropriate time. A detailed explanation of advisory actions, response personnel, motorist notification, and the role of TxDOT's PIO relative to these three items is captured in Chapter 5 *District Level and Maintenance Section Operations Guidance*.

Implement Deployment and Redeployment Plans

When engaging in multi-district operations, employing a "just-in-time" philosophy is ideal to ensuring your resources will be when and where they are needed most. Also, by synchronizing

the deployment and redeployment forces will ensure that the operation has the necessary "footprint" to be effective in responding to the winter weather event. Below is Table 6-2 and it shows the layout of actions needed for establishing a foundation upon which the multi-district operational structure can successfully work. Also, it can serve as a general checklist Districts and their respective Maintenance Sections to use to when responding to multi-district winter weather operations.

Table 6-2. Deployment and Redeployment for Multi-District Operations.

Phases / Responsible	**Deployment**	**Field Operations**	**Redeployment**
Host (Supported) District	• Initiate notification and "On-Call" or "May-Call" to personnel • LOCs • Coordination and communication • Risk management	• Prioritize roadways • Determine crew sizes and rotation cycles • LOCs • Equipment • Safety • Control actions • Treatment actions • Risk management	• Safety • Risk management • Reporting
Visiting (Supporting) District	• Initiate "On-call" or "May-Call" to personnel • LOCs • Coordination and communication • Equipment, materials and supplies (if necessary) • Safety • Logistics • Risk management	• LOCs • Equipment, materials and supplies (if necessary) • Safety • Employ control and treatment actions • Risk management	• Excess Equipment, materials and supplies (if necessary) • Safety • Logistics • Risk management • Reconstitute assets • Reporting

As the operation progresses and the additional forces are integrated under the host (supported) District command, the responsibilities and functions of the host (supported) Maintenance Supervisors and District Director of Maintenance (or Director of Operations) will follow the guidance outlined in Chapter 5 *District Level and Maintenance Section Operations Guidance*.

Also, in order for the host (supported) District to maintain the integrity of their organic assets as well as the visiting (supporting) District or Maintenance Section asset, it is recommended the host (supported) District led the field operations activities. This would include being responsible for establishing the LOCs, crew sizes and composition, equipment distribution, safety, control actions, treatment actions, and reporting requirements.

Moreover, both the host (supported) and visiting (supporting) Districts and Maintenance Sections are responsible for performing a risk assessment for any work activities that engages their employees. In Chapter 5 *District Level and Maintenance Section Operations Guidance*, the factors to consider are discussed in detail. Always, complete and submit a risk assessment analysis for each phase of the deployment and redeployment plan.

Section 4

Recovery

After Action Review – Multi-District Level

Following each winter weather event, the host (supporting) Director of Maintenance as well as the respective visiting (supporting) Districts should call a meeting of all maintenance supervisors and other key personnel shortly after the event to discuss procedures that worked and identify those that did not, so that changes may be implemented prior to the next winter weather event. These meetings should occur after meetings at the maintenance section level are completed. The after action reviews at the District level will follow those discussed at the maintenance section level but will include additional items specific to District input in winter weather operations, such as the following:

- Sharing of maintenance personnel, equipment, and material resources across different Districts and sections.
- Communication and coordination between the host (supporting) District and Maintenance Sections and the visiting (supporting) District and Maintenance Sections.
- Support by host (supported) and visiting (supporting) District maintenance staff to winter weather operations.

For very active winter seasons, an in-depth host (supported) District-level meeting may not be feasible and can be conducted at the end of the winter season instead of immediately after each winter storm event.

After Action Review – District Level and Maintenance Section

See Chapter 5 *District Level and Maintenance Section Operations Guidance* for information relative to the after action review process during the recovery phase. Particularly, Tables 5-7 and 5-8 have listed activities that should occur after winter weather events for the District and maintenance sections, respectively.

Section 5

References

1. *Amarillo District Ice and Snow Control Plan – FY 2011*. Amarillo District, Texas Department of Transportation. December 2010.
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3. *Emergency Response Plan Guidance for Small and Medium Community Water Systems to Comply with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002*. Environmental Protection Agency, Office of Water (4601M), April 2004.
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Chapter 7
Winter Weather Equipment and Maintenance

Contents:

Section 1

Overview

It is the mission of the TxDOT to provide a safe thoroughfare during the winter weather season. In order to accomplish this, the coordination of numerous pieces of equipment and personnel is necessary. During the winter weather season, the equipment must be ready to respond with very little notice. Therefore, proper maintenance of all equipment before, during, and after a winter event is important to ensure readiness for future storms. The following sections outline the regional support services available to the Districts, schedule for reporting equipment inventories, visibility enhancement options for various pieces of equipment, District level equipment assets, and proper equipment maintenance required before, during, and after winter weather events.

Section 2

Regional Support Services

TxDOT's four regional service centers provide administrative and project management support to the Department's 25 Districts (1). The four regions are:

- West Region: Abilene, Amarillo, Childress, El Paso, Lubbock, Odessa, San Angelo.
- North Region: Atlanta, Brownwood, Dallas, Fort Worth, Paris, Tyler, Waco, Wichita Falls.
- South Region: Austin, Corpus Christi, Laredo, Pharr, San Antonio, and Yoakum.
- East Region: Beaumont, Bryan, Houston, and Lufkin.

With regards to equipment considerations, the Region provides the Districts with fleet support and purchasing support. The key personnel that should be contacted are the **Fleet Manager** and **Purchasing Manager**. The functions of both are vital to the overall success of an equipment and maintenance program. Moreover, guidance for purchasing major equipment, minor equipment, and replacement parts is provided in Chapter 5 *District Level and Maintenance Section Operations*.

Section 3
Reporting Equipment Inventory

Maintaining a high equipment readiness level is important during the winter weather season. Knowing that equipment used in winter weather operations must be mission capable and ready on short notice requires maintenance sections to perform accurate record keeping and report their equipment status to the Districts and their respective Regions on a periodic basis. This systematic reporting of equipment inventory provides visibility to all levels within the organizational structure regarding the operational condition of equipment assets.

It is recommended to report equipment status and inventory at least three times a year, prior to, during, and after the winter weather season. As a general guideline, it is recommended to submit the data as prescribed below.

Table 7-1. Recommended Equipment Inventory Reporting Schedule.

Report From – Report To	Report From – Report To	Due Date
Maintenance Section to Director of Maintenance	Director of Maintenance to Region Fleet Manager	October 1 January 1 April 1

Section 4
Modernize Winter Weather Equipment

Modernizing winter weather equipment to enhance its visibility while used in winter weather operations presents a wide variety of options to consider. These options include warning lights; retro-reflective tape, truck-mounted attenuators; decals placed on the equipment in areas that are visible to the human eye and uses pictures that have dark or light red, blue, or green colors; mounting red and yellow signal lighting on side mirrors or on top of the equipment; using the Truck-Lite's LED Snow Plow kit; and the advanced vehicle control systems (AVCS) for snow and ice removal equipment applications. While there is not clear guidelines, a 2002 Synthesis of Best Practices for Increasing Protection and Visibility of Highway Maintenance Vehicles conducted by Iowa State University for the Iowa Department of Transportation concluded that mounting warning signs and rotating or strobe lights on the rear of maintenance vehicles is common for Iowa counties. Also, the most common warning devices used during their counties' snow removal operations are reflective tapes, warning flags, strobe lights, and auxiliary headlamps.

Moreover, in Chapter 10 *Safety Considerations,* the National Cooperative Highway Research Program research study found that both forward visibility and rear visibility are crucial for safety and must be considered when equipping emergency vehicles for winter weather usage (4). Also, the impact on visibility is influenced by the different aspects of the light source (e.g., mounting location, aiming angle, beam spread, and spectral power distribution or color). Using the information gather, TxDOT Districts have a concise summary of products and practices available to District and Maintenance personnel to enhance the visibility of their winter weather equipment as well as improve the safety of their employees and the traveling public.

Section 5
District Level Equipment Assets

Districts have an array of winter weather equipment that are used to battle snow and ice events. The traditional equipment available in TxDOT's inventory are dump trucks, motor graders, loaders, snow plows, V-Box spreaders, tail gate spreaders, snow wings, snow blowers, herbicide rigs, and pickup applicators. Since the length of winter season greatly vary by within the state of Texas, the Districts will have available equipment that is relevant to the types of storms that impact their respective jurisdictions. This remaining portion of this section provides a picture and a brief description of each piece of equipment.

Dump Truck

Snow plows are mounted to dump trucks and are used to push the accumulated snow off the roadway. Spreaders are also mounted on dump trucks to facilitate the spreading of materials for snow and ice control.

Figure 7-1. Dump Trucks Are the Workhorses of TxDOT Snow Removal.

Motor-Grader

This may be the best piece of equipment we have for snow removal. It does not require any other attachments to do the job. This piece of equipment is self-contained and ready to go.

Figure 7-2. Motor-Grader (Maintainer).

Loader

Loaders are a vital piece of equipment during a snow and/or ice event. They are used for loading material on the trucks to fight the ice and snow. They are also used to clear intersections and driveways.

Figure 7-3. Loader.

Snow Plow

A snow plow is an attachment for a six- and 10-cubic yard truck. It is used to remove snow from the pavement.

Figure 7-4. The Snow Plow.

V-Box Spreader

The V-box spreader is an attachment for a dump bed truck. It is used to accurately put out applications of de-icing materials on bridges and icy spots. These spreaders can either be hydraulic or gasoline operated.

Figure 7-5. The V-Box Spreader.

Tail Gate Spreader

Tail gate spreaders are used to apply de-icing and anti-icing materials. They are a spinner type applicator and operate via a hydraulic system.

Figure7-6. Tail Gate Spreader.

Snow Wing

The Snow wing attachment provides extra width on a motor grader or truck for plowing two lanes at a time or picking up a lane and a shoulder at the same time.

Figure 7-7. The Snow Wing.

Snow Blower

Figure 7-8. Snow Blower Is an Attachment that Is Used to Remove Large Quantities of Snow.

Herbicide Rig

The herbicide rig is used to apply anti-icing liquids prior to an approaching storm. It is also used for de-icing applications during the storm.

Figure 7-9. The Herbicide Rig.

Pickup Applicator

A pickup applicator is used to apply anti-icing liquids prior to an approaching storm. It is also used for de-icing applications during the storm.

Figure 7-10. A Pickup Applicator.

Section 6

Equipment Calibrations and Maintenance

Equipment calibration and proper maintenance of all equipment before, during, and after a winter weather event is important to ensure readiness for future storms. All equipment should be calibrated annually and the information should be part of the equipment inventory reporting requirements. Moreover, the equipment maintenance tasks to be performed at each phase are presented in Tables 7-2 through 7-4.

Table 7-2. Recommended Maintenance Actions during Preparedness Phase.

PREPAREDNESS ACTIONS	EQUIPMENT									
	Dump Trucks	Motor-grader	Loader	V-Box Spreader	Tail Gate Spreader	Snow Plow	Snow Wing	Snow Blower	Herbicide Rig	Pickup Applicator
Complete Dump Truck Daily Inspection Checklist	X									
Attach desired equipment (snow plow, spreader)	X									
Bleed air system to reduce chance of freezing	X									
Ensure all mounting points are tight	X					X				
Check all hydraulic, lines, fittings, and connections	X			X	X	X	X			
Grease and lubricate all moving parts at attachment points	X	X								
Check levels on hydraulic tank			X			X				
Ensure equipment is full of fuel	X	X	X					X		
Check all electrical components for correct operation	X	X	X					X	X	X
Make sure all safety equipment is in place and operational	X	X	X							
Call base station to ensure correct operation of State radio	X	X	X							
Complete Motor grader Inspection Checklist		X								
Check all fluid levels		X								
Check blade/mold board for damage, replace as necessary		X				X	X			
Complete Loader Inspection Checklist			X							
Lubricate per manufacturer's recommendations			X		X		X	X		
Complete V-Box Spreader Inspection Checklist				X						
Check conveyor system (conveyor chain and belt)				X						
Check PTO and drive assembly.				X						
Check spinner assembly (hinge rod and spinner disk)				X						
Gasoline: check fuel, electrical, drive belt, fuel filters, oil				X						

Table 7-2. Recommended Maintenance Actions during Preparedness Phase (Continued).

PREPAREDNESS ACTIONS	EQUIPMENT									
	Dump Trucks	Motor-grader	Loader	V-Box Spreader	Tail Gate Spreader	Snow Plow	Snow Wing	Snow Blower	Herbicide Rig	Pickup Applicator
Mount to equipment to assure proper operation					X		X	X		
Check mounting brackets that attach to the dump truck					X		X			
Check bearings in spinners					X					
Check oil in hydraulic motors					X					
Complete Snowplow Inspection Checklist						X				
Adjust trip chain on plow						X				
Check switch/side-to-side blade operation						X				
Perform a visual check for any leaks						X				
Install lights to ensure visibility while plowing						X				
Service engine								X		
Start blower monthly (service day) to keep system charged								X		
Complete Preventive Maintenance Checklist									X	
Test all systems to ensure correct operation									X	
Service auxiliary motor									X	
Adapt herbicide rig to spray liquid de-icer									X	
Flush tank to prevent contamination									X	
Perform trial run with water to assure correct rates									X	X
Flush pump for correct operation									X	X

Table 7-3. Recommended Maintenance Actions during Response Phase.

RESPONSE ACTIONS	EQUIPMENT									
	Dump Trucks	Motor-grader	Loader	V-Box Spreader	Tail Gate Spreader	Snow Plow	Snow Wing	Snow Blower	Herbicide Rig	Pickup Applicator
Perform periodic walk-around to check lights, tires, leaks	X	X	X	X	X	X	X	X	X	X
Listen for air leaks	X									
Monitor all gauges	X	X	X							
Check all fluid levels		X								
Monitor blade wear to prevent mold board damage		X				X	X			
Check oiler on belt for fluid level				X						
Check for accuracy of material application				X	X					
Monitor hydraulic levels						X				
Lubricate after each eight hours of use								X		
Check attachment points (pins, hoses) at 2-hour intervals								X		
Repair problems as necessary									X	X

Table 7-4. Recommended Maintenance Actions during Recovery Phase.

RECOVERY ACTIONS	EQUIPMENT									
	Dump Trucks	Motor-grader	Loader	V-Box Spreader	Tail Gate Spreader	Snow Plow	Snow Wing	Snow Blower	Herbicide Rig	Pickup Applicator
Service equipment as necessary	X		X					X	X	X
Remove excess materials from cab/undercarriage	X			X						
Clean equipment		X	X		X	X	X	X	X	X
Check blade/mold board for wear or damage		X					X			
Check all air filters		X								
Perform a walk-around for any visible damage		X	X							
Lubricate all fittings and moveable parts		X	X		X		X	X		
Gasoline: check fuel filter				X						
Check conveyor system (belt and chain)				X						
Make sure all lights are operational				X						
Check all hydraulic hoses and fittings for wear or leaks				X	X	X				
Check all welds for fatigue cracks					X	X	X			
Make sure equipment is ready for next weather event						X			X	X
Install new blade if necessary						X	X			
Check operation before removal and storage								X		
Flush system									X	X

Section 7

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3. Website for Truck-Lite's LED Snow Plow Kits. http://www.truck-lite.com. Accessed on October 1, 2011.

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Chapter 8
Winter Weather Chemicals and Materials

Contents:

Section 1
Overview

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

- Air temperature.
- Pavement temperature.
- Humidity levels.
- Dew point temperatures.
- Exposure to solar radiation.
- Type and rate of precipitation.
- Weather forecast.
- Weather radar data.

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

Whereas anti-icing operations are conducted to prevent the formation or development of bonded snow and ice for easy removal, de-icing operations are performed to break the bond of already bonded snow and ice. It is important for maintenance personnel to understand the uses and limitations of each of the materials and techniques explained in this chapter.

Section 2

Regional Support Services

TxDOT's four regional service centers provide administrative and project management support to the Department's 25 Districts (1). The four regions are:

- West Region: Abilene, Amarillo, Childress, El Paso, Lubbock, Odessa, San Angelo.
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- South Region: Austin, Corpus Christi, Laredo, Pharr, San Antonio, and Yoakum.
- East Region: Beaumont, Bryan, Houston, and Lufkin.

With regards to equipment considerations, the Region provides the Districts with fleet support and purchasing support. The key person that should be contacted is the **Purchasing Manager**. The purchasing manager is responsible for securing materials and supplies for each District.

Section 3
Reporting Chemicals and Materials Inventory

Accurate record keeping of inventories of chemicals and materials used in winter maintenance operations is challenging. Most agencies use loader bucket counts or spreader control readouts as the primary methods to gather material usage data. However, during storms it is difficult to keep track of the number of bucket loads used and the amount of material that is returned into the shed after the storm. Also, the lack of appropriate tools for operators to determine the weight of a bucket load often contributes to inaccurate reporting. For example, when salt is mixed with abrasives at different ratios it is difficult to determine the actual amount of salt in a bucket load.

Therefore, it is common to have some discrepancy between the material usage reported by operators or spreader controls and the inventory data determined by the inspection of the remaining material stockpiles.

It is necessary to regularly check the accuracy of material usage data using stockpile verification. There is not set frequency of stockpile verification, it greatly varies between various state agencies. Stockpile verification may be done annually, monthly, or after each major winter storm.

For TxDOT districts, it is recommended to perform stockpile verification and material usage and inventory reporting at least three times a year, once before, once during, and once after the winter season. Since the length of winter season may greatly vary by geographical regions within the state of Texas, the reporting periods may also be different for different districts. As a general guideline, it is recommended to report chemicals and materials usage and inventory once in each of the following three time periods:

- September–October.
- December–January.
- April–May.

It is also recommended that spot check inventories be conducted in addition to the above mentioned inventories during winters with unusually high storm activity. A systematic reporting of chemicals and materials inventory can help maintain an optimum amount stockpile at all maintenance yards within the District, and it also provides up-to-date inventory information for nearby Districts that may need to share resources for successfully battling a storm.

Section 4
Application Rates

There are various strategies for applying materials in snow and ice control. Depending on number of site-specific factors the optimum materials selection, timing, application rate, and frequency are different. There is no single application strategy that is appropriate for all weather conditions. NCHRP Report 577 provides flexible guidelines for the use of materials and applications rates for the three common snow and ice control strategies and for different pavement temperature ranges. These guidelines are summarized in Table 4-1.

Table 4-1. Application Rates for Various Snow and Ice Control Strategies.

Strategy/ Method	Materials	Pavement Temperature Ranges	Application Rates
Anti-Icing	Liquid Chemicals, Solid Chemicals, Pre-wet Solid Chemicals	0°C to −12°C (32°F to 10°F)	18–110 Kg/Lane/Km (65–400 Lb/Lane/Mile)
De-Icing	Pre-wet Solid Chemicals, Dry Solid Chemicals	0°C to −18°C (32°F to 0°F)	113–400 Kg/Lane/Km (200–700 Lb/Lane/Mile)
Abrasives	Pre-wet Abrasives, Dry Abrasives	No limits	225–2,700 Kg/Lane/Km (500–6,000 Lb/Lane/Mile)
	Abrasive/Salt Mixes	0°C to −18°C (32°F to 0°F)	225–2,700 Kg /Lane /Km (500–6,000 Lb/Lane/Mile)

Section 5

Solid Chemical Application Capability

The use of dry solid chemicals as an anti-icing treatment can be effective in many circumstances, but only where there is sufficient moisture or accumulation of snow or ice on the pavement. Moisture must be present for two reasons:

- Prevent loss of material from dry pavement.
- Trigger the chemical into solution.

For initial operations, solid chemicals will be effective when maintenance forces have the operational resources available to apply the chemical soon after sufficient precipitation has fallen, but before ice bonds to the pavement. For subsequent operations, solid chemical treatments will usually be effective when there is adequate moisture or accumulation of snow or ice during later periods of storms.

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

Section 6

Liquid Chemical (Chemical Solution) Application Capability

There are advantages for using liquids at pavement temperatures of 23°F and above. These include:

- The ability to apply a chemical uniformly over the pavement.
- The ability to place a chemical onto dry pavement as a pre-storm treatment to prevent bonded snow or ice from forming.

However, this means putting the chemical down before enough snow has accumulated to prevent the chemical from reaching the pavement or from being excessively diluted. In some situations it may be beneficial to remove snow and slush from the road using traditional mechanical methods.

Liquids can be used at pavement temperatures below 23°F by following the manufacturer's suggested rate of application for varying conditions. The cost effectiveness of using liquid chemicals at lower pavement temperatures needs to be evaluated on a case by case basis.

Section 7

Pre-Wetted Solid Chemical Application Capability

The pre-wetting of a solid chemical prior to spreading can improve the effectiveness of the solid chemical in many situations. A solid chemical requires energy to go into solution, and a dry solid chemical particle will remain inert until a liquid film forms. The solution process will be accelerated if pre-wetting is performed to the solid material. This is only one of the benefits of pre-wetting. Other advantages include:

- The solid chemical is spread more uniformly because of less waste from bouncing or traffic.
- Action (although not all waste is eliminated).
- Wet granules adhere to the road surface better than dry granules.
- There is a faster and longer-lasting effect.
- Spreading speed can be increased.
- In some cases, the road surface dries quicker.

The practical result is a reduction in the resources necessary for maintaining the highway since a lower application rate translates into a spreader load covering more area, often requiring less deadheading (returning to the barn empty) to obtain material. NCHRP Report 577 provides guidelines for variable application rates with on-board wetting. These guidelines are summarized in Table 4-2.

Table 4-2. Variable Salt Application Rates with On-Board Pre-Wetting.

Precipitation Type	Road Surface Temperature Range °C (°F)		
	Warmer than −5°(23°) Kg/lane-km (Lb/lane-mile)	−5°(23°) to −10°(14°) Kg/lane-km (Lb/lane-mile)	Less than −10°(14°) to −18°(−1°) Kg/lane-km (Lb/lane-mile)
Frost	25 (97)	35 (136)	35 (136)
Light snow	35 (136)	50 (1950	65 (253)
Heavy snow	65 (253)	65 (253)	85 (331)
Freezing rain	65 (253)	85 (331)	85 (331)

Section 8
Recommendations for Use of Liquid Chemicals

Don't Use during Ice Storms

The use of a liquid is not recommended during either a freezing rain or sleet storm because of the large quantity needed to retain an effective concentration. The application rates are the equivalent dry chemical rates suggested by the manufacturer.

Using for Snow Storms

For snowstorms, initial liquid applications can be made either as a pretreatment in advance of the storm or as an early-storm treatment (i.e., soon after snowfall has begun and/or when the pavement temperature is dropping toward freezing).

Pretreatment

A pretreatment can be made prior to a storm, as long as the storm does not start out with above freezing temperatures and rain, washing the chemical away. Benefits from liquid pretreatments can include higher friction and better pavement conditions early in a storm. These benefits are generally short-lived and should not be expected over a long period. Subsequent chemical applications should be made as soon as conditions begin to deteriorate. Pretreatments can be thought of as "buying time" in the early stages of a storm until subsequent chemical applications become effective.

Early-Storm Treatment

In the case of early-storm treatment, the application may be made onto dry, wet, light slush, or lightly snow covered pavement. Late applications onto pavements with more than a light covering of slush or snow can result in excessive dilution of the chemical, lowering its effectiveness.

Preventing Black Ice

To prevent the formation of frost or black ice (caused by radiation cooling of the pavement in the presence of high humidity) the chemical should be applied before ice is expected to form so the water component of the chemical will evaporate or be removed by traffic action. This will leave only the chemical on the road surface and result in the greatest concentration when frost or black ice conditions occur.

Section 9
Recommendations for Use of Dry Chemicals

Timing Is Critical

Timing of an initial dry solid chemical application for snowstorm events is critical. The application should be made as soon as possible after sufficient precipitation has fallen to prevent loss, but before ice bonds to the pavement.

Do Not Use As Pretreatment

Application of dry solid chemical onto dry pavement is not recommended, and therefore should not be used as a pretreatment.

Section 10
Chemical Types

Sodium Chloride, NaCl

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

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

Most salt used for highway applications in the U.S. is rock salt, though some solar salt is produced in several western states and some is imported into the eastern states. Naturally occurring rock salt is the mineral halite, which usually contains between 1 percent and 4 percent impurities, mostly gypsum, shale, dolomite, and quartz.

Magnesium Chloride, MgCl2

The principal source of this ice control chemical is brines from the Great Salt Lake. Though it is available in solid (flake) form, it is used in liquid form for ice control. The lowest temperature at which $MgCl_2$ can melt snow or ice (eutectic temperature) is about −28°F at a concentration of 21.6 percent. Its ice melting capacity is about 40 percent greater than Calcium Chloride $CaCl_2$. Proprietary mixtures are available containing 20 percent to 25 percent $MgCl_2$ with various corrosion inhibitor additives. One proprietary compound reportedly has a eutectic temperature of −4°F. These solutions are effective ice-melting agents at temperatures above 19°F.

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

Calcium Magnesium Acetate (CMA)

Currently there is only one commercial source for CMA, using the reaction of acetic acid with dolomitic limestone for production. Acetic acid, the costly component of the compound, is manufactured from natural gas or petroleum, though small quantities have been produced by biodegradation of agricultural wastes.

The compound is available as pellets or powder. Though not as soluble in water as NaCl and $CaCl_2$, solutions can be made for use as a pre-wetting agent or straight chemical application.

It is not a highly effective de-icing chemical in solid form because of its affinity for water and its light particle mass. Its benefit is that it makes snow mealy so that it does not compact.

CMA is primarily a mixture of calcium and magnesium acetates, produced with a 3/7 Ca/Mg ratio, which was found to be optimum in previous Federal Highway Administration (FHWA) studies. The eutectic temperature is about −18°F at a concentration of 32.5 percent.

When CMA degrades, the calcium and magnesium elements are said to actually improve the water and air permeability of the soil by restoring sodium-compacted soils.

Since acetate degrades into carbon dioxide and water and is a natural component of plant decay, CMA is appropriate where roadside vegetation, crops, or ground water are especially vulnerable. Because it is less corrosive than salt, some agencies prefer CMA for use on bridges, parking structures, sidewalks, and certain road surfaces (**caution**: it does cause major scaling).

The cost of CMA is approximately $600 per ton whereas salt generally costs $20 to $40 per ton. Some advocates of CMA argue that the initial costs may be misleading because replacement costs for roads and bridges damaged by chloride-related corrosion should be factored into the overall figures.

The pellet form of CMA is usually preferable to the powdered form, since the powder dust is less controllable. The pellet form of CMA does not bounce off the road before melting and its residual action can reduce reallocation frequency.

Potassium Acetate, KC2H3O2

Potassium acetate, or KAc as it is commonly known, is produced by the reaction of acetic acid with potassium carbonate.

The sources of acetic acid are the same as in the production of CMA.

Potassium carbonate is one of the groups of salts commercially known as potash. Potassium carbonate was originally obtained by running water through wood ashes and boiling the resulting solution in large iron pots. The substance that formed was called potash.

Potassium carbonate is currently produced by one of several processes that use potassium chloride, another salt of the potash family. The compound, potassium acetate, is a white, crystalline, deliquescent powder that has a saline taste. It is soluble in water and alcohol. Solutions are alkaline under a litmus test.

The dry compound is combustible but is used as a dehydrating agent, a reagent in analytical chemistry, and in the production of synthetic flavors, in addition to other uses. The eutectic temperature of a KAc and water solution is −76°F at a concentration of 49 percent.
A commercial form of liquid KAc, containing a 50 percent concentration by weight plus corrosion inhibitors, has been used as a pre-wetting agent with dry salt or as a straight chemical application.

Sand

The most economical material used in snow and ice control is sand. The price of sand ranges from $6 to $16 per ton. However, sand on the road must be removed and sweeping is costly. Sand can also cause damage to windshields and auto body paint.

Section 11
Testing

Material Specification DMS-6400

TxDOT developed Departmental Material Specification DMS-6400, modeled after the Pacific Northwest States specification, to ensure the quality of anti-icers and de-icers. DMS-6400, De-icer/anti-icer, describes the requirements, testing methodology and a Quality Monitoring Program (QMP) for magnesium chloride (MgCl) and sodium chloride (NaCl).

Calcium magnesium acetate (CMA) and potassium acetate (KAc) are used in Texas in smaller quantities. These and other materials must be tested prior to use, in accordance with TxDOT standards.

For producers of MgCl and NaCl products to be considered for inclusion in the Department's Quality Monitoring Program (QMP), a producer must contact the Materials and Pavement Section of the Construction Division (CSTM) and submit a sample for evaluation. The sample must include test results from an independent laboratory indicating compliance with the requirements set forth in DMS-6400. After evaluation and specification compliance, the producer and material will be included on the Material Producer List (MPL).

A district may purchase any anti-icer/de-icer listed on the MPL with only verification sampling advised. Those anti-icers/de-icers not on the list will require full independent lab testing and CSTM verification before application. The following properties are verified at the CSTM laboratory:

- Corrosion.
- Sulfate.
- Percent total settleable solids and percent solids.
- Specific gravity.
- pH.

These tests were developed to ensure an environmentally sound material. Results from chemical properties are to be submitted every time material is ordered and delivered. All material supplied must include the following documentation:

- Current, clearly legible Material Safety Data Sheet (MSDS).
- Clear documentation of its percentage of concentration of MgCl.
- An application rate table that clearly states the manufacturer/vendor/supplier recommended rate for the various conditions of use at the place of delivery.
- Shelf life of material a Friction Analysis Report on all products. Any certified lab that is set up to run the test as a function of humidity and for the type of roadway [asphalt or concrete] specified may perform the test. Required information includes:
  - Hard data.
  - Graphical analysis.

  - A write-up about the product typically with comparison information.
- Information on how low temperatures will affect storage of liquid material.
- Clear documentation on proper storage.
- Certification that any MgCl supplied meets test methods SHRP-H-205.2 for effectiveness.

Upon delivery, it is very important that a TxDOT representative visually inspect the load for any obvious reasons for rejection. For example, no precipitates in liquid products are allowed in excess of the specification limits. Material portraying these or other uncharacteristic traits when delivered may be immediately rejected at the option of the engineer or representative at the delivery location.

In addition to verifying that a delivered liquid chemical meets the current specification, two additional tests, viscosity and specific gravity, may be performed at the district level to determine whether the right liquid chemical is delivered.

The viscosity test provides useful information that clearly indicates the chemical concentration of the liquid chemical. Specific gravity is a quick and simple verification acceptance test.

The two tests provide a simple and inexpensive mechanism for a district to ensure that the right chemical is being accepted at delivery. For more information on quality control testing, please contact the Materials and Pavement Section of the Construction Division (CSTM).

Section 12

References

1. Website for TxDOT Regional Service Centers. http://www.dot.state.tx.us/local_information/regions/default.htm. October 1, 2011.

2. *Guidelines for the Selection of Snow and Ice Control Materials to Mitigate Environmental Impacts*, NCHRP Report 577, Transportation Research Board, 2007.

Chapter 9
Bridge Maintenance Needs

Contents:

Section 1
Overview

Summary

Bridge decks typically are the first transportation structures to freeze during cold weather. The greatest risks associated with chemical use on bridges are corrosion of imbedded steel and concrete deterioration. TxDOT allows each district to use commercially available chemical products. Corrosion potentials vary with each material.

Bridges are composed of substructures (caps, columns, foundations) and superstructures (beams, bridge deck, and rail). Each respective structural element has an associated risk created by the use of de-icers and the related destructive forces created by the corrosive nature of the agents. Review of bridge components that exhibit the most risk and damage are contained in the following sections.

Section 2
Bridge Decks

Risks of Chemical Damage

Bridge decks, especially overhangs and joints, are at great risk of incurring de-icer related damage. When evaluating design loads, overhangs exhibit the greatest levels of stress in the deck design. Overhangs also store snow pushed by plows. The snow pushed by plows is typically laced with de-icers, possibly saturating our high stress areas with corrosive chemicals. Steel under stress corrodes at an accelerated rate. So, storing snow on overhangs is not an ideal situation.

The damage begins when the snow melts and concentrates the corrosive forces in the de-icing agents in the overhangs.

Washing the Deck

To prevent as much damage as possible, wash the deck when the temperatures rise and snow season is over. Washing helps in two ways:

- Physically removes remaining chemicals.
- Dilutes any chemical residues, reducing their corrosion potential.

Figure 9-1. Corrosion Damage due to Concentrated De-icing Solution at Drain Site.

Figure 9-2. Corrosion Damage due to Concentrated De-icing Solution at Drain Site.

Section 3
Bridge Joints

Risks of Chemical Damage

Joints are positions in the deck that allow thermal contraction and expansion to occur. If joints are not maintained then runoff will fall through joints. Typically, snow melt runoff is concentrated on the low side of the structure. Snow melt is particularly brutal because it is laced with chemical agents concentrated in one area and flows for extended periods of time (length of meltdown). This combination of concentrated flow combined with corrosive agents subjected to extended exposure allows for corrosion damage to initiate and progress.

Bridge Joint Inspection and Cleaning

TxDOT prefers bridge joint inspection and cleaning to be performed in the spring and re-inspection to occur prior to the beginning of snow season. This fulfills the six month bridge inspection criteria in accordance with the Maintenance Operations Manual.

Figure 9-3. Poorly Maintained Joint Allowed Concentrated De-icer Solution to Damage Cap.

Figure 9-4. Poorly Maintained Joint Allowed De-icer Solution to Damage Overhang to Second Mat of Steel and Top Plate Steel on Beam.

Section 4
Bridge Beams

Risks of Chemical Damage

Beams exhibit increased risks to corrosion due to cover reductions, high stress steel design, and concentrated chemical solution saturating end zones when joint seals are broken.

Repair of Joint Systems

Maintenance personnel should repair and maintain joint systems ensuring the protection created by the sealed joint systems.

Figure 9-5. Chemical Solution Corrosion Induced Beam Damage Created by Failed Joint and Poor Concrete Cover over Beam Ends.

Figure 9-6. Close up of Figure 9-5.

Section 5
Bridge Caps

Risks of Chemical Damage

Bridge caps support the superstructure and are the elements on which the beams are supported. Chemical damage occurs to caps when the sealed expansion joints fail and the concentrated chemical solution either falls from the deck through the joint to the cap or it travels through the joint down the beam to the cap. Contamination and damage to the cap can be accelerated when caps are finished flush and the chemical solution is allowed to pond on the cap.

Maintain Joint Systems

Maintenance personnel should maintain joint systems, eliminating the possibility of chemical solution saturating this structural element. If joint systems have failed, or are designed as an open system, caps should be washed at the end of snow season.

Figure 9-7. Corrosion Induced Damage in High Stress Cantilever Design.

**Figure 9-8. Failure on Cap due to Corrosion Damage.
Bridge Was Closed until Repair Could Be Performed.**

Section 6
Bridge Columns

Risks of Chemical Damage

Columns attach the foundations to the cap which support the beams. Chemical damage occurs when expansion joints fail and chemical solution flows through the expansion joint, down the beam, down the face of the cap and down the column. If chemical stock piles are stored next to bridge structures the corrosive forces of the chemicals will induce damage to the columns.

Don’t Store Chemicals by Columns

To eliminate chemical damage to columns, do not store chemical materials next to columns and maintain and repair bridge joints.

Figure 9-9. Column Deterioration from Chemical Solution Contamination.

Figure 9-10. Close up of the Damage. Notice the #9 bars Are Starting to Buckle. Two Reasons This Could Be Happening: (1) Rust Could Be Pushing on Concrete Causing the Buckling. (2) The Column Could Be Shortening. This Bridge Was Replaced after 20 Years of Service.

Figure 9-11. Salt Storage under a Bridge Next to Bridge Columns.

Figure 9-12. Damage Created due to the Salt Storage.

Chapter 10
Safety Considerations

Contents:

Section 1
Overview

TxDOT is committed to making travel as safe as possible for motorists on our state roadways. The safety of TxDOT crew members and the traveling public is the highest priority at all times during a winter weather event. Effective safety programs are integral to winter weather response operations.

Coordination

Maintenance supervisors are responsible for coordinating all activities within their geographical area of responsibility. During instances of adverse weather, maintenance supervisors should monitor approaching weather by utilizing all available tools. Roadway conditions must be closely monitored and evaluated to ensure timely response by the crews.

Maintenance supervisors should notify their area engineer and the district maintenance office when resources are requested from outside the maintenance section. Maintenance supervisors should coordinate with outside agencies (city, county, law enforcement, adjacent counties, etc.) as necessary. Respective area engineer(s) and the district maintenance office should be consulted for assistance when this coordination is needed.

All winter storm events are not the same. Variations in temperature, amount of precipitation, existing conditions, and duration of storm all contribute to how the roadways and bridges are affected. Maintenance supervisors should evaluate all aspects of the storm and make any necessary adjustments to methods and procedures before the next occurrence.

Section 2
Personnel Safety

The most valuable asset of TxDOT is personnel. During winter weather operations, it is essential that supervisors at all levels manage personnel wisely and with a particular emphasis on both personal and public safety. Successful management of personnel assets lead to safe and efficient winter weather operations.

Tracking Employees

During periods of snow and ice control, there should always be a supervisor and dispatcher on duty to oversee and coordinate field operations. The location, arrival, and departure times of field employees should be tracked to ensure safety of employees, efficient route selection, and adequate response time to potential roadway complaints.

Training

All personnel should be trained in proper procedures prior to being assigned winter weather response duties. TxDOT employees have varying degrees of experience with snow and ice control. It is important to recognize the varying levels of individual employee experience when assigning work activities. Those employees with greater experience should be considered for more critical work assignments. Managers should consider pairing experienced personnel with less experienced personnel, this allows less experienced personnel time to become familiar with winter weather operations.

Prior to the winter season, a safety meeting should be held in every maintenance section to discuss weather-related safety issues. The meeting should address new and refresher training topics for equipment operators and standard operating procedures during a winter weather event.

If possible personnel should be assigned routes prior to the onset of a winter storm event. All personnel should inspect routes prior to the onset of the winter weather season to note any hazards or changes to the roadway that may not be visible during a winter storm

Best Practice

Plan your routes prior to the storm season. Inspect routes for critical areas, as well as noting areas where debris and obstructions have occurred since the previous winter. These areas may hinder roadway clearing operations and snow melt. They should be cleared prior to the onset of winter weather.

Plan the most efficient way of covering the route and plan where you will begin operations.

Scheduling Employees

Personnel scheduling and management is the one tool in particular requires special attention during storm operations. Personnel must be managed in a way that allows them to function safely and efficiently. Care must be taken to include in scheduling adequate rest and recovery time during operations. Fatigue in particular can result in both unsafe and inefficient operations.

The Department of Transportation Federal Motor Carrier Safety Administration publishes current requirements for all personnel with Commercial Driver Licenses. Maintenance supervisors should consider these requirements when scheduling personnel. More information concerning Revised Hours of Service Regulations can be obtained by visiting the following: http://www.fmcsa.dot.gov/.

The maintenance supervisor will be responsible for determining when an employee is to be relieved. The maintenance supervisor shall immediately relieve any employee that notifies him that he is in need of relief. Employees are expected to be honest in their assessment of their ability to continue to work safely, prior to beginning and for the duration of response. If a winter weather event is expected to result in TxDOT personnel working outside their Area or in another District, maintenance supervisors should request DART cards for their employees to pay for rooms and meals.

Cold Weather Injury Prevention

Cold weather can directly affect an individual's health and performance by lowering body temperature, resulting in cold injuries and impaired performance. Cold weather injuries occur most often from heat loss. Heat flows from areas of high temperature (a human body) to an area of lower temperature (the surrounding environment), if heat escapes faster than the body can produce heat, hypothermia may occur. Heat loss is amplified by wind and moisture. Cold weather related injuries can be prevented by proper clothing, rest, and hydration.

Cold weather clothing protection is based on the properties of insulation, layering, and ventilation. Well insulated clothing allows air to be trapped in the material and provide an extra barrier against the cold. The thicker the clothing the better the insulation, it is important to remember that dirty clothing compromises insulation properties. Layering involves wearing multiple layers of clothing; this allows insulation to be adjusted according to workload and an individual's own needs and preferences. Layering is especially important if a person is moving in and out of heated vehicles or periodically undertakes vigorous physical activity. The final aspect of clothing protection is ventilation. Physically active people sweat even during cold weather. If the sweat cannot evaporate, the insular properties of the clothing will be compromised.

Cold weather injuries may also be reduced by ensuring that personnel are adequately rested, nourished, and hydrated. Personnel who are fatigued will not be able to sustain physical activity and this will increase chances for cold weather injuries such as hypothermia. Inadequate rest also impairs decision-making, reduces efficiency, and may compromise safety of both the individual and the traveling public. Lack of adequate hydration and nutrition can increase susceptibility to cold injury by decreasing physical performance and cognitive function.

Additional ancillary personnel supplies intended to keep crew members safe and their equipment functional should not be overlooked in preparing for winter weather response. Personnel protection equipment for all employees should be considered during times of snow and ice control response. Appropriate quantities of items such as gloves, storm suits, other personal protective equipment, flashlights and batteries, windshield de-icer, wiper blades, etc., should be kept on hand to adequately respond to each event.

Section 3
Equipment and Material Safety

Handling Materials

When personnel are working with anti-icing and de-icing chemicals, appropriate safety precautions should be taken based on the specific chemical. Many of the chemicals are eye irritants, skin irritants, or respiratory irritants.

Best Practice

When handling chemicals use prescribed personal protective equipment (i.e., gloves, masks, or safety glasses).
Practice good hygiene (wash hands after handling chemicals.

Equipment Visibility

Snow and ice control by its very nature requires operation of vehicles in extreme weather conditions. Visibility is dependent on the climatic conditions of each storm and contributes to hazards faced by both operators and motorists. A research study by the National Cooperative Highway Research Program found that both forward visibility and rear visibility are crucial for safety and must be considered when equipping emergency vehicles for winter weather usage (1). The reflected light from snow, rain, and fog toward the snowplow operator during inclement weather contributes to glare and decreased visibility. The impact on visibility is influenced by the different aspects of the light source (e.g., mounting location, aiming angle, beam spread, and spectral power distribution or color).

Rear lighting of snowplow vehicles provides two distinct functions: a conspicuous signal to other drivers to indicate that the plow is on the road and cues about the plow's operating speed and distance relative to other vehicles. The conspicuity of rear lights is optimal when an array of lights are used that flash with a rate of 5 to 9 flashes per second (1). This lighting configuration allows other drivers to "see" the vehicle and make accurate judgments of speed and distance. An assessment by snow plow operators in New York suggested that the LED light bar configuration provided the highest visibility and confidence in the overtaking of the snowplow by other motorists.

Section 4
Reference

1. M. Rea and B. Thompson, "Improved Visibility for Snowplowing Operations," *Research Results Digest*, Number 250, National Cooperative Highway Research Program, November 2000.

Chapter 11
Training Considerations

Contents:

Section 1
Overview

Personnel readiness is critical to winter weather operations. Employees who actively participate in winter weather operations should engage in collective as well as individual training depending on their individual job duties and responsibilities. Also, it is important to recognize the levels of individual employee experience when developing formalized training, on-the-job training, and assigning work activities.

This chapter highlights an array of available practical training programs that expose for District and Maintenance personnel to real-world challenges and experiences involving winter weather operations. It is recommended that all formalized training be completed prior to the winter season.

Section 2
District Level and Maintenance Section Training

Training Principles

The Texas Department of Transportation (TxDOT) is provided with adaptive employees and leaders that are ready to conduct winter weather operations when needed. To maintain a competitive edge, realistic, standards-based, performance-oriented training should be integrated into the overall development of each employee.

Leaders at every level are responsible for training their subordinates. The District Engineer (DE) is the primary training manager and must continually be involved in supporting training activities. Their support demonstrates the importance of training as well as provides guidance on effective ways to train on fundamentals, to standard, and to sustain.

Key Personnel

The key personnel at the District level involved in winter weather operations consist of the following:

- **Director of Maintenance.**
- **Director of Transportation Operations.**
- **District Emergency Coordinator.**
- **Public Information Officer.**
- **District Engineer.**

The individuals at the Maintenance Section level involved in winter weather operations are:

- **Maintenance Section Supervisor.**
- **Maintenance Office Managers.**
- **Crew/Technicians.**

When serving in these positions, there are a number of training opportunities as well as different types of training that can be used to enhance the efficiency of the organizational unit and proficiency of the individual employee.

Training Types and Topics

Formal training can ensure the readiness of District level and Maintenance Section personnel for the complexities of the winter weather operational environments they are likely to face. It also ensures that the forces are operationally adaptable. In 2011, TxDOT offered two new courses entitled, *Winter Weather Management Training* and *Winter Weather Operations Training*, for Maintenance Managers and Operators.

Other type of training opportunities can include briefing sessions, classroom sessions, or mock exercises. Refresher training should be conducted on a regular basis. Training should include testing the Snow and Ice Control Plans. In fact, drills and exercises that challenge the information in the Snow and Ice Control Plans Some should be conducted at least annually.

Moreover, there are many sources (Federal, State, and industry specific) that describe what should be included in winter weather training. Listed in Table 11-1 are some training topics to consider for improving response and recovery activities related to future winter weather operations.

Table 11-1. District Level and Maintenance Section Training.

TRAINING TOPICS	DISTRICT					MAINTENANCE		
	District Engineer	Director of Maintenances	Director of Transportation Operations	District Emergency Coordinator	PIO	Maintenance Sect Supervisor	Maintenance Office Manger	Crew/Technicians
Preparedness Requirements	X	X	X	X	X	X	X	X
Safety Policies	X	X	X	X	X	X	X	X
Operational Policies	X	X	X			X	X	X
Fundamental Snow and Ice Control Concepts	X	X				X		X
Decision-Making	X	X	X			X		
Management and Reporting Systems	X	X	X			X	X	
Snow and Ice Policy Issues	X	X	X			X		
Snow and Ice Control Materials		X				X		X
Personnel Policies	X	X				X		
Equipment Issues	X	X				X		
Communications Issues	X	X				X		X
Logistics	X	X				X		X
Legal Issues	X	X				X		
Weather Reports - Where to Get Them & How to Use Them	X	X	X		X	X	X	
Training First-Rate Snowfighters	X	X				X		X
Response Requirements	X	X	X	X	X	X	X	X
Recovery Requirements	X	X	X	X	X	X	X	X
Winter Weather Treatments								
Anti-Icing/RWIS Computer Based Training Program		X				X	X	X
Salt Brine: Breaking Snow & Ice on Your Pavement		X				X		X

Section 3
Multi-District Level Training

Key Personnel

During multi-district training activities, it is important to incorporate the Area Engineers from each participating District to the list of key personnel listed in Section 2. The Area Engineers can serve as a unique dimension for overcoming logistical coordination challenges faced by visiting and hosting Districts during winter weather operations. Additionally, due to the complexity of the operational environment, the Area Engineer can be a major asset in maintaining visibility and stability to operations that maybe ongoing at the same time in different geographical areas.

- **Area Engineer**

Types of Training

In multi-district training, the focus is to identify and synchronize the use of personnel resources that will potentially be transferred to assist with winter weather operations away from their home District. Cross training for this level of complexity provides managers, supervisors, and crews with a better assessment of the organization's operational proficiency and whether the training conducted contributes to a higher level of readiness. Listed in Table 11-2 are types of activities that may be considered when conducting multi-district level training.

Table 11-2. District Level and Maintenance Section Training.

TRAINING	SCOPE	PARTICIPANTS	FACILITIES REQUIRED
Drills			
Limited with a focus on procedures	**X**		
Typically less than 10		**X**	
Practice using real or simulated equipment			**X**
Tabletops			
Broader in scope, focuses on roles, policy, and strategy	**X**		
Less than 20 individuals and will include multiple roles within an organization or with other organizations		**X**	
Large room sufficient for communication and may require separate tables to simulate different roles			**X**
Functional Exercise			
Scope is to emphasize different functions of the plan	**X**		
Less than 20 individuals		**X**	
Full-Scale Integrated Exercise			
Broad in scope and includes others outside the organization	**X**		
At least 20 individuals and up to several hundreds. Will involve different functions with the organization and often includes multiple organizations		**X**	
Use real facilities to the extent possible and use normal communication facilities			**X**

Chapter 12
Reporting Requirements and Considerations

Contents:

Section 1
Overview

Reporting

Reporting is an important but often overlooked component of a good overall winter weather response plan. Effective reporting procedures help to accomplish several goals that are important to TxDOT:

- Providing timely and timely and accurate information to the public—public awareness of current roadway conditions can be a potentially life-saving service.
- Providing a basis for Departmental actions when responding to the media, public complaints, or litigation.
- Supporting efforts by TxDOT supervisors and managers to plan for future winter weather events or obtain assistance in repairing damage to roadways as a result of winter weather events.

Reporting should occur at the Federal, State, District, Multi-District, and Local levels, depending on the nature and severity of the winter weather event.

Section 2
Federal Reporting

Tracking Storm Damage Costs

For significant and severe winter weather events (events with damages typically in excess of $1 million), Districts may seek reimbursement through the Federal Emergency Management Agency (FEMA). Federal reimbursement is limited to damages from severe ice storms; damages due to snow storms are not eligible. Damage estimates are cumulative across all affected maintenance sections and Districts, increasing the likelihood of meeting the damage cost threshold for reimbursement. Each maintenance section should track their costs for the storm using the appropriate emergency function (see Code Chart 12 under MMIS Training at http://crossroads/org/mnt/. This information should be reported to the District maintenance office that will compile the information and report to FEMA as required.

Section 3
State Reporting

Highway Condition Reporting System

Reporting at the state level is normally accomplished through the Highway Condition Reporting System (HCRS). The roadway condition information that is entered into the HCRS is directly relayed to the traveling public through the Department's Internet site and the Statewide toll free number for highway conditions. Because this information is not edited prior to being released to the public, it is extremely important that the information be accurate and current.

The District HCR coordinator (or designee) should enter weather conditions in HCRS and update conditions every 4 hours during winter weather events. Maintenance sections should also enter roadway conditions to HCRS and update every 4 hours—or as conditions change—during winter weather events. If maintenance section personnel are unable to access the HCRS due to a loss of power or other constraint, neighboring sections or the District HCRS coordinator should be contacted for data entry support. The HCRS coordinator or their backup will monitor the HCRS data for the District to ensure that it is kept up to date and accurate.

Conditions should be entered within 30 minutes of occurrence when inclement weather strikes, and deactivated within 30 minutes after occurrence has ceased to exist. During normal business hours, conditions should be entered by 9:00 a.m. and updated prior to 4:00 p.m.

When entering roadway condition information into HCRS, sufficient information should be provided to allow motorists to react appropriately. Some general guidelines are provided below.

- *Winter Storm Warning issued by the National Weather Service*—Describe the current road conditions.
- *Drive with caution*—Describe the condition which makes driving with caution recommended.
- *Travel is not recommended*—Describe the condition, which makes driving hazardous and therefore not recommended.
- *Emergency travels only*—Describe the conditions, which make driving extremely dangerous.
- *Roadways closed*—Describe why the roadway is closed and location of closure. When possible, use recognizable landmarks to identify limits of specific locations.

Suggested terminology for reporting winter weather conditions in the HCRS includes the following:

- *Ice and snow present*
- *Icy conditions*
- *Patchy icy conditions*
- *Snow pack*
- *Structures may have ice*
- *2-4 inches of snow*
- *Black ice*
- *Expect (minor/major) delays*
- *TxDOT crews working*

Terms to avoid include the following:

- *Slick.*
- *Dangerous.*
- *Hazardous.*
- *Crews sanding* (implies that ice conditions are not a problem).
- *Bridges sanded* (implies that ice conditions are not a problem).

Do not report roads that are dry or only wet—only report conditions that impact safe driving. In addition, report road conditions but avoid providing driving instruction.

Section 4
District Reporting

Reports from Each Maintenance Section

District level reporting may vary because of unique conditions within area. A typical District level report includes detailed information from each maintenance section that can be used by the District maintenance office to coordinate the movement of personnel and equipment to areas experiencing the greatest impact and to respond to public complaints and requests for information during a winter weather event.

Immediately after a winter weather event, each maintenance section should report the following information to the Director of Maintenance:

- Total man-hours worked.
- Total overtime hours paid.
- Total overtime cost.
- Total labor cost.
- Ice aggregate used (cy).
- Salt used (lb).
- Liquid MgCl used (gal).
- Granular Meltdown 20 used (lb).

Additional information should include:

- Time that winter weather response operations began and ended.
- The nature of response (i.e., snow plowing, chemical treatment, etc.)
- Depth of any accumulated snow on the roadway surface and general roadway conditions.

For extended winter weather events, anticipated manpower or equipment needs should also be reported.

Section 5
Multi-District Reporting

Reports from Each Host and Visiting Maintenance Section

Multi-district level reporting will require each host maintenance section to submit information to hosting District Maintenance office. A typical multi-district level report includes detailed information to coordinate the movement of personnel and equipment (from both the hosting and visiting Districts) to areas experiencing the greatest impact and to respond to public complaints and requests for information during a winter weather event.

Immediately after a winter weather event, each host maintenance section should report the following information to the hosting Director of Maintenance:

- Total man-hours worked for the hosting District Personnel.
- Total man-hours work for the visiting District Personnel.
- Total overtime hours paid to the hosting District Personnel.
- Total overtime hours paid to the visiting District Personnel.
- Total overtime cost for the hosting District Personnel.
- Total overtime cost for the visiting District Personnel.
- Total labor cost for the hosting District Personnel.
- Total labor cost for visiting District Personnel.
- Ice aggregate used (cy).
- Salt used (lb).
- Liquid MgCl used (gal).
- Granular Meltdown 20 used (lb).

Additional information should include:

- Time that winter weather response operations began and ended
- The nature of response (i.e., snow plowing, chemical treatment, etc.)
- Depth of any accumulated snow on the roadway surface and general roadway conditions.

For extended winter weather events, anticipated manpower or equipment needs should also be reported.

Section 6

Local Maintenance Section Reporting

Reporting requirements at the local maintenance section level should include all routine reports in addition to any District, State and/or Federal reports. A well organized system for local reporting can make responding to District, State, and Federal inquiries much easier.

Local information should include:

- Pre-trip inspection reports for trucks as well as snow plows, spreaders, snow blowers, motor graders, loaders, and light vehicles.
- Daily activity reports tracking hours worked, mileage, equipment hours, and materials used during winter weather response.
- Salt applications and calibration reports for each salt spreader.
- A priority roadway and salt route map demonstrating an organized effort to clear the roadways.
- Responses to local media inquiries, public requests for roadway conditions, and service requests from residents or businesses on State routes.

Roadway condition information and knowledge of how to assist the public in acquiring information from surrounding areas should be readily available in each maintenance section.

Chapter 13
Alternative Methods

Contents:

Section 1
Overview

A winter maintenance program consists of several elements with varying degrees of importance depending on the size of the operational jurisdiction it covers. The traditional method of only clearing snow and ice off a road after it falls or builds up is no longer acceptable. The traveling public demands a more proactive approach from TxDOT in clearing snow accumulation and preventing the development of bonded snow and ice on the roads. Technology has provided various alternate methods to help keep roads clear of snow and ice during inclement weather. Both installation costs and yearly upkeep costs vary depending on the complexity of the system chosen; therefore the level of service requirements of a particular road must be considered and evaluated to determine a system's viability. Costs can range from a few thousand dollars to over a million dollars just to get started. This chapter presents some of the alternative methods that have been used successfully.

Section 2
Connecting with the Community

In today's world of instant communications it is crucial to connect with the community and the traveling public to keep them informed of the most current roadway condition. The Pew Research Center study (1) found that local television and the internet were the most relied upon sources for information regarding weather, while radio was the most popular form of media for traffic information. It is also beneficial to educate both the media and the public on the capabilities of the local TxDOT offices so that there are realistic expectations regarding of TxDOT response to each approaching winter storm. Connecting with the community and increasing public awareness is a constant and on-going task that utilizes multiple tools.

Best Practice

Houston District hosted a day for the local media to visit with maintenance personnel and supervisors as they prepared equipment for the on-coming winter season. This provided local media information on the Districts capabilities to respond to a winter storm.

Prior to the onset of the winter season, the use of informative brochures, video clips, websites, and social media can be used to educate the public on what to expect during the winter season. These tools may also include instructions on how to prepare for traveling during the upcoming winter weather season. Information provided may include:

- Tips on winter driving.
- Winter safety tips.
- Facts about TxDOT winter operations, winter road clearing equipment, and materials.
- Priorities for road clearance.
- Phone numbers and website addresses on where to get more information.

Most traveler information is broadcast over commercial AM and FM radio or television. As an indication of the importance of providing traffic-related information, private traffic-reporting firms that collect, package, and "sell" traffic information to the broadcast media have developed in many urban areas. Cooperative media partnerships help to ensure that public-sector agencies are fully utilizing resource opportunities that exist. Effective media relationships require an understanding of media perspectives, needs, and limitations, as well as a media education effort to stress the importance of accurate and timely information. Multidisciplinary training may provide convenient forums for improving media relations, interactions, and briefings for local media on the upcoming winter season is also appropriate at this time. This may be a part of the pre-season winter meetings with local officials.

Just prior to an approaching storm, communications should switch to specific roadway information as well as informing the public of what to expect regarding roadway accessibility and closures and where to find current information regarding changing roadway status. Some of the more traditional tools include traveler information tools such as static signs with flashers, dynamic and portable changeable message signs, highway advisory radio, television and radio announcements, and telephones. More innovative methods include websites and social media.

During the storm communications include previously discussed tools as well as route specific communications. This type of communications may include telephone messages with local roadway information, local transportation management center websites (if available for the area), the TxDOT toll free number for statewide roadway conditions, and the HCR website.

The Internet has allowed transportation agencies to widely disseminate traveler information such as real-time traffic congestion, incidents, and updates on construction activities, as well as other transportation related information to the public. The information is available 24 hours a day at a relatively low cost to the provider, and it can be accessed by users from home, from work, or en route if Internet access is available. The effectiveness of traveler information websites is dependent upon the nature and extent of, and level of effort expended to maintain, the traveler information provided on the website.

Best Practice

Social media can be used to supplement traditional communication methods and help increase public involvement. TxDOT uses a variety of channels to inform the public, including Facebook™, Twitter™, Flickr™, and YouTube™.

Twitter™—which is focused on extremely brief (140 characters) and timely updates exchanges—is perhaps most useful for supporting traveler information related to winter weather events.

The use of websites is effective however, if websites are not maintained or kept current, the public trust in those websites will be severely diminished.

Section 3
Emerging Technologies and Trends

With the advancement of computer technology applications and roadway weather information systems (RWIS) a number of new and innovative technologies and trends are emerging for winter weather maintenance. There are also a number of emerging trends toward more environmentally friendly materials and materials application methods used for both anti-icing and de-icing. Some of these emerging technologies and trends are discussed below.

Data Collection Automated Sources

Some States have used technologies such as personal digital assistants (PDAs) as a way to standardize data collection and document efforts. The goal of the data collection effort is to document where and when personnel applied material, how much material was applied, and to measure the outcome of the effort. A program was written to run on a PDA for download into a central database. Ease of use by the equipment operator and the collection of common data elements were the primary goals. This type of data collection allows DOTs to more efficiently deploy resources and gauge success in winter operations.

Maintenance Decision Support System

In the late 1990s, the FHWA recognized that there was no link between available weather forecasts and winter road maintenance decisions. It was this missing link that led to the development of the winter Maintenance Decision Support System (MDSS) prototype. A winter MDSS is an integrated software application that provides users with real-time road treatment recommendations based on weather forecast information and predicted pavement conditions. These recommendations include guidance for material use (e.g., salt brine), application times, and rates. They help agencies minimize the amount of material applied to the roads while maintaining the highest level of service possible under given resource constraints. A winter MDSS can also be used for analyzing "what-if" scenarios and compare treatment alternatives using various material types, application times, and rates. It can also serve as a training tool for new and less experienced maintenance managers. After a winter season ends, conditions can be re-entered in the MDSS to determine if different courses of action would have proven more beneficial.

Intelligent Spreaders

Intelligent spreaders are salt spreaders that utilized Global Positioning Systems or Geographic Information Systems (GIS) applications. These applications used utilized historical data as well as geographic information to automatically adjust salting applications. These applications are being utilized in Denmark and Wisconsin. The initial evaluation of these technologies shows promise, however, some technical issues, concerning refinements to and effective use of the systems need to be addressed. Institutional issues that must also be addressed before effective, long-term use can be realized including responsibility for development and maintenance of accurate roadway centerline spatial databases, integration of system and its databases with

existing information technology environments at the county level, training and staffing, and long-term technical support and maintenance of the system's code.

Materials and Material Methods

Hot Water and Sand Mix

Norway has developed and implemented a new method of sanding which is based on the use of a mix of hot water and sand. The most significant factors in this method are the sand quality, the amount of water, the spreading speed, and the water temperature. The sand should be of a specified quality corresponding to a 0 to 4-mm gradation. Hot water means that the water temperature is 194°F to 203°F. The amount of water in the mixture of sand and water is approximately 30-weight percentage, and the normal dosage of sand used is equivalent to 200 g/m^2 as an average. Testing of this new method against traditional sanding methods concluded that the warm wetted sand method has a broad range of applications and therefore can be recommended as a supplement to existing sanding methods. It is important to emphasize that the wet-sand method can be used under conditions for which traditional methods have little or no effect. This method also makes it possible to maintain the friction standard under conditions for which it is normal to spread sand less frequently than necessary in order to maintain the friction standard. The new sanding method can be used under conditions under which traditional methods have little or no effect: hard blue ice, roads with a high percentage of heavy vehicles, and thin ice or frost on asphalt.

Agricultural By-Products

In response to the detrimental effects of deicing salt, ecosystem damage and corrosion of metals, alternative strategies for de-icing and anti-icing are being investigated. One of these strategies is the use of anti-icing compounds developed from animal by-products (ABP). Manufacturers claim that ABPs perform better, are environmentally friendly, and are less corrosive than conventional anti-icing and deicing materials. These products have shown promise in trial applications within Michigan and elsewhere in the nation. Their primary use is for anti-icing operations, but improved performance of deicing chemicals used in conjunction with ABPs also has been documented. Overall MDOT found that ABP liquids when used appropriately for anti-icing are powerful tools in providing safer roads at less cost.

Snow Fences

The primary purpose of a snow fence is to prevent the problems of snow drifting onto highways. Many of the drifting problems occur in the same place year after year. The use of strategically placed snow fences can help.

Snow fences come in many different varieties and forms. There are the traditional wood fences, high-density polypropylene fabric, extruded polyethylene, and even living snow fences. Living snow fences are designed plantings of trees and/or shrubs and native grasses located along roads or around communities and farmsteads. Properly designed and placed, these living barriers trap snow as it blows across fields, piling it up before it reaches a road, waterway, farmstead, or community. Snow fences have proven to be cost effective in many areas of the country that

receive large amounts of snowfall. While they have been used effectively in Texas, they are used sparingly due to lower annual snowfall amounts.

Figure 13-1. Living Snow Fence (1).

Figure 13-2. Wood Fence (1).

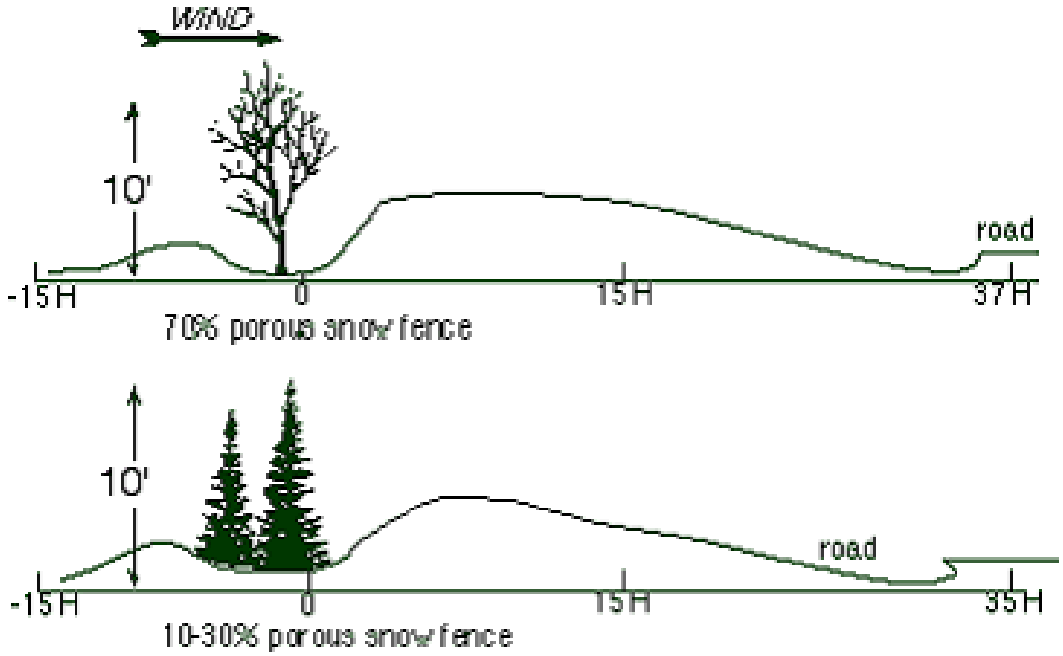

Figure 13-3. Snow Fence Density and Height Control Snow Deposition Distance.

As per figure 13-3, the more porous the snow fence, the longer the deposition distance.

Thermal Mapping

Across a roadway system, some sections will be warmer or colder than others. Thermal mapping identifies where these warm and cold sections are going to occur and helps identify areas that are likely to freeze. Thermal maps are influenced by the surrounding physical environment, such as cuts and fills, embankments, urban heat, trees and buildings and the prevailing weather patterns.

Thermal maps can be used in several ways, such as:

- Determining the location for ice detection sensors.
- Extrapolating temperature trends over a thermal mapped network from a few measured sites.
- Aiding in the design of pretreatment routes.

The long term goal of thermal mapping is to establish an ice prediction system that will cover the entire maintenance section.

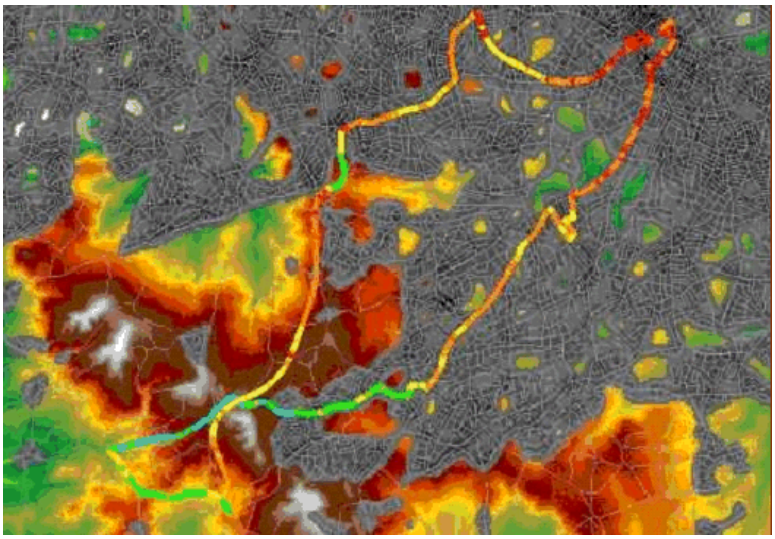

Figure 13-4. Thermal Map (2).

Heated Bridge Decks

In 1995, as a result of the 1991 Intermodal Surface Transportation Act, the FHWA sponsored research into heated bridge technology and the construction of bridges in five states: Nebraska, Oregon, Virginia, West Virginia, and Texas (the Amarillo District). Different heating methods and designs were built and their effectiveness evaluated. Hydronic, heat pipe, and electrical technologies were evaluated with heating sources from fossil fuel, well water, heat pump, and geothermal. The different designs and heating methods met with varying degrees of success.

The system designed and installed in Texas uses a hydronic heating system of propylene glycol to transfer heat to the bridge deck from a series of geothermal wells. It has proven to be a success and is still in operation. However, TxDOT does not have personnel with the expertise and maintenance knowledge of the entire system and is therefore dependent on a contract for system maintenance. The cost effectiveness of this technology in Texas is a matter of opinion. A more in depth study of the cost/benefit ratio will need to be conducted before the system is used elsewhere.

The systems used in other states were not as successful. Some never operated at all and others were not as effective as expected. Further study and research will be necessary to determine if this technology is a wise choice.

Figure 13-5. Pipe for Heating Bridge Deck.

Figure 13-6. Bridge Deck Showing Instrument Wire on Trees.

De-icing and Anti-icing Systems

There are two distinct snow and ice control strategies that have been gaining popularity and show promise in making use of chemical freezing-point depressants: de-icing and anti-icing. Anti-icing operations are conducted to prevent the formation or development of bonded snow and ice for easy removal, while de-icing operations are performed to break the bond of snow and ice and eliminate the buildup on the roads.

Anti-icing

Unlike de-icing operations that are performed following a winter weather event to break the bond of snow and ice and eliminate the buildup on the roads, anti-icing operations are conducted to prevent the formation or development of bonded snow and ice for easy removal. Anti-icing involves pre-treating a road before the freezing weather or storm arrives with the goal of limiting or preventing the buildup of ice. Successful anti-icing efforts require accurate timing and good judgment about when and where to treat, relying on weather forecasts, field sensors, and in-field measurements or observations to predict when a storm will hit and its severity. Studies by various agencies and institutions have identified several benefits of a sound anti-icing strategy:

- By preventing snow or ice from bonding to pavement, removal and control is much easier.
- Material is applied ahead of the storm, making it safer for equipment and operators.
- Lower material application rates compared to de-icing operations.
- The need for sand or other abrasives is reduced.
- Cleanup of sand or other abrasives is reduced.
- Reduced environmental impact.

TxDOT commonly uses MeltDown 20™ to prevent ice form forming on bridges and overpasses. Recommended application practices include the following:

- When moisture is present and freezing temperatures are possible, MeltDown 20 should be applied to bridges and overpasses. Make applications prior to the temperature reaching freezing to prevent ice forming.
- If the temperature drops below freezing, begin treatment applications at steep grades, sharp curves, intersections, and other points where the hazard is greatest.
- Treatment should continue as long as precipitation continues to fall. The interval allowable between treatments will vary depending upon the rate of precipitation and traffic but should be not be longer than 4 hours.

Anti-icing can be more effective when coupled with a Roadway Weather Information System (RWIS). An RWIS helps to make informed decisions about when and where to deploy materials, crews, and equipment. While an anti-icing strategy coupled with an RWIS can be beneficial, there are some drawbacks associated with RWIS:

- High initial cost.
- Potential for premature and/or unnecessary application of materials.
- Insufficient sensors/stations and the incompatibility of RWIS platforms.
- Over-application of chloride-based chemicals can result in slick pavement.
- High maintenance and upkeep costs.

Anti-icing systems can be either mobile truck-mounted spray rigs, capable of covering large areas where needed, or fixed spray systems that will treat specific problem locations. Both use a chemical that can lower the freeze point of water, requiring a storage tank for the chemical. Generally, a 6,000-gallon capacity tank with agitation and circulation capabilities is used. However other sizes are acceptable, depending on specific local needs and conditions.

The equipment for a mobile system consists of a truck-mounted tank with a spray boom and controls for accurate calibration. Cost-effective dual herbicide/anti-icing spray units have been designed and built. In such dual-use systems, the chemicals used for anti-icing can be corrosive and thorough cleaning between seasons is necessary. Commercial vendors can supply a large variety of types and size rigs suitable to the section's needs. GSD purchases major equipment for all snow and ice control methods.

There have been marked advancements in the use of fixed anti-icing systems in the past few years. Fixed systems have been placed at toll plazas, super-elevated bridges, and steep hills where maintaining vehicle traction is critical. These systems use the same chemicals available for mobile anti-icing systems. They are designed and installed at problem locations and can be linked with RWIS to assist in predicting conditions favorable for treatment. Depending on the complexity of the RWIS equipment, the system can be activated remotely or automatically.

The spray systems themselves vary in complexity but will spray the anti-icing chemical from fixed points onto the road's surface. Traffic, in turn, will spread and track the chemical over the designed area providing the desired effect. Fixed systems can be installed during new road construction or added at existing problem locations. Vendors specializing in fixed anti-icing systems can be found on the Internet.

De-icing

Whereas anti-icing operations are conducted to prevent the formation or development of bonded snow and ice for easy removal, de-icing operations are performed to break the bond of already bonded snow and ice. It is important for maintenance personnel to understand the uses and limitations of each of the materials and techniques.

De-icing methods generally involve the use of chemicals to speed the melting process after snow pack or ice has formed on a road. Liquid chemicals with similar spray equipment can be used for de-icing, provided they can be applied at sufficient pressure to cut though the ice or snow pack. Caution must be exercised during de-icing since spraying liquids on top of the pack may cause the road to become slick. The use of dry solid chemicals and pre-wetted abrasives in conjunction with de-icing will speed the melting of the snow and ice pack. This practice will improve the de-icing process and reduce the time it would take to melt naturally.

Section 4
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Appendix A
Components to a Snow and Ice Plan District Level

Contents:

Section 1
District Level Plans

The major components of a District Snow and Ice Control Plan are briefly outlined below.

DISTRICT OBJECTIVES

Describe the District's objectives for snow and ice operations response. The objectives could define goals that are to be attained by the District during winter events. These objectives help shape up the entire snow and ice response operations and give a focus to the various elements of winter weather response. In defining a District's objective(s), the following should be considered:

- Make objective(s) reasonable and attainable.
- Consider District equipment and personnel resources.
- District political environment.
- Consider the risks associated with weather event.
- Aim for the best, while acknowledging the risks.

PREPARATION ACTIVITIES

The bulk of winter weather operations begin at this point. A detailed, organized and well thought out pre-season preparation plan can lead to well trained, well-prepared maintenance staff and provide better coordination within the District during winter weather events. Typical components of preparations include the following:

- **Incoming Weather Information.**
    - Outline sources of weather information for District and maintenance section/area offices.
    - Indicate required communication protocol between weather information services and District.

- **Outline Emergency Operations Center structure.**
    - Designate and identify facility for EOC.
    - Identify communication and coordination protocols including key roles and responsibilities.
    - Define Incident Command System for Winter Operations at District and Maintenance Section levels (at a minimum).
    - Provide listing of key regional and district emergency contacts including external agencies involved in winter weather operations management.

- **Equipment**: Outline equipment activities.
    - Equipment maintenance checks.
    - Inventory and Purchasing procedures.
    - Equipment calibration procedures.
- **Materials and Supplies:** Identify pre-season materials and supplies activities.
    - Materials inventory checks.
    - Outline purchasing procedures for various chemicals and abrasives.
    - Supplies inventory checks.
    - Outline purchasing procedures for ancillary personnel supplies.
- **Deployment Plans.**
    - Identify route prioritization for treatment.
    - Identify equipment pre-staging locations as needed.
    - Identify storage and pre-staging locations.
    - Identify other key protocols
- **Personnel Training and Safety.**
    - Identify required training for personnel and provide sources of training.
    - Outline strategies to improve skills and expertise of staff.
    - Outline safety measures to be followed at all maintenance sections.

RESPONSE ACTIVITIES

Response activities detail District response during the weather event. The response operations are typically the most visible to the public; however, it is typically just an implementation of pre-season planning and prior framework for communication and coordination within TxDOT and with external stakeholder agencies.

- **Incoming Information.**
    - Identify all requirements for handling incoming weather information.
- **Coordination and Communication.**
    - Identify ongoing communication protocols during winter weather response.
    - Identify key roles and responsibilities involved in response procedures.
- **Treatment Actions.**
    - Define pre-treatment procedures, if applicable.
    - Outline specific materials to use during the different winter weather conditions.

- **Control Actions.**

    - Define priority routes for roadway treatment.
    - Define roadway closure procedures.
    - Define alternate routing procedures.
    - Identify traffic signal operations strategies.

RECOVERY ACTIVITIES

Identify pertinent activities to be undertaken immediately after the conclusion of the winter season. General areas to address include the following:

- **Communication and Coordination:** Identify all coordination activities post winter season.

    - Identify all required meetings at maintenance section level. Include meetings between TxDOT and other stakeholder agencies.
    - Identify all required meetings at the District level. Include meetings between TxDOT and other stakeholder agencies.
    - For all meetings highlight topics that need to be discussed.

- **Equipment:** Identify all equipment-related activities.

    - Cleaning, inspection and repair.
    - Inventory and storage requirements.

- **Materials and Supplies:** Outline all materials and supplies activities.

    - Aggregate removal procedures.
    - Inventory and storage requirements.

MATERIALS AND SUPPLIES

Identify the different types of materials to be applied during winter storm operations. Each district must determine, based on current information, which chemicals and abrasives will be used for road treatments. Consider purchasing and storage cost, impact to structures, environmental impacts, cleaning costs and other related issues in determining which products are right for the District.

EQUIPMENT

Outline the types of equipment and their use in winter weather response operations. Identify the District's equipment inventory by maintenance section. Include a detailed maintenance checks list (one is provided in the *Winter Weather Response Guide*).

REGIONAL SUPPORT ACTIVITIES

Identify all relevant regional activities that the District is involved in during winter weather response operations. Include the following under Regional Support Activities:

- An outline of the communication and coordination protocols when winter operations involve the Region.
- Identify the Incident Command System for the Region and define the role of key District staff in the Regional ICS.
- Identify District responsibilities to the regional emergency response plan in responding to winter weather events.

EXHIBITS AND ATTACHMENTS

Any winter weather storm plan should, at a minimum, include critical attachments such as the following:

- Emergency Contact Lists
    - Regional emergency contacts.
    - District emergency contacts.
    - District emergency stakeholders contact list (e.g., DPS, DEM, Texas Forest Service (TFS)).
    - Neighboring district(s) emergency contacts.
    - Local emergency contacts for TxDOT (area offices and maintenance sections) and stakeholder agencies involved in winter weather operations and emergency management.
- Prioritize spray routes (shown on a map).
- District winter equipment list by county or maintenance section.
- Flowchart(s) for communication protocol for District.
- Information on logistics for maintenance crew including:
    - Use of non-CDL crew.
    - Cell phone use.
    - DART card use.

Section 2
Multi-District Level Plans

The major components of a multi-District Snow and Ice Control Plan are briefly outlined below.

MULTI-DISTRICT OBJECTIVES

Describe the host (supported) and visiting (supporting) District's objectives for snow and ice operations response. The objectives could define goals that are to be attained by the participating Districts during winter events. These objectives help shape up the entire snow and ice response operations and give a focus to the various elements of winter weather response. In defining the participating District's objective(s), the following should be considered:

- Make objective(s) reasonable and attainable.
- Consider participating District's equipment and personnel resources.
- Consider the risks associated with weather event.
- Aim for the best, while acknowledging the risks.

PREPAREDNESS ACTIVITIES

Typical components of preparation include the following:

- **Incoming Weather Information.**
    - Outline sources of weather information for the host (supported) District and maintenance section/area offices.
    - Indicate required communication protocol between weather information services and the host (supported) District.

- **Outline Host (Supported) District Emergency Operations Center structure.**
    - Designate and identify facility for EOC.
    - Identify communication and coordination protocols including key roles and responsibilities.
    - Define Incident Command System for Winter Operations at District and Maintenance Section levels (at a minimum).
    - Provide listing of key regional and district emergency contacts including external agencies involved in winter weather operations management.

- **Equipment**: Outline equipment activities.
    - Equipment maintenance checks.
    - Inventory and Purchasing procedures.
    - Equipment calibration procedures.

- **Materials and Supplies:** Identify materials and supplies activities.

    - Materials inventory checks.
    - Outline purchasing procedures for various chemicals and abrasives.
    - Supplies inventory checks.
    - Outline purchasing procedures for ancillary personnel supplies.

- **Deployment and Redeployment Plans.**

    - Identify route prioritization for treatment.
    - Identify equipment pre-staging locations as needed.
    - Identify storage and pre-staging locations.
    - Designated assembly area(s) where personnel can gather to get ready for deployment.
    - Identify other key protocols.
        - Determine level of winter weather threat protocols.
        - Coordinating activities to align with the appropriate levels of a deployment response.
        - Lines of communication (LOC) for organic forces and host (supported) District and/or Maintenance Section forces.
        - Determine the equipment and training necessary to the requirements for both internal and interagency communications.
        - Create an interoperable system for both internal and interagency communication.

- **Personnel Training and Safety.**

    - Identify required training for personnel and provide sources of training.
    - Outline strategies to improve skills and expertise of staff.
    - Outline safety measures to be followed at all maintenance sections.

RESPONSE ACTIVITIES

Response operations will detail how the multi-district management will respond during the weather event. The response operations are typically the most visible to the public; however, it is typically just an implementation of preparedness planning activities and the prior framework for communication and coordination internal and external to TxDOT.

- **Incoming Information.**

    - Identify all requirements for handling incoming weather information.

- **Coordination and Communication.**

    - Identify ongoing communication protocols during winter weather response.
    - Identify key roles and responsibilities involved in response procedures.

- **Deployments and Redeployments.**
    - Short-term.
    - Long-term.
- **Equipment Distribution.**
- **Materials and Supplies.**
- **Personnel Distribution.**
    - Determine the number of crews.
    - Crew composition.
    - Staffing rosters, duties, and responsibilities.
    - Tracking of field employees.
    - Color coding crew teams.
    - Contact information (chain of command, phone numbers, etc.).
- **Field Operational Protocols for Levels of Deployment.**
    - Implement LOCs.
    - Acquire knowledge regarding the host (supported) District and/or Maintenance Section area of responsibility.
        - Capabilities of the personnel and equipment.
        - Route prioritization and location.
        - Identification of major vulnerabilities (e.g., loss of communication equipment).
- **Safety and Risk Management.**
- **Logistics and Administrative.**
    - Acquiring equipment, materials, and supplies.
    - Travel Arrangements.
        - Coordination and schedule lift for organic winter weather equipment.
        - Packing of equipment, materials, and supplies.
        - Fuel cards.
    - Lodging Arrangements.
        - External agency agreements.
        - Potential lodging facility or facilities.
    - Strip maps outlining convey routes.
    - Personnel reimbursements and incentives.
    - Outsourcing for personnel and equipment services.
- **Redeployment.**
    - Reporting and debriefing.

  - Travel Arrangements.
    - Coordination and schedule lift for organic winter weather equipment.
    - Repacking organic winter weather equipment, materials, and supplies.
    - Fuel cards.
  - Lodging Arrangements.
    - Potential lodging facility or facilities.
  - Reconstitute Assets.
    - Equipment, materials, and supplies.
    - Redistribution of excess materials and supplies.
  - Conduct required equipment inspections.

- **Treatment Actions.**

  - Define pre-treatment procedures, if applicable.
  - Outline specific materials to use during the different winter weather conditions.

- **Control Actions.**

  - Define priority routes for roadway treatment.
  - Define roadway closure procedures.
  - Define alternate routing procedures.
  - Identify traffic signal operations strategies.

RECOVERY ACTIVITIES

Identify pertinent activities to be undertaken immediately after the conclusion of the winter season. General areas to address include the following:

- **Communication and Coordination:** Identify all coordination activities to consider during the recovery phase of the winter season.

  - Identify all required meetings at maintenance section level. Include meetings between TxDOT and other stakeholder agencies.
  - Identify all required meetings at the District level. Include meetings between TxDOT and other stakeholder agencies.
  - For all meetings highlight topics that need to be discussed.

- **Equipment:** Identify all equipment-related activities.

  - Cleaning, inspection, and repair.
  - Inventory and storage requirements.

- **Materials and Supplies:** Outline all materials and supplies activities.

  - Aggregate removal procedures.
  - Inventory and storage requirements.

MATERIALS AND SUPPLIES

Identify the different types of materials to be applied during winter storm operations. Each district must determine, based on current information, which chemicals and abrasives will be used for road treatments. Consider purchasing and storage cost, impact to structures, environmental impacts, cleaning costs and other related issues in determining which products are right for the District.

EQUIPMENT

Outline the types of equipment and their use in winter weather response operations. Identify the District's equipment inventory by maintenance section. Include a detailed maintenance checks list (one is provided in the *Winter Weather Response Guide*).

REGIONAL SUPPORT ACTIVITIES

Identify all relevant regional activities that the District is involved in during winter weather response operations. Include the following under Regional Support Activities.

- An outline of the communication and coordination protocols when multi-district winter operations involve a single or multiple Regions.
- Identify the Incident Command System for the Region and define the role of key multi-District staff in the Regional ICS.
- Identify District responsibilities to the regional emergency response plan in responding to multi-district winter weather events.

EXHIBITS AND ATTACHMENTS

Any winter weather storm plan should, at a minimum, include critical attachments such as the following:

- Emergency Contact Lists.
    - Regional emergency contacts.
    - District emergency contacts.
    - District emergency stakeholders contact list (e.g., DPS, DEM, Texas Forest Service (TFS)).
    - Neighboring district(s) emergency contacts.
    - Local emergency contacts for TxDOT (area offices and maintenance sections) and stakeholder agencies involved in winter weather operations and emergency management.
- Prioritize spray routes (shown on a map).
- District winter equipment list by county or maintenance section.
- Flowchart(s) for communication protocol for District.

- Information on logistics for maintenance crew including:

    - Use of non-CDL crew.
    - Cell phone use.
    - DART card use.

Appendix B
Example of 2011 Snow and Ice Plan Urban District

Contents:

Section 1

Austin District Winter Storm Plan

District Objective

The Austin District's objective in any winter storm event is to respond to the road conditions in an expedient manner and to maintain the highways in a condition that is accessible to public travel as is feasible and reasonable. It is the District's intentions to keep all State highways open throughout the duration of the winter storm event as long as there is a sufficient inventory of deicing materials and as long as personnel are able to safely reach and apply the deicing agents to the road surface.

However, if the duration of the storm event exhausts the inventory of deicing agents, or if the resources of responding State or local assisting personnel can no longer provide reasonably safe public travel, then a decision to close some segments of roadways will be considered. Roadway segments that will be given first consideration for closure are those which have redundancy or easily accessible alternatives. For example, elevated direct connector ramps or bridges may be considered for closure if frontage road or at grade alternatives are readily available.

It is also the Austin District's intention to work closely with local governments and their law enforcement and public works agencies. In particular, the Austin District will actively work with all partners in the Combined Transportation Emergency Communication Center (CTECC).

CTECC (Combined Transportation Emergency Communications Center)

CTECC is a joint venture between the Austin District, the City of Austin, Travis County, and the Capital Metropolitan Transportation Authority. This operation is housed in a facility located just east of IH 35 along 51st St. CTECC accommodates not only the 911/311 operations of the Austin area law enforcement and fire fighting services, but it also serves as the base for the emergency operations of the partnering entities. During region-wide emergency incidents (such as winter ice storms, flooding events, coastal evacuations, etc.) the partnering entities send representatives to work in the CTECC Emergency Operations Center (EOC). The CTECC/EOC remains activated as long as is believed necessary to effectively respond to the incident event.

While on-going winter storm operations are directed locally from individual Austin District maintenance offices, coordination and communications between these offices is primarily facilitated through the Austin District's representative on the CTECC/EOC floor. By having a representative on the CTECC/EOC floor, the Austin District also remains in constant contact with both city and county transportation representatives as well as representatives from law enforcement and fire fighting. Particularly during winter storm events, this level of coordination greatly enhances the District's ability to quickly respond to trouble spots. This centralized communication also allows for decisions to be made in coordination with the local agencies.

Through direct conversation with representative from law enforcement and fire fighting we have made it clear to them that we make every effort to keep all roads and bridges open at all times throughout the winter storm events.

Austin District Winter Storm Response

Winter storm response operations are primarily directed from the local maintenance office level. Each of the 15 maintenance sections in the Austin District has an area of responsibility as shown by the District map in Exhibit 1. Each maintenance supervisor has an inventory of equipment and materials at their disposal as is detailed in Appendix A. In some cases the supervisor has created a specific predetermined schedule that section employees are expected to follow. In other cases the supervisor determines their employee's work schedule at the onset of the winter storm event. The scheduling method used by each section is up to the discretion of the maintenance supervisor and the corresponding area engineer and is generally determined by what has historically worked best in their local situation.

The decision as to when to begin application of pretreatment or anti-icing agents is left in the hands of each local maintenance supervisor at the onset of the winter weather event. Supervisors rely on a combination of several factors when making this decision:

- Current weather forecast information.
- On-going discussions with the CTECC/EOC representative or District Maintenance management.
- Pavement temperature readings on bridge decks by infrared thermometers, reports from their personnel in the field.
- Field reports from local law enforcement officers. There is always a risk of applying anti-icing agents too soon and having them washed off the pavement surface.

But supervisors are encouraged to error on the side of caution when making this decision. It is the Austin District's position that we would prefer to have anti-icing agents washed off by the rain rather than have traffic caught on highways that have not been pretreated. While maintenance section autonomy in winter storm events is deemed most effective for handling local operations, central communication is critical for maintaining a district-wide response. As previously discussed, the Austin District representative on the CTECC/EOC floor serves a critical role in fostering this communication.

In the event that additional support is needed at a local maintenance section, the first tier of response will be looked for the needed support from an adjacent maintenance office within the Austin District. Frequently, this communication is handled at the maintenance section level without involvement from the District Maintenance Office or the EOC floor representative. If the support needs cannot be satisfied by the neighboring maintenance section, then the maintenance section request should be forwarded to the District Maintenance Office or the EOC floor representative. Support can then be sought from other sections within the Austin District, from neighboring districts, or through the acquisition of materials.

The contact information for Austin District Maintenance Office personnel who serve in the CTECC/EOC or are available to assist the maintenance offices during winter storm events is shown in Exhibit 2 (not included).

Winter Storm Response on Austin District Toll Roads

The Austin District has approximately 690 lane-miles of highway on the toll road system. This system includes SH 130, SH 45 North, SH 45 Southeast, Loop 1 North, and US183A. At the present time the winter weather response on these highways is handled by contracted maintenance forces. The direct winter weather response for the toll road system is coordinated through the mainline plaza facility located on Loop 1 North.

These efforts are made in coordination and communication with the Austin District representative at the CTECC/EOC. The resources available for winter weather response on the toll roads are summarized in Appendix A. Contact information for those involved in toll road response is shown in Exhibit 2 (not included).

Winter Storm Preparations

Each year in the early fall months, the District Maintenance Office queries the maintenance sections about their inventory of aggregates, anti-icing, and deicing agents. It is the responsibility of each maintenance section to maintain an adequate inventory of necessary materials and to be sure their equipment is in operational condition. In addition to operational V-box spreaders, it is also necessary for the sections to have their herbicide trucks properly prepared for applying liquid magnesium chloride for pretreatment (anti-icing) operations. When believed necessary, the District will request assistance from the Vegetation Management Section of the Maintenance Division to help properly calibrate the herbicide trucks for winter operations. The quantities of stockpiled winter storm response agents are best determined by each maintenance section and are based on historical experience. Generally, each section is expected to maintain an inventory sufficient to handle an event lasting two to three days.

There is also an annual winter storm preparation meeting held at the CTECC/EOC.
This meeting is usually held in October and involves all the partner agencies. During this meeting each participating agency gives an overview of their winter storm objective and level of inventory preparedness.

Materials Used in the Austin District

In recent years the Austin District has adopted an operational strategy of trying to use only chemical anti-icing and deicing agents in the Austin metro area. The primary ant-icing agent used is liquid Magnesium Chloride (MgCl), and our primary deicing agent is granular MgCl. This strategy has evolved from the experience of excessive cleanup costs and environmental impacts caused by using aggregates in response to winter storm conditions. Following past winter storm events when aggregates have been deployed on the urban highway system, the costs associated with sweeping and cleanup have far exceeding the cost of using straight deicing agents. Not only are the cleanup costs nearly eliminated, but there is no post-storm buildup of aggregates sitting on our bridges and curb and guttered sections of highway. The use of aggregates also creates silting problems in our bridge joints and storm sewer systems, which undoubtedly leads to similar environmental concerns in the nearby streams, rivers, and other water bodies. In the event that a winter storm lasts longer than two or three days then we will use aggregates on the road surface, but we try to refrain from that option as long as possible.

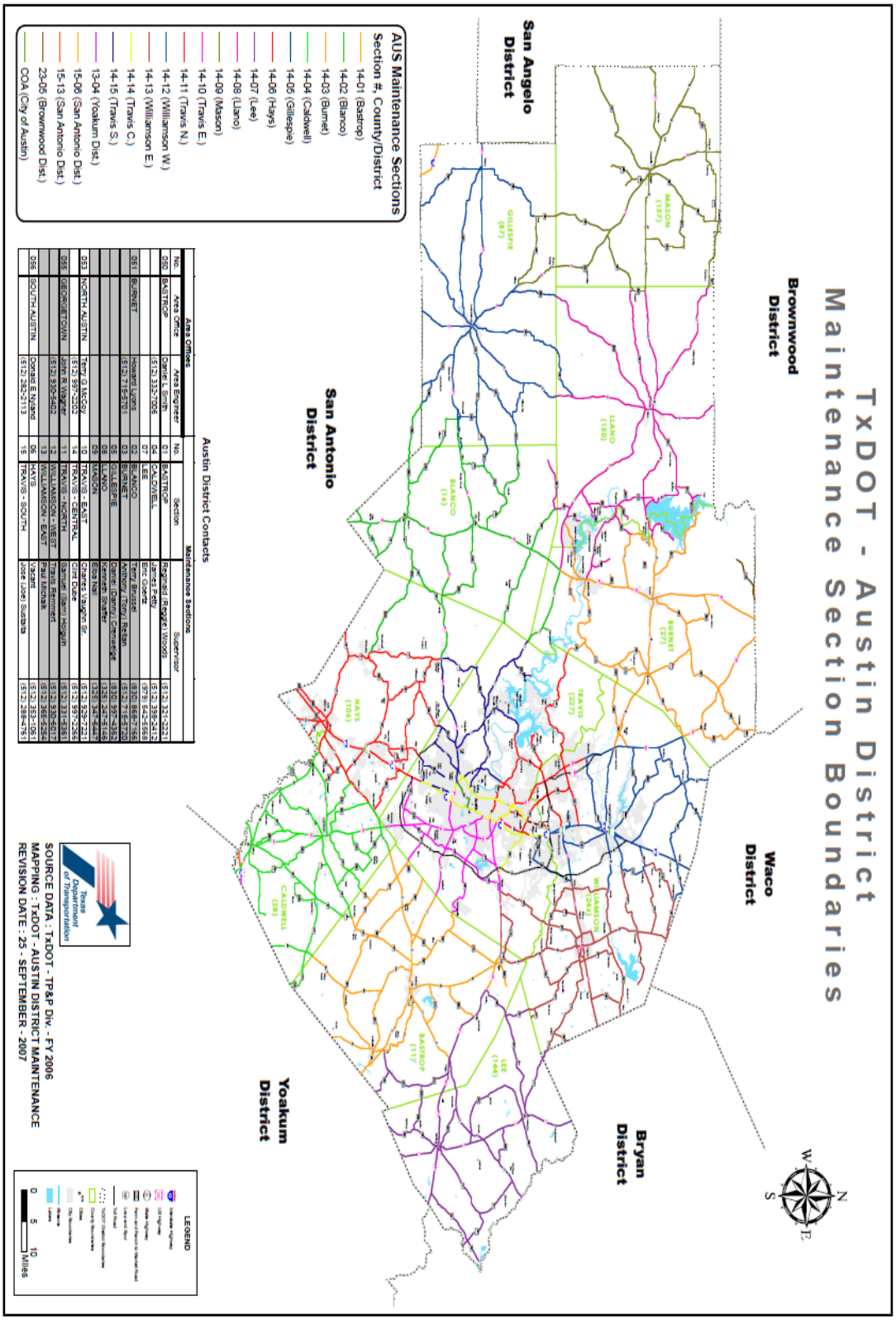
Outside of the Austin metro area we use deicing agents in combination with aggregate. In these areas the highways are primarily a ditch cross section so there is no curb and gutter and storm sewer system to trap the aggregate. In these areas the aggregate can blow off the pavement and be absorbed into the surrounding ground surface so additional cleanup costs are minimized.

Austin District Winter Storm Response Resources

As previously stated, the Austin District Maintenance sections are fairly autonomous in their winter storm response. This is because throughout the 11 county areas there are a wide variety of highway types, levels of adjacent development, and highway geometry. For this reason it is most effective if each maintenance section can tailor their response to fit their local conditions. See Appendix A for a summary of each section's response resources. Personnel from the Austin District's Special Crews are also a resource for the maintenance section supervisors. Special Crews personnel are generally deployed to the maintenance sections in the Travis, Williamson, and Hays County areas as needed.

Section 2

District Maintenance Boundaries Map



Section 3

District Contact Lists

- Includes contacts for key district staff involved in winter weather operations.
- Includes information on equipment and shift hours for various maintenance sections.

Austin District Maintenance Operations Contact Information		
Lowell D. Choate, P.E.	Director of Maintenance	(512) 832-7030 (office) (512) 585-4601 (mobile) (512) 992-0840 (home) (512) 779-3919 (personal cell) lowell.choate@txdot.gov
Wayne L. Rehnborg, P.E.	Assistant Director of Maintenance	(512) 832-7019 (office) (512) 965-2468 (mobile) (512) 837-1570 (home) (512) 914-3055 (personal cell) wayne.rehnborg@txdot.gov
Jamie Witten	District Maintenance Administrator	(512) 832-7099 (office) (512) 585-4678 (mobile) (512) 864-4441 (home) jamie.witten@txdot.gov
Paul Michalk	Tollroad Maintenance Contract Inspector	(512) 365-5254 (office) (512) 745-4114 (mobile) (512) 470-9033 (home) paul.michalk@txdot.gov

AUSTIN DISTRICT AREA ENGINEER & MAINTENANCE OFFICES

(50) BASTROP A.E.
174 SH 21 East, Bastrop TX 78602
Radio Base: 96R

Area Engineer: Danny Smith, P.E.
(512) 304-8119 *Cell Phone*
(512) 321-2195 *Office Phone*
(512) 321-3343 *Fax*

(51) BURNET A.E.
3029 E. Hwy 29, Burnet TX 78611
Radio Base: 97R

Area Engineer: Howard Lyons, P.E.
(830) 798-3762 *Cell Phone*
(512) 756-2316 *Office Phone*
(512) 756-4251 *Fax*

(55) GEORGETOWN A.E.
2727 S. Austin Ave, G'town TX 78626
Radio Base: 99R

Area Engineer: John Wagner, P.E.
(512) 585-4637 *Cell Phone*
(512) 930-5402 *Office Phone*
(512) 869-1419 *Fax*

(53) NORTH A.E.
1001 E. Parmer Ln, Ste. B, Austin TX 78753
Radio Base: 453

Area Engineer: Terry McCoy, P.E.
(512) 470-6788 *Cell Phone*
(512) 997-2200 *Office Phone*
(512) 997-2280 *Fax*

(56) SOUTH TRAVIS / HAYS A.E.
9725 S. IH 35 Austin, TX 78744
Radio Base: 456

Area Engineer: Don Nyland, P.E.
(512) 585-3358 *Cell Phone*
(512) 282-2113 *Office Phone*
(512) 282-2362 *Fax*

(01) BASTROP MAINT (Bastrop Co)
174 Hwy 21, Bastrop TX 78602
Radio Base: 96M

Supervisor: Reggie Woods
(512) 304-8854 *Cell Phone*
(512) 321-2221 *Office Phone*
(512) 321-3343 *Fax*

(02) JOHNSON CITY MAINT (Blanco Co)
608 Hwy 281 S, Johnson City TX 78636
Radio Base: 101

Supervisor: Terry Brussel
(512) 585-4129 *Cell Phone*
(830) 868-7166 *Office Phone*
(830) 868-0853 *Fax*

(03) BURNET MAINT (Burnet Co)
3029 E. Hwy 29, Burnet TX 78611
Radio Base: 97

Supervisor: Anthony "Tony" Reitan
(830) 798-3761 *Cell Phone*
(512) 756-2315 *Office Phone*
(512) 756-4251 *Fax*

(04) LOCKHART MAINT (Caldwell Co)
1315 N. Blanco, Lockhart TX 78644
Radio Base: 102

Supervisor: James Petty
(512) 376-8050 *Cell Phone*
(512) 398-2412 *Office Phone*
(512) 398-2788 *Fax*

(05) F'BURG MAINT (Gillespie Co)
1623 E. Main, Fredericksburg TX 78624
Radio Base: 98

Supervisor: Danny Crenwelge
(830) 739-7222 *Cell Phone*
(830) 997-4361 *Office Phone*
(830) 990-8137 *Fax*

AUSTIN DISTRICT AREA ENGINEER & MAINTENANCE OFFICES

(06) SAN MARCOS MAINT (Hays Co)
1710 Hwy 21, San Marcos TX 78666
Radio Base: 105

Supervisor: Joe Sustaita
(512) 585-3170 *Cell Phone*
(512) 353-1061 *Office Phone*
(512) 353-1117 *Fax*

(07) GIDDINGS MAINT (Lee Co)
1975 N. Main, Giddings TX 78942
Radio Base: 100

Supervisor: Eric Goertz
(979) 540-6398 *Cell Phone*
(979) 542-5568 *Office Phone*
(979) 542-9713 *Fax*

(08) LLANO MAINT (Llano Co)
2504 S. Hwy 16, Llano TX 78643
Radio Base: 103

Supervisor: Ken Shaffer
(512) 585-4182 *Cell Phone*
(325) 247-5146 *Office Phone*
(325) 247-2230 *Fax*

(09) MASON MAINT (Mason Co)
2424 E. Hwy 29, Mason TX 76856
Radio Base: 104

Supervisor: Elba Nail
(325) 347-2049 *Cell Phone*
(325) 347-6447 *Office Phone*
(325) 347-5661 *Fax*

(10) TRAVIS EAST MAINT
8902 F.M. 969, Austin TX 78724
Radio Base: 150

Supervisor: Charles Vaughn
(512) 585-6318 *Cell Phone*
(512) 929-7221 *Office Phone*
(512) 928-2090 *Fax*

(11) TRAVIS NORTH MAINT
2001 W. Whitestone, Cedar Park TX 78613
Radio Base: 288

Supervisor: Sam Holguin
(512) 585-3064 *Cell Phone*
(512) 331-5361 *Office Phone*
(512) 335-0869 *Fax*

(12) GEORGETOWN MAINT (Wmson Co)
2727 S. Austin Ave, G'town TX 78626
Radio Base: 99M

Supervisor: Travis Remmert
(512) 585-4617 *Cell Phone*
(512) 930-4700 *Office Phone*
(512) 869-5590 *Fax*

(13) TAYLOR MAINT (Williamson Co)
3101 W. Second St, Taylor TX 76574
Radio Base: 106

Supervisor: Deral Milliken (acting)
(512) 585-4692 *Cell Phone*
(512) 365-5254 *Office Phone*
(512) 352-6401 *Fax*

(14) TRAVIS CENTRAL MAINT
1001 E. Parmer Ln, Ste B, Austin TX 78753
Radio Base: 425

Supervisor: Clint Dube
(512) 585-3084 *Cell Phone*
(512) 832-6676 *Office Phone*
(512) 997-2281 *Fax*

(15) TRAVIS SOUTH MAINT
12315 W. Hwy 290, Austin TX 78737
Radio Base: 427

Supervisor: Joe Sustaita
(512) 585-3170 *Cell Phone*
(512) 288-4761 *Office Phone*
(512) 301-3053 *Fax*

(440) Special Crews
9725 S. IH 35 Austin, TX 78744
Radio Base:

Supervisor: Jamie Witten (interim)
(512) 585-4678 *Cell Phone*
(512) 832-7099 *Office Phone*
(512) 832-7390 *Fax*

Weather Emergency Contact List
ML1 Phone: 874-9205

NAME	TITLE	PHONE	EMAIL
DPS			
Vacant	DPS-THP Captain	997-4101 ofc cell	
Lt. Victor Taylor	DPS-THP Lieutenant	997-4104 ofc 496-4328 cell	
Sgt. Kelly Wilkison	DPS-THP Sergeant	874-9264 ofc 486-0447 ofc	kelly.wilkison@txdps.state.tx.us
DPS Communications	Communication Department	424-7391 ofc	
TxDOT			
Linda Sexton	Toll Operations Program Coordinator	874-9177 ofc 853-0441 BB 658-0323 cell	Linda.sexton@txdot.gov
Erica Ramirez	Marketing and Communications	874-9713 ofc 563-0098 cell	Erica.ramirez@txdot.gov
JD Witten	Transportation Specialist	585-4678 cell 864-4441 cell	Jamie.witten@txtdot.gov
Paul Michalk	Transportation Specialist	745-4114 cell 470-9033 cell	Paul.milchalk@txdot.gov
Lori Wagner	Transportation Specialist	745-4115 cell	Lori.wagner@txdot.gov
CTRMA			
Chuck Murphy		413-5258 cell	cmurphy@ctrma.org
PBS&J			
Allen Beck	Consultant	874-9720 ofc 739-5333 cell	abeck@pbsj.com
WGI			
Perry Kirby	Project Manager	874-9171 ofc 407-491-3711 cell	Perry.kirby@wgint.com
David Stephenson	Toll Operations Manager	874-9168 ofc 426-2006 cell	David.stephenson@wgint.com
WP Engineering			
Tom Frank	Central Texas Manager	874-9245 ofc 203-0608 cell	tfrank@txtag.org
CTECC			
	TxDOT Line Duty Officer	974-0883 974-0600	Wayne.rehnborg@txdot.gov
EMERGENCY AGENCY			
	Austin Police Dept.	974-5750	
	Round Rock Police Dept.	218-5515	
	Pflugerville Police Dept.	251-4004	
	Williamson County Sheriff Dept.	943-1389	
	Hutto Police Dept.	846-2017	
	Travis County Sheriff Dept.	974-0854	
	Cedar Park Police Dept.	258-2800	

Section 4

Ice Control Schedules

Date_____ Time_____

ICE CONTROL SCHEDULE

Winter 2010

Travis Central Maintenance

NIGHT CREW	CALL #	EQUIPMENT		DAY CREW	CALL #	EQUIPMENT	AREA
Rusty Davenport	3485-1	5344-J		Clint Dube	3485	4151-J	Travis Central
Teresa Resendez	580	Office		Rosalinda Gamez	580	Office	Maintenance Section
Cesar Garcia	3584-8	6675 (loader)		Dale Turner		6675 (loader)	Travis Central Stock Pile
VACANT		6849-A (loader)		VACANT		6849-A (loader)	LP1 / US 183 Stock Pile
VACANT		Borrow loader		VACANT			LP 1 / SW Parkway Stock Pile
John Taylor (JT)	3485-5	5249-H (10cuyd)		Daniel Mendez	3485-14	5249-H (10cuyd)	IH 35 (FM 1327 to 51st)
							No sand on PFC (Riverside to BW)
Ed Seale	3485-18	3876-G (10cuyd)		Amado Samora	3485-19	3876-G (10cuyd)	IH 35 (51st to SH 45)
Bill Lantz	3485-13	4213-J (6cuyd)		David Browning	3485-11	4213-J (6cuyd)	IH 35 (US 290 to SH 71)
							SP 69 (IH 35 to RR xing)
Gary Atwood	3485-21	3337-H (10cuyd)		Jacob Wells	3485-3	3337-H (10cuyd)	LP 1 (FM 734 to FM 2222)
Dustin Armstrong	3485-17	5472-F (10cuyd)		Gregory Stephens	3485-7	5472-F (10cuyd)	LP 1 (FM 2222 to Barton Creek)
							No sand on PFC (RM 2222 to 1st/5th)
Jay O'Donald	3485-2	4732-F (10cuyd)		Carmelo Reyes	3485-4	4732-F (10cuyd)	US 183 (IH 35 to LP 360)
							No sand on fingerjoint segments
VACANT		4885-D (6cuyd)		Santos Almaguer	3485-15	4885-D (6cuyd)	US 183 ramps (IH 35 to LP 360)
							No sand on fingerjoint segments
VACANT		4121-E (6cuyd)		VACANT		4121-E (6cuyd)	FM 734 (US 290 to IH 35)
Jonnie Perrine	3485-12	7571-G		Ronald Crawford	3485-20	7571-G	IH 35 (FM 1325 to FM 1327)
VACANT		7573-B		VACANT		7573-B	US 183 / LP 1 Flyover
							LP 1 (Parmer Ln to Barton Creek)
VACANT		7567-C (Giddings)		VACANT		7567-C (Giddings)	IH 35 (FM 1325 to FM 1327)
							US 183 (IH 35 to LP 360)

Material On Hand:				Clint Dube	585-6318wk/mbl,923-4389mbl		
Cal.Mag. Acetate	150611	Maint Yard	19 bags	Rusty Davenport	585-3778	CTECC	974-0883
Mag.Chloride	165612	Maint Yard	86 bags	Jay O'Donald	585-3104	Travel Division	512-921-6213
Mag.Chloride	150669	US 183/LP 1	50 bags	Jacob Wells	585-3084	Roadway Info	1-800-452-9292
Liquid Mag Chloride	157072	Dist. Yard	12,500 gal	G'town Remmert	585-4617	Terry McCoy	819-9985hm,818-9554mbl, 470-6788wk/mbl
Liquid Mag Chloride	157072	Maint Yard	6200 gal	G'town Stacy	569-0681	Mike McKissick	585-3237
Sand	11542	Maint Yard	260 cuyd	S.M. Sustatia	585-3170	Dale Turner	569-7021wk, 272-8643hm, 921-1338mbl
Sand	11542	US 183/LP 1	237 cuyd	S.M. Leclerc	557-3047	Clint Best	762-5571
Chat Rock	88375	Maint Yard	379 cuyd	T.South Sustatia	585-3170	Rosie Gamez	796-2213
				T. South Rice	585-3571	Chris Green	992-5003
Equip On Hand:				T. North Holguin	585-3064	Renell Springer	762-4374
10 cuyd Dump Trucks	5			T. North Brown	585-3045	Lanny Hall	689-4050wk
6 cuyd Dump Trucks	3			T.East Vaughn	585-3043	Teresa Resendez	771-5834
Front End Loaders	2			T. East Schulze	585-3751	Lowell Chaote	585-4601
Liquid De-Icing Trucks	3			Toll Rd. Michalk	745-4114	Jamie Witten	585-4678
Motor Graders	2				Reserve:	Daniel Bridges	422-2574, hm 992-2500, 809-9025wk
Sweeper	1				Reserve:	Chad Franks	227-1181
Trk Attenuators	2				Reserve:	Steve Schmidt	585-3283

Date_____ Time_____ **ICE CONTROL SCHEDULE** **Winter 2010/2011**

Travis East Maintenance							
NIGHT CREW	EQUIPMENT	CALL #		DAY CREW	EQUIPMENT	CALL #	AREA
Ronald Schulze	4416-H	3421-1		Charles Vaughn	4417-H	3421	Travis East
Patti Perez	Office	150		Carol Jarosek	Office	150	Maintenance Section
Slade Harris	Yard			J.Copenhaver	Yard	3421-6	4875-H/6614-A
Mike Jones	4729-F	3421-12		Robert Salas	4729-F	3421-10	SH 71 (IH 35 to Co. Line)
				Eddie Cooper			FM 812
Michael Salas	3873-G	3421-8		Paul Galvan	3873-G	3421-9	US 183 (IH 35 to Col. River)
							LP 111
Vacant				Vacant			FM 973
							LP 212
							*help US 183 south
Vacant	4124-E			Victor Herrera	4124-E	3421-4	FM 969
							FM 3177
							*help US 183 south
Jayme Holmes	4212-J	3421-7		J. Zaragoza	4212-J	3421-11	US 183 (Col. River to Co. Line)
							FM 1327
							FM 1625
Josh Wilson	5475-F	3421-2		Felix Zapata	5475-F	3421-3	US 290 (IH 35 to FM 973)
Chad Robinson	7518-G	3421-5		M.Dube	7518-G	3421-13	US 290 (Includes CTRMA US 183 overpass)
							US 183 (Col. River Interchange)
Lowell Choate	Off.-512-832-4601			Charles Vaughn	585-3043		SH 71 & US 183 Interchange
Jamie Witten	Off.-512-832-7099			Ronny Schulze	585-3751		SH 71 (ABIA Bridges)
Paul Michalk/Toll Roads	Mb.-512-745-4114			Terry McCoy	470-6788-TxDOT Mb		Neighboring Sections and Supvisors:
					819-9985-Home		Travis South:Joe Sustaita
Travel Division	512-921-6213				818-9554-Mb		Off-512-288-4761
Roadway Info	1-800-452-9292			Mike McKissick	512-585-3237Mb.		Mb.-512-585-3170
CTECC	512-974-0883			Eddie Cooper	W-585-3931		Gene Rice Maint.Asst.
					C-297-5467		Mb.-512-585-3571
				Slade Harris	W-784-8627		Bastrop Mo: Reggie Woods
					C-844-3006		Off.-512-321-2221
				Patti Perez	C-589-4302		Mb.-512-304-8854
				Equipment:			Celso Harper Maint.Asst.
Material on Hand:				2 ea-Front End Loaders			Mb.-512-304-8122
Mag.Chloride 150669 Maint.Yard 44 bags				2 ea-MotorGrader			Lockhart MO:James Petty
Mag.Chloride 150669 Old Special Crews Yard 68 bags				3 ea-10yd Dumps w/V-Box Spreaders			Off.-512-398-2412
Sand 11542 Maint.Yard 350 tons				2 ea-6yd Dumps w/V-Box Spreaders			Mb.-512-376-1118
Salt 88bags Maint.Yard (Use w/Sand as last resort)				1 ea-Herbicide Unit to apply Liquid De-Icer			Cody Chambliss Maint.Asst.
Liquid MagChloride 157072 11000 gals.				1 ea-Rotary Broom			Mb.-512-376-8095

SAN MARCOS ICE CONTROL PLAN 2011

DAY CREW SUPERVSOR OFFICE TRUCK/SANDER	SHADOW		LOCATION	NIGHT CREW SUPERVSOR OFFICE TRUCK/SANDER	SHADOW
		1	BEN WHITE ML: from Lamar Blvd to woodward Ave. N&W direct connects		
		1A	BEN WHITE FRONTAGE: from Lamar Blvd to IH 35, and LP 275		
		2	LOOP 1: from Barton Skyway to William Cannon		
		3	LOOP 360: from Lamar Blvd to Pennybacker bridge		
		4	US 290: from sh 71 west to Westgate Blvd		
		5	LOOP 1: from William Cannon to SH 45, and FM 2304		
		6	HILL COUNTRY: SH 71, US 290, RM 12 (SH 71 IS PFC, use liquid/melt down 20 only)		

EMERGENCY NUMBERS

JOE SUSTAITA (3422)	512/585-3170
GENE RICE (3422-1)	512/585-3517
ROLAND MANCHA (3422-2)	512/619-6176
OFFICE	512/288-4761
BASE STATION	427

SHIFTS ARE FROM 9:00 AM - 9:00 PM

APPLICATION RATES FOR "V" BOXES

1. MELT DOWN 20 BY ITSELF: SET GATE @ 1/2" - 1" SET VALVE @ 5-6 ON DIAL
2. SAND/ GRADE #5, MELT DOWN 20: SET GATE 1 1/2" - 3" DEPENDING ON MOISTURE
3. LIQUID DE-ICER: PRE-TREAT

MIX RATIOS ALL TRUCKS

1. 3 LOADER BUCKET GRADE #5, 1 LOADER BUCKET SAND, 4 BAGS SALT
2. 3 LOADER BUCKETS SAND, 1 BAG MELT DOWN 20
3. MELT DOWN BY ITSELF - 1 BAG PER TRIP

EMPLOYEES	EQUIPMENT	MATERIAL IN STOCK
JOE SUSTAITA	10-YD 4731-F	GRADE #5 MODIFIED - 320 CUYD
GENE RICE	10-YD 3335-H	LIQUID DE-ICER MAG CHLORIDE - 5100 GALS
ROLAND MANCHA	10-YD 3870-G	MAG CHLORIDE (MELTDOWN 20) - 109 BAGS
ALBERT BRIENO	6-YD 4890-D	MAG ACETATE - 18 BAGS
SALVADOR CALZONCIT	6-YD 4127-E	
JOE JIMENEZ	6-YD 4024-E	
BEJAMIN YOUNG	6-YD 4116-E	
BLAYNE BIRCK	BACKHOE- 6584-A	
EDUARDO CALZONCIT	LOADER 6648-G	
RICARDO CALZONCIT	UNI-LOADER 6760-A	
LARRY CLEMENTS	BLADE 1142-A	
CLINTON DOWDY	BLADE 1750-B	
ROLAND MANCHA	HERBICIDE - 7571-B	
BRAD PHIPPS		
TROY PHIPPS		
LYDIA RAMIREZ		
GLEN SANDERS		

MEMORANDUM

TO: North Travis Maintenance Employees **DATE:** December 17, 2010

FROM: Sam Holguin

SUBJECT: Schedule for Inclement Weather for 2010-2011

6am to 6pm		6pm to 6am	Roadway
Tom Brown		Sam Holguin	Monitor all roadways and assist as needed
Tommy Frierson	Shop		Load and repair equipment as needed
David Bauer	Office	Steve Sylvester	Monitor all roadways and assist as needed
William Bonnell	4118E	David Williams	RM1431: Lime Creek-IH35, & FM734
Phillip Morris	3878G	James Sites	RM620 & RM2222
Jimmy Holland	3879G	Gary Gietl	US183: RM620-LP360, FM1325, & LP275
Ben Parada	4730F	Eric Buchhorn	US183: RM620-LP360, FM1325, & LP275
Tim Parlak	4896D	Cody Lewis	US183: RM2243-RM620, RM1431
Jamie Atencio	7517G	Danny Hudson	US183 Main Lanes & OCP

Equipment Available for Incident Management Response:

- 2) Loaders
- 1) Motor Grader
- 1) Rotary Sweepers
- 1) Vacuum Broom
- 5) Arrow Boards
- 3) 10 CY Dump Trucks
- 3) 6 CY Dump Trucks
- 1) 2 CY Dump Truck w/arrowboard
- 1) Herbicide Truck
- 2) Haul Trailers
- 2) Truck Mounted Attenuators
- 1) Fork Lift
- 4) Pickups (2 w/Arrow Boards)

Material on Hand

Liquid De-icer	12,000 Gal
Granular De-icer	41 Bags (2205/Bag)
Grade 1 Aggregate	233 CY
Grade 5 Aggregate	114 CY

All material equipment and personnel will be based at maintenance yard. All seventeen employees at TNMO have a CDL and will assists as needed. We will operate on a rotating 12 hour shift to keep all roadways opened and assist emergency response personnel and stranded motorist.

Winter Weather Plan (Georgetown Maintenance)

1st Response	Equipment	Area to Maintain
Travis Remmert	Pick-up	Supervisor
Tisha Lyda		Office
Timmy Stacy	Pick-up	Asst. Supvr. (Check Area roads / Assist w/ Operations as needed)
Anthony Paidle	Pick-up	Crew Chief (Check Area roads / Assist w/ Operations as needed)
Douglas Havins	10 Yd Dump	IH 35 (ML/FR) - Bell Cty Line to SH 130 (Assist each other as needed)
Roland Thompson	10 Yd Dump	IH 35 (ML/FR) - SH 130 to RM 2338 (Assist each other as needed)
Jeremy Mikes	10 Yd Dump	IH 35 (ML/FR) - RM 2338 to Inner Space Caverns, Spur 158, Spur 26 (Assist w/ Eastern Roads)
Richard parker	10 Yd Dump	IH 35 (ML/FR) - Inner Space Caverns to SH 45, FM 3406, Bl 35 L (Assist w/ Eastern Roads)
Charlie Havins	6 Yd Dump	All roads West of IH 35 - US 183, FM 487, FM 2843, FM 970, SH 195, SH 138, FM 3405, RM 2243, SH 29 W
Steve Kelley	6 Yd Dump	All roads West of IH 35 - US 183, FM 487, FM 2843, FM 970, SH 195, SH 138, FM 3405, RM 2243, SH 29 W
Mike Walton	6 Yd Dump	All roads East of IH 35 - FM 971, FM 1105, FM 487 E, US 79, SH 29 E, FM 685, FM 1825
Jeff Snider	Liquid Truck	IH 35 - Bell Cty Line to Lakeway (Assist Sanding Operations as needed)
Cub Brundige	Liquid Truck	IH 35 - Lakeway to SH 45 (Assist Sanding Operations as needed)
Guy Freeman	TMA	Assist w/ one of the Liquid Trucks as needed

Mixing Materials / Load Trucks

Espirio Puga
Harold Buchhorn
Elton Copeland

Materials On Hand

Material	Location	Quantity
Melt Down 20	Yard	124 bags
Mag Chloride (Liquid)	Yard	6800 gal
Sand	Yard	549 cuyd
Grade 5 Aggregate	Yard	500 cuyd

AE Personnel available to assist Maint. Operations

Jason Hudson	Shadow Vehicle
Sherman Coots	Shadow Vehicle
John Peters	Shadow Vehicle
Gerald Pohlmeyer	Shadow Vehicle
Mark Olson	Shadow Vehicle

Equipment On Hand

10 Yd Dump Trucks	4	Yard
6 Yd Dump Trucks	3	Yard
Front End Loaders	2	Yard
Motor Graders	1	Yard
Skid Loader	1	Yard
Sweeper	1	Yard
Crash Cushion Truck	1	Yard
Backhoe	1	Yard
Liquid De-Icing Trucks	2	Yard

***Available CDL Operators in Maint. 16
***Available CDL Operators in AE Office 0

Note:
Everyone is listed as 1st Response due to not enough CDL Operators to keep all necessary equip. on the road or man the Office for a 2nd shift

Note:
Pre-treating Operations will be performed prior to the event if applicable using a slow moving operation w/ 2 liquid trucks and 3 shadow vehicles for IH 35 ML

SAN MARCOS ICE CONTROL PLAN 2011

DAY CREW SUPERVSOR	DAY CREW OFFICE	DAY CREW TRUCK/SANDER	DAY CREW SHADOW	LOCATION	NIGHT CREW SUPERVSOR	NIGHT CREW OFFICE	NIGHT CREW TRUCK/SANDER	NIGHT CREW SHADOW
				1 HILL COUNTRY: RM 12, RM 150, RM 1826, RM 3237				
				2 IH 35 NORTH: from Blanco river to Onion creek(main lanes) no sand PEC				
				2A IH 35 NORTH: from Blanco river to onion creek(all bridges), FM 1626, RM 967				
				3 IH 35 TOWN: from Blanco river to Hays county line (main lanes) no sand PEC				
				3A IH 35 TOWN: from Blanco river to Hays county line, all bridges. Assist main lanes				
				4 IH 35 TOWN: from Blanco river to Hays county line RM 12 to city limit SH 123 SH 80				
				5 EAST: SH 21, FM 2001, FM 1984, assist location 6 as needed				

EMERGENCY NUMBERS

JOE SUSTAITA	3422	512/585-3170
DONALD LECLERC	3435	512/557-3047
HENRY RAMIREZ	3435-1	512/557-3046
BASE STATION		105
OFFICE		512/353-1061

SHIFTS ARE FROM 6:00 AM - 6:00 PM

APPLICATION RATES FOR "V" BOXES

1 MELT DOWN 20 BY ITSELF: SET GATE @ 1/2" - 1" SET VALVE @ 5-8 ON DIAL
2 SAND/ GRADE #5, MELT DOWN 20: SET GATE 1 1/2" - 3" DEPENDING ON MOISTURE
3 LIQUID DE-ICER: PRE-TREAT

MIX RATIOS ALL TRUCKS

1 3 LOADER BUCKET GRADE #5, 1 LOADER BUCKET SAND, 4 BAGS SALT
2 3 LOADER BUCKETS SAND, 1 BAG MELT DOWN 20
3 MELT DOWN BY ITSELF - 1 BAG PER TRIP

EMPLOYEES	EQUIPMENT	MATERIAL IN STOCK
JOE SUSTAITA	**10-YD 3333-H**	**GRADE #5 MODIFIED - 320 CUYD**
DONALD LECLERC	**10-YD 3875-G**	**SAND - 682 CUYD**
HENRY RAMIREZ	**10-YD 5474-F**	**LIQUID DE-ICER - 7939 GALS**
DALE BLUME	**10-YD 4237-J**	**MAG CHLORIDE (MELTDOWN 20) - 120 BAGS**
JOHN BUCKLEY	**10-YD 3304-K**	**MAG ACETATE - 16 BAGS**
SUZIE DOUGLAS	**6-YD 4210-J**	
DAVID DREW	**6-YD 4014-E**	
JOE GARZA	**BACKHOE- 6596**	
BENNY GAY	**LOADER 6828**	
JOE HENNIG	**LOADER 6756-A**	
MICKEY JOHNSON	**BLADE 1062-G**	
TIM MCDONALD	**BLADE 1140-A**	
MICAHEL MCNABB	**HERBICIDE SAN MARCOS - 7505-G**	
RENE PINALES	**HERBICIDE LOCKHART - 7574-B**	
JASON RODRIGUEZ		
MIGUEL RUIZ		
JESSE SERNA		
EDWARD TILL		

Texas Department of Transportation

MEMORANDUM

TO: Law Enforcement Officials – Bastrop County **DATE:** **November** 19, 2010

FROM: Texas Department of Transportation (Bastrop County)

SUBJECT: Ice Control

This is to inform you of the "Ice Control" efforts which are currently in place by TxDOT's, Bastrop Maintenance office. We will be using a de-icing material called Meltdown 20 and this product will perform more effectively than just using sand and salt. Attached is a list of characteristics of this product. In brief, once the Meltdown 20 has been applied to a frozen surface, the ice will melt leaving only a wet surface. Meltdown 20 is most effective on wet pavement. The product will present a certain sheen resembling black ice but in fact the surface is only wet not frozen. Should Bastrop County experience ice conditions, our intention is to initiate a control plan providing safer roadways for the traveling public.

Please inform all personnel of this new method of controlling frozen roadway surfaces.

For question or concerns please call our office at 512-321-2221.

Ice Control Plan for Winter - 2010/2011
Bastrop Maintenance Section

Maintenance personnel will be divided into two - 12 hour shifts. When ice is anticipated by local weather reports, the beginning shift will standby at the warehouse. All sanding trucks will be prepared with V-box sanders and fueled. Personnel shifts and truck assignments are listed below:

Day Shift: (6:00 a.m. – 6:00 p.m.)

Reggie Woods/Paulette Goertz: Office
Paul Shirocky: 4467-H – *Route 2* ([redacted])
Angel Beltran 3871-G – Route 3 ([redacted])
Willie Thomas: 3366-J – Route 4 (Yellow)
Marvin Burgess: 3332-J – Route 1 ([redacted])
Vacant Loader/Road Monitor/Back-up Driver

Night Shift: (6:00 p.m. – 6:00 a.m.)

Celso Harper: Office
Pete Peterson: 4467-H – Route 2 ([redacted])
Kip Adams: 3871-G – Route 3 ([redacted])
Bob Kempf 3366-J – Route 4 (Yellow)
Scott Burdette: 3332-J – Route 1 ([redacted])
Vacant Loader/Road Monitor/Back-up Driver

Section 5

Ice Control Routes

Ice Control Routes – Winter 2010/2011

Route 1- Blue 12,964' = 2.55 mi. = 613.82lbs. (Equip.: 1 ea. 6 yard dump)

Routing:
SH 21/71 – from SH 304 to SH 95N – 5 bridges
SH 21 east – from SH 95 to US 290 – 2 bridges
Loop 150 – from SH 21/71 to Main St. (Bastrop) – 2 bridges

Route 2 – Orange 15,166' = 2.87mi. = 717.50lbs. (Equip.: 1 ea. 10 yard dump)

Routing:
SH 71 from LP 150(Bastrop) to Fayette County Line - 7 bridges
SH 95S from SH 71 to Fayette County Line – 4 bridges
FM 2571 from SH 95 South to SH 304 – 2 bridges
SH 304 – 1 bridge -
FM 535 east from SH 304 – 2 bridges

Route 3 – Green 8,233' = 1.56mi. = 390lbs. (Equip.: 1 ea. 10 yard dump)

Routing:
FM 20 from SH 71 to Caldwell County Line – 6 bridges
FM 535 from FM 20 to SH 21- 2 bridges
FM 535(Pearce Lane) from SH 21 to second bridge -- 2 bridges
FM 812 from FM 20 to SH 21 – 2 bridges
FM 672 from FM 812 to county line – 1 bridge
SH 21 from SH 71 to FM 812 – 5 bridges

Route 4 – Yellow 6,124' = 1.16mi. = 290lbs. (Equip.: 1 ea. 10 yard dump)

Routing:
SH 71 from FM 20 to Travis County Line – 4 bridges
FM 969 from SH 71 to Travis County line -- 2 bridges
FM 1704 from FM 969 to US 290 – 1 bridge
US 290 (Elgin) – 1 bridge
FM 3000 (Elgin) – 1 bridge
FM 1100 (Loop 109) – 1 bridge
SH 95 from US 290 to SH 21 – 2 bridges
FM 1441 from SH 95 to first bridge – 1 bridge

Route 1 – 9 bridges
Route 2 – 17 bridges
Route 3 – 18 bridges
Route 4 – 13 bridges
57 bridges = 42,487' =8.05mi. = 2011.71lbs. = 1 coverage @ 250lb/lane mile

Bastrop Ice Control Bridge Lengths

Route 1 - Blue

220	4	880	
220	4	880	
1202	4	4808	
480	4	1920	
1300	2	2600	
126	4	504	
128	4	512	
215	4	860	
		12964/2.46	**615 lbs.**

Route 2 - Pink

162	4	648	
190	4	760	
1177	4	4708	
370	4	1480	
215	4	860	
303	4	1212	
82	4	328	
1124	2	2248	
155	2	310	
80	2	160	
85	2	170	
110	2	220	
156	2	312	
130	2	260	
		13676/2.59	**647 lbs.**

Route 3 - Green

522	2	1044	
125	2	250	
530	2	1060	
150	2	300	
526	2	1052	
150	2	300	
120	2	240	
182	2	364	
95	2	190	
170	2	340	
208	2	416	
200	2	400	
290	2	580	
80	2	160	
58	2	116	
133	2	266	
90	2	180	
95	2	190	
460	2	920	
110	2	220	
205	2	410	
		7646/1.45	362 lbs.

Route 4 - Yellow

100	4	200	
188	4	752	
65	4	260	
90	4	360	
569	2	1138	
86	2	172	
284	2	568	
365	4	1460	
128	2	256	
100	2	200	
290	2	580	
129	2	258	
225	2	450	
		6654/1.26	**315 lbs.**

Route 1	*2.46 mi*	*615 lbs.*
Route 2	*2.59 mi*	*647lbs.*
Route 3	*1.39 mi*	*348 lbs.*
Route 4	*1.26 mi*	*315 lbs.*
Total	**7.98 mi.**	**1996 lbs.**

1 lane mile = approx. 250lbs. - "meltdown 20"

Refer to Ice Control Map for Route Locations

Winter Weather Plan
Taylor Maintenance Section

We watch the weather and if there is a chance of Ice or Snow we split the crew into two groups, 7 people during the day and 5 people at night.

Day Crew 7:00 AM to 7 PM.
Deral Milliken- CDL
Randy Nelson -Office no CDL
Jackie Volek-CDL
Fred Wilson-CDL
Jeremiah Boehme-CDL
Vacant- CDL
Vacant- CDL

Night Crew 7:00O PM to 7:00 AM.
James Henderson-CDL
Clinton Anderson-CDL
James Cole-CDL
Mike Schneider-CDL
Vacant-CDL

Equipment
3 each-10 Yard Dump Trucks with V-Box Spreaders.
2 Each- 6 Yard Dump Trucks with V-Box Spreaders.
2 each- front end loaders.
1 each- Fork Lift.
1 each-TMA.
1 each- Herbicide Truck

Deicing Agents
3,810 Gallons of Liquid Magnesium Chloride.-Taylor Maintenance Yard
43 Super Sacs of Meltdown 20. - Taylor Maintenance Yard
400 CY of Sand. - Taylor Maintenance Yard

From: Terry Brussel
To: Wayne Rehnborg
Date: 12/21/2010 3:40 PM
Subject: Fwd: Re: Winter Weather Plan

>>> Terry Brussel 12/16/2010 10:02 AM >>>

The Johnson City Maintenance Section does not have a formally written winter weather response plan. We operate on a case by case basis utilizing our resources available at the time.

We have 12 employees other than myself. (total 13) We will work shifts as directed by me.

Equipment Inventory:

Loader 1
Skid Steer 1
2- 6 yards with V-Boxes
3- 10 yards with V-Boxes

Materials Inventory:

Sand- 400 cubic yards
Grade 5-150 cubic yards
15-2000# bags of Mag Chloride

From: Anthony Reitan
To: Wayne Rehnborg
Date: 12/17/2010 9:17 AM
Subject: Re: Winter Weather Plan

Here is Burnet Maintenance plan:
12 people working 12 hour shifts with 6 people per shift. (the A/E Office has 3 people if needed.)
Equipment : 6 -V-Box Spreaders 2-6 yard
3-10 yard
1-1/2 yard
3-Front end loaders
2-Graders
2-Drag type snow plows
1- Sweeper with plow blade

Anthony J. Reitan
Texas Department of Transportation
Burnet Maintenance Section Supervisor
PH# (512)-756 -2315
Fax#(512)-756-4251
Anthony.Reitan@txdot.gov

From: Anthony Reitan
To: Wayne Rehnborg
Date: 12/22/2010 9:09 AM
Subject: Fwd: Re: Winter Weather Plan

>>> Anthony Reitan 12/22/2010 8:56 AM >>>

Burnet Winter Weather Materials Inventory: All materials located in maintenance yard

48 super sacks of deicer
50-50 lbs bags of deicer
400 tons of sand
500 tons of grade 5 rock.

Gillespie County Maintenance
Winter Weather Plan

Available Employees:

Employee	Position	Office	CDL	HCRS Input
Daniel Crenwelge	Maint. Supv.	Maint.	√	√
Doyle Moellering	Asst. Maint. Supv.	Maint.	√	√
Kristi Koch	Office Manager	Maint.		√
Karl Wilke	Crew Chief	Maint.	√	
Russell Hartmann	Sign Tech	Maint.	√	
Dennis Segner	Maint Tech	Maint.	√	
Will Weidenfeller	Maint Tech	Maint.	√	
Randy Kalka	Maint. Tech	Maint.	√	
Lonnie Hohmann	Maint. Tech	Maint.	√	
David Wiemers	Maint. Tech	Maint.	√	
Dennis Behrends	Sign Tech	Maint.	√	
Girard Behrends	Maint. Tech/Office Backup	Maint.	√	√
Denzal Wright	Maint. Tech	Maint.	√	
Keith Schneider	Mechanic	Region	√	
Stevie Kothe	Eng. Tech	AE		

Available Equipment:

Equipment No.	Description	Sander Available
1350	John Deere motor grader	
3330-J	Ford 6 cy dump truck	√
3343-K	Ford sign truck	
4027-J	Chevrolet pickup	
4128-E	GMC 6 cy dump truck	
4129-E	GMC 6 cy dump truck	√
4413-H	Ford pickup	
4553-H	Chevrolet field mechanic truck	
4871-H	Chevrolet pickup	
4898-D	Ford 6 cy dump truck	
4730-G	International 10 cy dump truck	√
5445-D	Chevrolet 6 cy dump truck	√
5585-F	Ford 10 cy dump truck	√
5678-H	Ford pickup	
5575-J	Ford baby dump truck	
6114-B	GMC bucket truck	

6559-G	New Holland backhoe	
6693-G	Case loader	
6847-A	Case loader	
8368-K	Broce road sweeper	
8420-A	Equipment trailer	
8707-G	Equipment trailer	
8037-L	Electronic Changeable Message Trailer	
####	Cone/sign trailer	

Available de-icing materials/aggregates:

Description	dht #	Quantity	unit	Location
De-icer; MeltDown 20	150669	37	3000 lb bag	Fredericksburg maintenance yard
Salt	11563	506	50 lb bag	Fredericksburg maintenance yard
Sand	11542	165	cubic yards	Fredericksburg maintenance yard
Aggregate; gr. 5-mod	88375	202	cubic yards	Fredericksburg maintenance yard

From: Lana Nickel
To: Wayne Rehnborg
Date: 12/21/2010 3:08 PM
Subject: Fwd: Re: Winter Weather Plan

>>> Lana Nickel 12/20/2010 10:20 AM >>>

The Giddings Maintenance Section has 9 employees that will be doing shift work and that have their cdl's. At present we have not ask for anyone from AE office.
We have: 4 pick up trucks, 2 loaders and 4 spreaders for 10 yard dump trucks.
We also have 19 bags of deicer stockpiled in the maintenance yard.

Lana S. Nickel
Giddings / Lee County
Office manager
Ph: 979-542-5568
Fax: 979-542-9713

Llano Maintenance Winter Weather Plan

# Of Employees with CDL	Equipment Available	Materials Available
13	Three 10 yard dump trucks with sanders.	20 bags of melt down 20 (approx. 2000#'s per bag) DHT# 150669
	Two 6 yard dump trucks with sanders.	168 CY of Sand (DHT# 162218)
	Two rubber tired loaders.	177 CY of Grade Special Aggregate (DHT# 162058)
	One maintainer.	
	One skid steer loader.	
	One rotary broom.	
	One Herbicide truck for spraying liquid de-icer.	

From: Elba Nail
To: Wayne Rehnborg
Date: 12/16/2010 9:43 AM
Subject: Re: Winter Weather Plan

Personnel available with CDL: Elba Nail, Randy Stockbridge, Chris Ake, Jared Carter, Cole Farmer, Terry Geistweidt, Joey Ingracia, Sean Reardon, Dennis Simon, Charles Schmidt and Rick Smith. Gwen Stockbridge (no CDL)is available for office

Equipment available: (10 cy. trucks-- 5586-F, 4732-G) (6 cy. dump trucks-- 4130-E, 3360-H, 3326-J) (Loaders-- 6848-A, 6776, 6517-A) (Broom--8390-H) (maintainer-- 1031-A) (pickups-- 4908-H, 4407-H, 4291-F, 5324-J, 4555-H) (V-box sanders-- 10 yd (2), 6yd (3),) (pickup sanders (4) (sm. truck (1))

Materials and quantities: Sand-- 330cy, gr. 5-- 80cy, gr.4 lw-- 333 cy. meltdown 20-- 14 bags. (each bag is 3000 lb)

Don't have any written plan, shifts are split with half of employees on nights and half on days, 7pm to 7AM

Section 6

Austin District Toll Road Winter Weather Plan

- ISI (maintenance contractor) has 9 V-BOX spreaders 4 of these are on dump trucks and 5 are mounted on flatbed trucks that do not require CDL drivers. All spreaders are manufactured by Bonnell and have a 6 yard capacity. ISI has a total of 9 CDL drivers. The plan is to have 32 contract employees to work split 12 hour shifts with 16 working each shift. ISI also has 7 liquid applicators to spray Mag-Chloride. ISI has one loader and will rent another as soon as winter weather forecasted

- Once winter weather is eminent ISI will be out on standby. We will begin pre-treatment depending on moisture on pavement will determine if we will use liquid or granular. Once ice has formed we will treat pavement with both liquid and granular de-icier. We also will before storm stage barrels at key ramps and other areas that ice over more in case we need to close these areas.

- We have in stock 134 bags of granular de-icier and 9200 gallons of liquid de-icier. These are stock piled in two locations. One is at LP 1 and SH 45 and the other is on SH 130 at Greg/Manor Road. Each location has 62 bags of granular and 6000 gallons at the LP1/ SH 45 site and 3200 gallons at the SH 130 site. The plan is to order 4500 more gallons for the SH 130 site.

Appendix C
Example of 2011 Snow and Ice Plan – Rural District

Contents:

Section 1

Childress District Winter Weather Plan

Department Policy & Procedure Manuals & Document References:

- **Snow and Ice Control Operations Manual**, dated September 1, 2005, describes general responsibilities and requirements for Districts and Maintenance Sections to follow during snow and/or ice storms.

Purpose:

To supplement the **Snow and Ice Control Operations Manual** by outlining Childress District guidelines for providing safe and efficient movement of people and goods during snow and/or ice storms.

List of Attachments:

Attachment A	District Emergency Contact List
Attachment B	Neighboring District Contact List
Attachment C	Texas DPS Disaster Map
Attachment D	Map of Prioritized Roads
Attachment E	District Equipment List
Attachment F	Use of Non-CDL Drivers for Patrolling
Attachment G	Policy for Personal Cell Phone Use
Attachment H	Storm Database Information

Objectives/Goals

The primary goal during any winter storm event is to keep roadways safe and traffic moving. TxDOT will use all available resources to accomplish this goal.

TxDOT employees will work together to ensure that snow and ice is removed from roads in a timely manner. This not only keeps the system safe, but minimizes the damage to pavement caused by snow and ice.

District Administration will work with neighboring districts to ensure routes are kept safe and continuously cleared of snow and ice, regardless of section or district lines.

District Administration will work diligently to ensure that motorists are made aware of road conditions through all available media.

District Guidelines

Each Maintenance Supervisor shall ensure that all equipment, operators, and supplies are ready prior to October 15th of each year. Maintenance Supervisors should monitor the winter forecast

closely. Sections will work together and may be required to cross section and/or District lines to assist with high priority roadways.

Emergency Operations Center

The phone numbers to the District Emergency Operations Center (EOC) are (*provided in original document but not included in this document*).

The Maintenance Supervisor will determine if additional resources are needed in the section, and request such resources through the Area Engineer and/or District Maintenance Coordinator. Upon request of additional resources by any section, the District EOC will become operational and will assist with all coordination activities. The District EOC will operate under the Incident Command System Structure with the District Engineer, or designee, serving as Incident Commander.

The staff in the EOC typically consists of the Director of Operations, District Maintenance Administrator and Public Information Officer for the District, plus other staff as needed to assist with data input, monitoring resources, and other tasks as determined by the Incident Commander. The support staff will be assigned tasks by the Incident Commander. The primary duties of the EOC are as follows:

- Monitor storm events.
- Communicate with field personnel.
- Answer phones during non-business hours.
- Perform and/or assist with HCR updates.
- Coordinate shifting of resources to critical areas.
- Coordination the use of DART cards.
- Coordinate accommodations for crews from other Districts or sections.
- Communicate with local law enforcement and assist as needed.
- Communicate with local media to alert the public of road conditions.

The Incident Command System of operation is referenced as a separate document.

Preseason Preparations

Maintenance Supervisors should update emergency contact lists by October 15th of each year:

- Local city and county officials.
- Local law enforcement.
- Adjoining TxDOT Districts and/or Sections.
- Adjoining States if applicable.

Check all equipment by October 15th of each year:

- In order to minimize wear of snow plow blades, the use of double blades is recommended, using one steel blade against the mold-board and one carbide blade in front.

- Tension should be checked and adjusted on the snow plows to minimize tripping, which can cause loss of steering control.
- Calibration of sprayers and v-boxes should be checked and adjusted as necessary.

Stock enough materials for at least three typical storms:

- All snow and ice control materials (aggregate, salt, MgCl, MD 20, snow plow blades, etc.) should be ordered, tested and stockpiled prior to November 1st of each year.

Acquire and preload DART cards for 4 nights/3 days' worth of expenses (approx. $400):

- DART cards will be kept at the District Office.
- DART cards will be used to pay for rooms and meals if called to work extended hours that require overnight stays.

Each Maintenance Supervisor should review the District's list of prioritized roads for their section:

- Priority 1 roadways – High volume roadways such as Interstate and US highways.
- Priority 2 roadways – State highways and high volume FM roads.
- Priority 3 roadways – Low volume FM roads. Some FM roads may be a higher priority based on their importance to the local communities such as emergency routes.

The District Maintenance Office will conduct a preseason winter storm conference call as deemed necessary. Discussion topics may include:

- Incident Command System.
- Emergency Contact lists.
- General treatment practices.
- Materials, application rates, etc.
- Protocol for road closures.
- Protocol for shifting resources.
- Equipment needs and/or repairs.
- Material needs.

Conference Call Numbers: (*Provided in original document, but excluded from this document*)
Host Pass code: (*Provided in original document, but excluded from this document*)
Participant Pass code: (*Provided in original document, but excluded from this document*)

Pre-Storm Activities

The District Maintenance Office will schedule meetings and/or conference calls for AEs, Maintenance Supervisors, and Shop Personnel to discuss preparations prior to each upcoming winter storm.

The PIO will contact media outlets (radio, TV, newspapers, etc.) to ensure they are available and willing to broadcast road conditions.

When winter storms are approaching, appropriate measures should be taken, such as:

- A safety meeting shall be held in each Maintenance Section prior to each storm event to discuss storm-related safety issues.
- Sections should pre-determine and ensure that everyone knows their assignments:
    - Discuss shifts to work.
    - Ensure all equipment is in proper working order.
    - Discuss the application of chemicals and/or abrasives and recommended rates.
    - Pre-treating with liquid Magnesium Chloride solution is recommended for Priority 1 roadways a couple of days prior to a forecasted storm event.
    - When freezing precipitation begins to fall, granular Salt or MD 20 deicing material should be applied with spreaders to minimize bonding of ice to the pavement.
    - A bottom ash or sand/salt mixture can be applied for traction when necessary but granular chemical applications should continue.

- All sections should have equipment on the road at the onset of a storm.
- Personnel should be notified of the potential of being called out for rapid response to winter storm events.
- Discuss how to handle stranded motorists and vehicles.
- Inform employees that state law allows us to remove vehicles from the travel way.
- If traffic is being impaired, push it off the road.
- Maintenance sections should establish communications with key entities ahead of and during the storm.
- Motor graders can be used during a winter storm event to remove ice and snow. Be mindful of leaving windrows in front of driveways, intersections, railroad grade crossings, or any location that might impair or block access.
- Equipment components subject to deterioration and corrosion should be given particular attention and high-wear replacement parts should be in stock.
- A test run of equipment should be completed by Oct 15th of each year and prior to each storm event throughout the winter.
- Pickups used for patrolling should be stocked with proper equipment and necessities to assist stranded motorists.
- Message boards and other traffic control devices should be pre-staged at predetermined locations for alerting motorists to pertinent information.

Supervisors may request permission to take their TxDOT vehicles home on a temporary basis if a winter storm is approaching.

Storm Operations

Conference calls will be scheduled throughout the event as deemed necessary to gather and share information. The District has a conference call number established for such calls and it is as follows:

Numbers: (*Provided, but excluded from this document*)
Host Pass code: (*Provided, but excluded from this document*)
Participant Pass code: (*Provided, but excluded from this document*)

There will be regular conference calls between affected Districts, MNT, and the National Weather Service prior to and during storm events. The Panhandle Districts also communicate using pre-established email groups that include District Administration as well as field supervisors.

The Highway Condition Reporting System (HCRS) will be updated as follows:

- Highway conditions must be entered into HCRS within one hour of occurrence, and should be updated as conditions change, but at least every 2-4 hours until all roads are clear.
- The EOC will perform and/or assist with data entry. Supervisors should keep the EOC staff updated on road conditions.

In addition to HCRS, a second storm reporting database will be used to record more detailed data than HCRS allows. The database is located on the Amarillo District's SharePoint site, and should be updated at the following times during storms: at storm's onset, then at 5:00 am, 10:00 am, and 4:00 pm throughout the storm. As with HCRS, EOC personnel will assist with data entry.

Supervisors and employees should be prepared to begin operations from the first snow flake, and to remain diligent in attacking the storm until the last road is safe and clear. Every available employee and piece of equipment will be utilized around the clock.

The AE, Director of Operations, and/or District Maintenance Administrator should be contacted if additional assistance is needed within a Section. All Sections should report the roads they are working on. Crews may be shifted within the District or to other Districts to ensure priority roadways are kept clear. This may include shifting crews from low priority roadways in their section to higher priority roadways in other sections or other Districts. It is imperative that roads are kept clear from town to town, not leaving any possibility of stranding a motorist in an unsafe location, even if crossing section or District lines becomes necessary.

Non-CDL personnel (inspectors, designers, support staff, etc.) may be needed to work during winter storm operations. Non-CDL drivers can patrol roads and assist motorists so crew members can continue plowing snow or gain valuable rest.

Other factors to consider during a storm event are as follows:

- Rotation of crews is recommended and left up to the supervisor's discretion as to how shifts are divided. Two 12 hour shifts are recommended, typically from noon to midnight.
- Drivers are not expected to work more than 16 hours without resting 8 hours, although going over the 16 hour threshold is occasionally allowed for non-driving duties. Supervisors need to consider this when planning their resources.
- Sufficient materials should be stocked for at least three (3) typical storms and material should be replenished as needed during the winter months.
- Each Supervisor or designee should contact the AE, Director of Operations, or District Maintenance Administrator when snow and ice control measures begin.
- Communicating roadway conditions to adjoining sections and districts is critical.
- Communication, between sections is essential to achieve consistent treatment of roadways across section lines for the length of the roadway segment. This also applies to neighboring Districts as it is critical to keep routes clear from town to town.
- EOC will have designated employee(s) who will be responsible for the input of roadway conditions into the Highway Condition Reporting System. This information is extremely important to our operations, the media, and the traveling public.

Public Information Officer

In any emergency situation information is vital. Communication with local media should take place on a regular basis to keep the traveling public informed and updated on road conditions. The District PIO will prepare and distribute press releases to the media to best fit their schedule for transmitting that data to motorists.

- PIO will stay in contact with local media to broadcast road conditions.
- Twitter and Facebook will be used by the PIO to keep motorists informed of road conditions.
- Information on road conditions above and beyond that entered into HCRS or the storm reporting database should be reported to the EOC and PIO.
- Any incident that might attract media attention should be immediately reported to the EOC and PIO with as many details as are known.

Road Closures

The District's goal is to keep all state maintained highways open to motorists. Roads are to be closed only as a last resort and if it becomes impossible to keep the road passable. The decision to formally close a road will be made by the Incident Commander in conjunction with the Texas Department of Public Safety (DPS).

In the event DPS authorizes or instructs a road to be closed, TxDOT will do its best to assist. However, TxDOT resources are very limited as far as signs, barricades, personnel, and other resources to fully close a road, especially one where access control does not exist. TxDOT resources should continue to be focused on clearing roads.

Volunteer Fire Departments, Hospitals, Clinics, Schools, Etc.

Pretreatment and removal of snow and ice from off-system driveways and streets for emergency services is typically the responsibility of the city or county. However, most local entities in the Childress District do not have proper equipment for this task. If the emergency response facility is near to or adjacent to a state maintained roadway, TxDOT personnel may clear the driveway or street to improve access for emergency vehicles.

Similarly, school districts do not have proper snow moving equipment; therefore, TxDOT employees may clear streets around schools to provide safe access for the assortment of traffic trying to maneuver in these areas.

Supervisors should consider these areas when assigning operators to specific routes, and inform those operators of what's expected before allowing them to treat a road off the state highway system.

Stranded Motorists

It is imperative that TxDOT maintain a presence on roads throughout a storm event, both day and night. Non-CDL drivers will be used to maintain or enhance TxDOT's presence so that operators can continue their jobs of clearing roads.

Non-CDL drivers will patrol roads to look for and assist stranded motorists and/or vehicles. They will be furnished 4X4 pickups for this purpose. Typically, two Non-CDL employees will travel together in the same pickup.

If a motorist is stranded TxDOT will offer assistance, such as calling a wrecker, offering to take the motorist to the nearest town, etc. If a TxDOT employee is requested to pull a stranded vehicle from the ditch, and can do so without damaging the vehicle, assistance should be provided. Should it become necessary to rescue stranded motorists, TxDOT will deploy all available resources to assist.

Post Storm

The District Maintenance Office will schedule meetings and/or conference calls as necessary to follow up on how each storm was handled, and how to improve operations on future storms. Supervisors should also conduct meetings to debrief employees after each storm, and evaluate their operations.

Supervisors should service and ready all equipment, replenish materials, inspect roadways for damage, and thoroughly evaluate their response to the storm.

The storm reporting database will summarize each storm event, including road conditions, materials used, equipment used, and so on. These data will be available for review and will be a good tool for future planning.

Section 2

Attachment A: District Emergency Contact List

CHILDRESS DISTRICT INFORMATION
7599 US 287, Childress, TX 79201-9705
Phone: 940-937-2571 Fax: 940-937-7154 1-888-844-0243
MAINTENANCE OFFICES

County	Section	Supervisor	Address	FAX	Speed Dial
BRISCOE County # 23 **Rhonda Collinsworth**	08	**Jeff Smith** Home: 806-823-2023 Mobile: 806-930-5244	Silverton RR 1 Box 1F 79257 **Office: 806-823-2386**	806-823-2064	**80**
CHILDRESS County # 38 **Phyllis Mills**	01	**Bill Thompson** Home: 940-937-2748 Mobile: 940-585-8416	Childress 7599 US 287, 79201-9705 **Office: 940-937-7140 / 7132**	940-937-7269	N/A
COLLINGSWORTH County # 44 **Cindy Fires**	09	**Michael Breedlove** Home: 806-205-2733 Mobile: 806-930-5266	Wellington 16215 FM 338, 79095 **Office: 806-447-2971**	806-447-2640	**90**
COTTLE County # 51 **Phyllis Mills**	06	**Ron Gilbert** Home: 806-596-4323 Mobile: 806-346-7001	Paducah Box 369, 79248-0369 **Office: 806-492-3313**	806-492-3895	**60**
DICKENS/KING Dickens County # 63 **Mary Marshall** King County # 135	03	**Jay Hurt** Home: 806-596-4389 Mobile: 806-346-7032	Dickens Box 77, 79229-0077 **Office: 806-623-5241** **Guthrie Office: 806-596-4433**	806-623-5312 806-596-4454	**30** **61**
DONLEY County # 65 **Marcia Henard**	02	**Refugio Benavidez** Home: 806-874-3104 Mobile: 806-930-5254	Clarendon 3268 US 287, 79226-9801 **Office: 806-874-3721 / 2651**	806-874-5165	**20**
FOARD County # 79 **Marcia Henard**	11	**Max Gerhardt** Home: 940-684-1897 Mobile: 940-839-8099	Crowell Box 34, 79227-0034 **Office: 940-684-1302** Marcia: 806-874-3721	940-684-1497	**71**
HALL County # 97 **Rhonda Collinsworth**	12	**Brent Foard** Home: 806-259-3725 Mobile: 806-930-1295	Memphis 220 E. Noel, 79245-3529 **Office: 806-259-2122 / 3872**	806-259-2969	**21**
HARDEMAN County # 100 **Denise Key**	07	**David Seal** Home: 940-937-3782 Mobile: 940-839-8196	Quanah 405 Loop Road, 79252 **Office: 940-663-2822**	940-663-5812	**70**
KNOX County # 138 **Kamela Bonham**	05	**Gene Ward** Home: 940-657-3843 Mobile: 940-203-0098	Munday Box 349, 76371-0349 **Office: 940-422-4350**	940-422-4226	**50**
MOTLEY County # 173 **Mary Marshall**	04	**Ben Kautz** Home: 806-347-2448 Mobile: 806-346-7034	Matador Box 378, 79244-0378 **Office: 806-347-2448**	806-347-2414	**40**
WHEELER County # 242 **Cindy Fires**	10	**Jody Watts** Home: 806-236-3532 Mobile: 806-930-5205	Shamrock 16100 I-40, 79079-9504 **Office: 806-256-3206 / 3964**	806-256-2358	**10**

Childress Area Office
Area Engineer - Chris Reed, P.E.
7599 US 287
Childress, Tx 79201
Office Manager: **Barbara Sims**
Counties: **Briscoe, Childress, Collingsworth, Donley, Hall, Hardeman, & Wheeler**
Childress Office: 940-937-7249 Wellington Office: 806-447-5137 or 2444
Home: 940-585-6348 Blackberry: 512-934-2702
Mobile: 940-585-8163

Munday Area Office
Area Engineer - Gary Mizer, P.E.
P.O. Box 349
Munday, TX 76371-0349
Office Manager: **Kamela Bonham**
Counties: **Cottle, Dickens, Foard, King, Knox, & Motley**
Office: 940-422-4115 or 940-422-4350
Speed Dial: # 50
Home: 940-422-5274 Blackberry: 512-965-2463
Mobile: 940-256-8375

District Office	Home Phone	Mobile
Terry Keener, P.E., D.E.	940-937-3166	512-963-1340 940-585-8329
Darwin Lankford, P.E., DOO	940-937-0199	512-466-9983 940-537-1461
Marty Smith, P.E., DTPD	940-937-2929	512-922-0733 940-585-0733
Barbara Seal, PIO	940-937-3783	512-971-4309
Mark Hightower, Dist Maint	940-937-8591	512-965-2348 940-585-8415
Ronald Hatcher, Lab Supv.	940-937-2329	940-585-8412
Tommy Holcomb, Shop Supv.	940-937-8287	940-585-8328
Bart Sherrill, Traffic Ops	940-937-8497	940-585-8362
Kim Butler, Safety Officer	806-347-2189	512-971-3185

District Shop 940-937-7166 **District Lab** 940-937-7161

Attachment A

Section 3

Attachment B: Neighboring Districts Contact List

Lubbock District Emergency Contact List

County or Office	Employee	Cell Phone Number	Office Number 8 AM - 5PM
District Engineer	Doug Eichorst	806-790-5005	806-748-4420
Safety	Christy McMeans	806-773-6608	806-748-4352
Public Information	Dianah Ascencio	806-790-2816	806-748-4472
Districtwide Emergencies	Ted Moore	806-773-0660	806-748-4432
Floyd County	Douglas Campbell	806-281-4996	806-983-3320
Crosby County	David Barrera	806-773-0680	806-253-2575
Swisher County	Michael James	806-627-7131	806-995-3009
District Equipment Shop	Kelly Roberts	806-773-0640	806-748-4456
Regional Fleet Manager	Joe Wilkerson	806-543-8437	806-748-4597
Regional Purchasing	Kenneth Wood	806-470-5812	806-748-4580

Amarillo District Emergency List

County or Office	Employee	Cell Phone Number	Office Number 8 AM - 5PM
District Engineer	Howard Holland	806-681-3025	806-356-3201
Safety	Tracy Byrd	806-654-1706	806-356-3279
Public Information	Paul Braun	806-570-6301	806-356-3256
District Maint Engineer	Mike Taylor	806-681-3021	806-356-3270
Armstrong County	Billy Hester	806-681-5949	806-226-2321
Carson/Grey County	Robert Hollingsworth	806-681-5959	806-248-7555
Hemphill County	Mark Dorris	806-217-0318	806-323-6781
District Equipment Shop	Bobby Pulliam	806-681-3032	806-356-3324

Abilene District Emergency List

County or Office	Employee	Cell Phone Number	Office Number 8 AM - 5PM
District Engineer	Laren Garduno	325-370-9572	325-676-6801
Safety	Steve Batko	325-671-3349	325-676-6845
Public Information	Mary Beth Kilgore	N/A	325-676-6806
District Maint Engineer	Brian Crawford	325-725-1093	325-676-6803
Haskell County	Chris Medford	325-725-9935	940-864-8521
Kent County	Paul Martinez	325-725-9959	806-237-2493
Stonewall County	Glover Miller	325-725-9946	940-989-3557
District Equipment Shop	Roy Isom	325-668-8422	325-676-6881

Wichita Falls District Emergency List

County or Office	Employee	Cell Phone Number	Office Number 8 AM - 5PM
District Engineer	Larry Tegmyer	940-867-2222	940-720-7790
Safety	Larry Gulley	940-867-2234	940-720-7729
Public Information	Adele Lewis	940-642-3177	940-720-7728
District Maint Engineer	Tim Hertel	940-867-2216	940-720-7721
Wilbarger County	Billy Taylor	940-839-5964	940-538-6561
Baylor	Shan Slaggle	940-867-8993	940-888-2797
District Equipment Shop	Curtis Jordan	866-638-7903	940-720-7786

Oklahoma DOT Emergency List

County or Office	Employee	Cell Phone Number	Office Number 8 AM - 5PM
District Engineer	Brent Almquist	580-445-1002	580-323-1431
District Maint Engineer	Kevin Kehoe	580-445-1003	580-323-1431
Beckham County Supv	Cody Howell	580-445-1142	580-928-3120
Harmon County Supv	Steve Page	580-471-3027	580-688-2600
Jackson County Supv	Geoffrey Harrington	580-471-1629	580-482-7658

Attachment B

Childress District County Judges

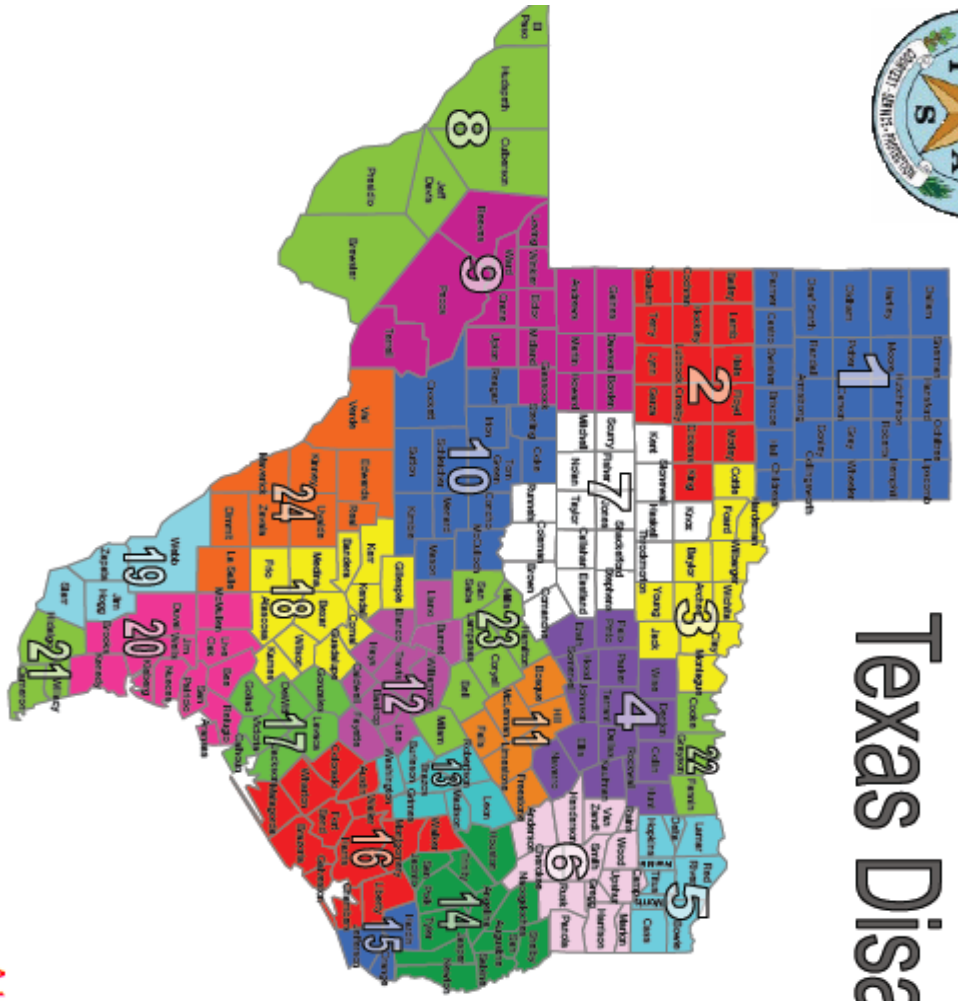
County or Office	Judge	Cell Phone Number	Office Number 8 AM - 5PM
Briscoe	Wayne Nance	806-847-7442	806-823-2131
Childress	Jay Mayden	940-674-5202	940-937-2221
Collingsworth	John James	806-205-0994	806-447-5408
Cottle	D.N. Gregory	806-681-6267	806-492-3613
Dickens	Lesa Arnold	806-789-4555	806-623-5532
Donley	Jack Hall	806-570-6140	806-874-3625
Foard	Mark Christopher	940-655-4175	940-684-1424
Hall	Ray Powell	940-585-1414	806-259-2511
Hardeman	Ronald Ingram	940-839-8356	940-663-2911
King	Duane Danie	806-346-2272	806-596-4411
Knox	Travis Floud	940-256-3422	940-459-2191
Motley	Ed D. Smith	806-269-0251	806-347-2334
Wheeler	Jerry Hefley	806-662-5014	806-826-5961

Dept of Public Safety

County or Office	Employee	Cell Phone Number	Office Number 8 AM - 5PM
Sgt-Collingsworth, Childress, Hall, Wheeler	Kirby Lambert	940-585-8338	940-937-2548
Sgt-Donley, Briscoe	Ronald Ward	806-205-1651	806-874-3825
Sgt-Knox	Jodi Tullos	325-668-9896	940-864-3356
Sgt-Cottle, Hardeman, Foard	Clay Conner	940-249-0504	940-552-2571
Sgt-Motley, Dickens, King	Ruben Garcia	N/A	806-675-2131
Amarillo Regional Laison	David Solis	806-517-0581	806-468-1414

Section 4

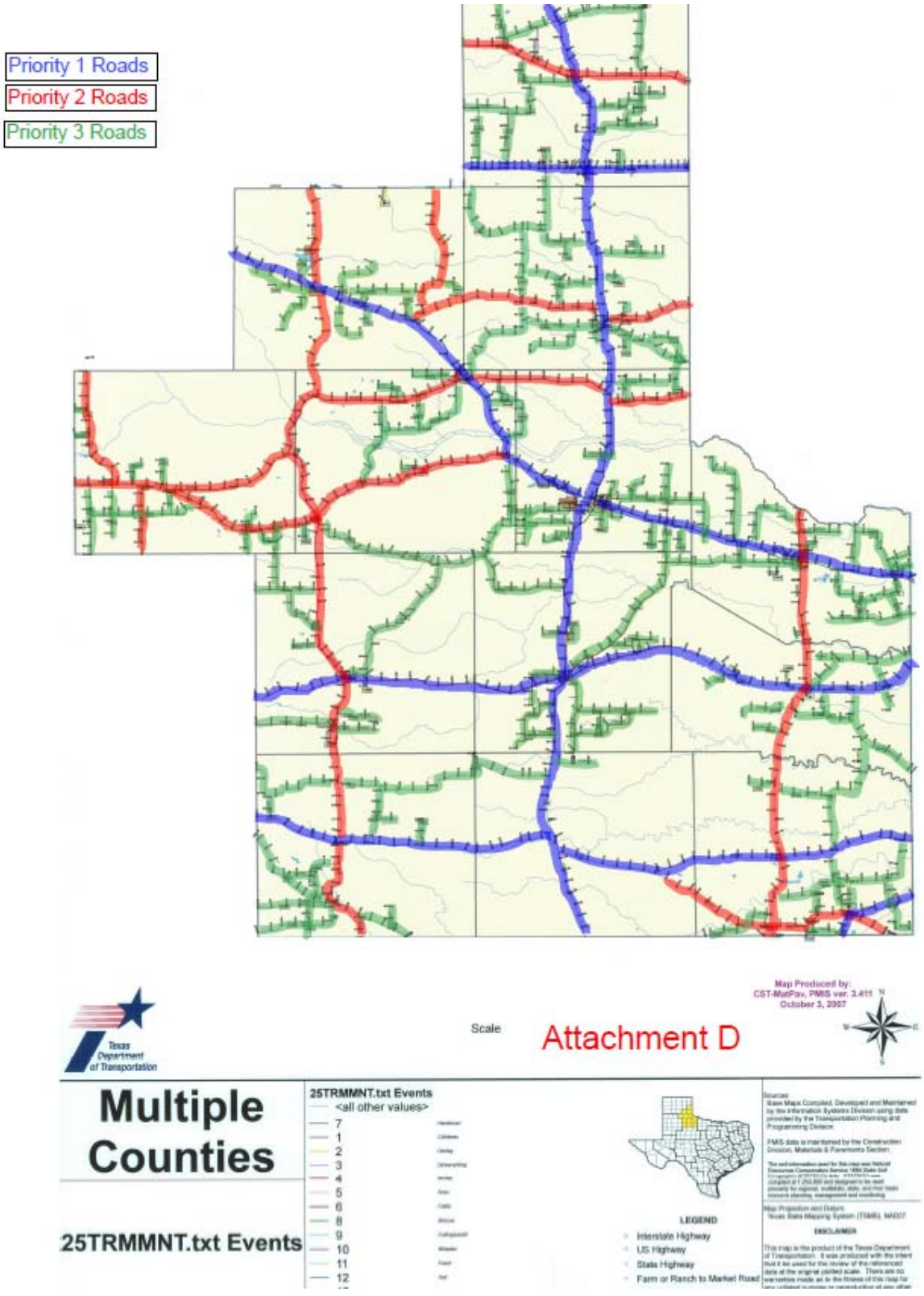
Attachment C: Texas Disaster Districts



	Station	DDC Chair	Phone
1	Amarillo	Capt. Richard Degelman	806-468-1310
2	Lubbock	Capt. Bill Schneider	806-472-2710
3	Wichita Falls	Lt. Alan Troup	940-851-5521
4	Garland	Capt. Michael Lathan	214-861-2155
5	Mount Reasant	Lt. Kevin Wood	903-572-3616
6	Tyler	Capt. Audra Livingston	903-939-6031
7	Abilene	Capt. Douglas Farber	325-795-4020
8	El Paso	Lt. Luis Najera	915-849-4002
9	Midland	Capt. Kevin Napier	432-498-2141
10	San Angelo	Lt. Jason Hester	325-223-6711
11	Waco	Capt. Larry Allen	254-759-7160
12	Austin	Capt. Raul Vargas	512-475-4820
13	Bryan	Capt. Dwight Mathis	979-776-3182
14	Lufkin	Lt. Roy Owens	936-699-7302
15	Beaumont	Capt. Michael Bradberry	409-924-5422
16	Houston		281-517-1217
	Hou (Conroe)	Capt. Patrick Mulligan	936-442-2807
17	Victoria	Lt. Glen Garrett	361-578-3495
18	San Antonio	Capt. Casey Goetz	210-531-2204
19	Laredo	Capt. Mario Lopez	956-728-2282
20	Corpus Christi	Capt. Rhonda Lawson	361-888-5672
21	McAllen	Capt. Juan Rodriguez	956-984-5808
22	Gar (Sherman)	Capt. James Spencer	214-881-9870
23	Waco	Capt. Kenneth Plunk	254-759-7167
24	Del Rio	Lt. James Dreyer	936-442-2811

Section 5

Attachment D: Map of Prioritized Roads



Section 6

Attachment E: District Equipment List

Equip List Aug 2010.xls

Section		3/4 Ton PU	Truck, 10 CY	Truck, 6 CY	Snow Plow, 10 ft	Snow Blower	Maintainer, Cl II	Maintainer, Cl III	Maintainer, Cl IV
1	Childress	1	2	4	6	1			1
2	Donley	1	3	3	7				1
3	Dickens	2	3	5	8			1	1
4	Motley	1	2	5	6				1
5	Knox	1	1	4	5				1
6	Cottle	2	1	5	6		1		
7	Hardeman	1	2	4	6				1
8	Briscoe	2	1	5	6			1	
9	Collingsworth	1	1	5	6		1		
10	Wheeler	1	3	4	7	1		1	1
11	Foard	1	1	4	5				1
12	Hall	1	2	3	6			1	1
	Mnt Support	1						1	
	Shop/Etc	1			2			1	
	Totals	**17**	**22**	**51**	**76**	**2**	**2**	**6**	**9**

Equip List Aug 2010.xls

Section		Loader, 2 CY	Loader, 2-3 CY	Chg Mess Sign	Equip Trailer, 3 Ton	Transport Trailer
1	Childress		2	1	1	1
2	Donley	1	1	1	1	1
3	Dickens	3			1	2
4	Motley	1	1		1	1
5	Knox	2			1	1
6	Cottle	1	1		1	1
7	Hardeman	1	1	1	1	1
8	Briscoe	2			1	1
9	Collingsworth	1	1		1	1
10	Wheeler	1	1	1	1	1
11	Foard		2		1	1
12	Hall	1	1	1	1	1
	Mnt Support	1				1
	Shop/Etc					1
	Totals	**15**	**11**	**5**	**12**	**15**

Section 7

Attachment F: Use of Non-CDL Drivers for Patrolling

Snow and ice events are unpredictable and vary in duration, severity, and location. During the snow and ice events, Commercial Drivers License (CDL) operators are needed to operate snowplows, motor graders, front end loaders and other heavy equipment. Employees are allowed to work 16 continuous hours before mandatory rest periods are initiated. Due to the unpredictable nature of these events, valuable working hours are lost using CDL operators to patrol highways prior to the event and during the event.

This plan provides for the proper procedures for using Non-Maintenance personnel for patrols before and during snow and ice events.

A. Supervisors Responsibilities

- Supervisor calls EOC and requests number of patrollers needed.
- EOC contacts patrollers and assigns them to a Maintenance Supervisor.
- EOC contacts Maintenance Supervisor and informs him who is coming and the estimated time of arrival.
- Maintenance Supervisor and patrollers will meet at designated warehouse.
- Maintenance Supervisor will provide a map of the county with highlighted areas (hot spots) that need to be patrolled with hot spots being patrolled more frequently.
- Maintenance Supervisor will provide patrollers with any additional information needed, i.e., who to notify when icy conditions are detected

B. Patrollers Responsibilities

Be prepared to assist in the event of snow and ice.

- After EOC contact, report to your designated location and inform EOC of your arrival
- Receive keys to a vehicle assigned to you by the EOC.

Before you depart, check gasoline and gather the equipment bag. The equipment bag should include the following tools:

- 1-1/2 ton jack
- 4 way lug wrench
- Flashlight (Maglite) with additional batteries
- Flag
- Tow Rope
- Shovel
- Bags of salt (ballast, etc.)
- De-icer
- Gloves
- Hitches for all Patrol vehicles

- Provide EOC with the route and estimated time of arrival you are taking to.
- Report to the designated Maintenance Supervisor.
- Upon arrival, inform EOC of your arrival at the Maintenance Section.
- Meet with Maintenance Supervisor to receive county maps with locations needing to be patrolled. (Hot spots should be highlighted).

C. EOC Responsibilities

- Contact patrollers and assign them to a Maintenance Supervisor.
- Inform Maintenance Supervisors of patroller(s) name(s), route taking to location and estimated time of arrival.
- Provide vehicle (gassed and ready to go) to patrollers.
- Provide fully stocked equipment bag.

Section 8

Attachment G: Policy for Personal Cell Phone Use

Personal Cell Phone Use and Possible Reimbursement

With regard to TxDOT business calls made using personal cell phones, employees may be reimbursed for such calls only if the following are all true:

- The calls were for official TxDOT business.
- The employee **incurred costs by making the business calls.**
- The employee's supervisor and management approve the claim for reimbursement (following normal reimbursement procedures of the involved D/D/O).

A cell phone contract fee structure generally provides for a specific number of minutes of airtime (included minutes) for a fixed monthly rate plus a rate per minute for airtime in excess of those minutes. If the total minutes of airtime used are equal to or less than the included minutes, the owner of the contract pays that fixed amount regardless of the number of calls, length of calls, or purpose of calls. Therefore, if TxDOT calls were made, but all calls (both TxDOT and personal) were within the included minutes, no calls are reimbursable. TxDOT may not pay or reimburse an employee for an expense unless the employee has incurred the expense.

However, if TxDOT calls result in additional costs, those additional costs are reimbursable. TxDOT calls that are outside of the included minutes are reimbursable because there will be a specific cost related to each call. TxDOT calls made within the included minutes are also reimbursable to the extent those calls caused personal calls to be over the included minutes. A reimbursement for TxDOT calls made within the included minutes may not exceed the number of minutes that personal calls exceeded the included minutes.

A claim for reimbursement may be submitted to the appropriate accounting office for payment (district or FIN) on a Billing Statement (Form 132). A copy of the phone bill detailing the business costs incurred must be attached to the billing statement. See the table and examples on the attached pages for more information about what is reimbursable and about the reimbursement process.

<u>How to Submit a Claim for Reimbursement from TxDOT:</u>

A claim for reimbursement must be submitted on a Billing Statement (Form 132) using Object of Expense 856, Reimbursement for Business Use of Personal Phone. (Do not submit claims for cell phone use on a Travel Expense Account.) Claims for reimbursements for telephone calls of any kind (cell phone, long distance, hotel, etc.) are to be reviewed by an employee's supervisor and possibly others in the responsible D/D/O in the same manner as any other reimbursement claim in that D/D/O. A copy of the entire bill with the TxDOT business calls identified must be included with a request for reimbursement.

Cell Phone Use by TxDOT Employees
What Is and What Is not Reimbursable

Service of	Description of Call	Description of Reimbursement
Employee	**All calls are within the included minutes** of the contract (both TxDOT and personal).	Airtime is **not reimbursable**, but long distance and roaming charges specifically related to the TxDOT calls are reimbursable. **(See Example A)**
	All **TxDOT calls are outside of the included minutes.**	Airtime **is reimbursable** for the airtime charges shown on the bill plus long distance and roaming charges, if applicable. **(See Example B)**
	Some or all of the TxDOT calls were made within the included minutes, but total calls for the period exceeded the included minutes.	Airtime **is reimbursable** for the airtime of the TxDOT calls to the extent that those calls caused the included minutes to be exceeded. The reimbursement rate per minute will be the same as the rate per minute charged on the calls that were outside the included minutes. Reimbursement for airtime may not exceed the total charge for minutes used in excess of the included minutes. **(See Example C)**
TxDOT	Personal calls are within the included minutes of the contract.	Employee will pay TxDOT for airtime at 25 cents per minute for airtime plus long distance and roaming charges, if applicable.
	Personal calls are outside of the included minutes, and TxDOT's bill shows separate charges for the calls.	Employee will reimburse TxDOT for the airtime shown for the calls plus any applicable long distance and roaming charges.

Section 9

Attachment H: Storm Database Information

Location: Amarillo SharePoint Site

Information Requested:

- Date/Time.
- Is Salting Underway?
- Is Plowing Underway/
- Is HCRS Updated/
- Condition of Road/
- Accumulation, if any.
- Number Employees Working.
- Number Plows Working.
- Number of Snow Blowers Working.
- Number of Spreaders Working.
- Number of Maintainers Working.
- Message Sign being Used.
- Number of Accidents.

Most of the above fields have drop down menu choices. This database should be updated at the storm's onset, plus three times each day throughout the storm: 5:00 am, 10:00 am, and 4:00 pm.