SOUTH DAKOTA WINTER HIGHWAY MAINTENANCE PLAN 2015-2016

Prepared by

SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION
PIERRE, SOUTH DAKOTA

Website: http://www.sddot.com

DIRECTOR OF OPERATIONS
Greg Fuller, PE

CONSTRUCTION AND MAINTENANCE ENGINEER
Jason Humphrey, PE

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Chapter 1. General Information

Introduction

Snow and ice control is one of the most important roadway maintenance activities performed by the South Dakota Department of Transportation (DOT). Because of the impact to public safety and mobility, special attention needs to be given to coordinating the statewide Winter Highway Maintenance Plan.

This Winter Highway Maintenance Plan provides a written account of how certain activities are performed and is intended to serve only as a guide to assist staff in performing their functions. When appropriate, there may be deviations from these written procedures due to changes in personnel, policies, interpretations, law, or evolution of the plan.

Winter storms significantly impact South Dakota costing millions of dollars every year in removal efforts, increased transportations costs, lost productivity, increased travel time, fuel consumption and accidents. The purpose of this manual is to provide a resource that provides answers and options in the effort to keep South Dakota's Highways open and safe during the winter season.

This manual covers a wide range of topics: administration and management issues, personnel issues, equipment, snow and ice control materials, weather information systems, storm operations, and miscellaneous issues such as training aids and reports.

Climate and Weather

The most important factor influencing snow and ice removal is the weather. Because of South Dakota's geographic location there are considerable variations in winter weather events between the western and eastern parts of the state.

The Black Hills have considerably different weather than experienced by Aberdeen or

Sioux Falls. The southern Hills can experience significantly different winter events than the northern Hills. Figure 1 shows the annual snow amounts, in inches, across the state.

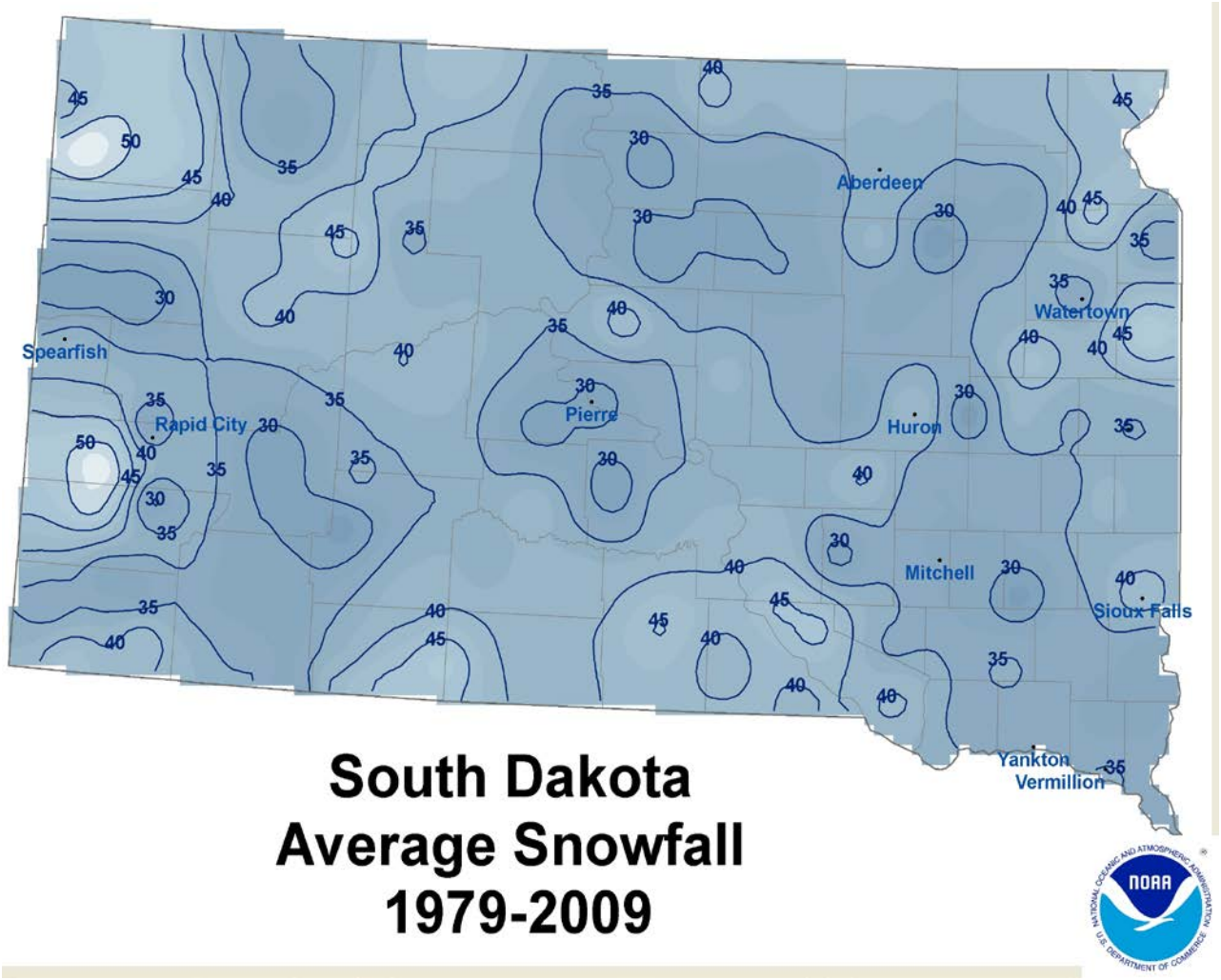


Figure 1

Objectives of Snow and Ice Control Programs

The Winter Highway Maintenance Plan establishes guidelines for achieving the Department's goals and objectives in snow and ice control. Effective snow and ice removal requires a concentrated and coordinated effort from all parts of SDDOT's organization.

SDDOT's number one winter maintenance priority is snow and ice removal. SDDOT will utilize all available resources to strive to obtain the following goals:

- Maximize mobility of the traveling public
- Minimize accidents due to winter traveling conditions

The proposed policies in this manual are practical and achievable. All employees involved in the snow and ice removal effort need to know and understand these policies and guidelines.

Normal Winter Maintenance Hours

In general, our snowplows make their rounds as often as practical provided that the conditions are safe enough for our crews to be out. On an interstate or other major route, this can be as often as every couple of hours. The air temperature, roadway temperature, precipitation rate and type, wind, and storm duration are all factors that contribute to the time it takes for our plows to make their rounds.

These same factors determine the effectiveness of salt and other de-icing chemicals used to combat snow and ice. As temperatures fall, the effectiveness of the salt and de-icing chemicals declines and it takes longer to melt the snow and ice. In severely cold temperatures, these materials may not work at all. Our plow operators adjust the amount of the materials placed and the timing of their application to be as effective as possible.

During a storm and when conditions are safe enough for our plows to be out, plows generally operate from 5:00am to 7:00pm. Winter maintenance outside of these hours may be performed when necessary and practical. Routine extended hours winter maintenance is also performed on some of the more highly traveled routes around the metropolitan areas of Sioux Falls and Rapid City.

Objective

The Winter Highway Maintenance Plan sets guidelines for the coordination of snow and ice control efforts done by the Department's Region and Area Offices and aids them in performing these duties in an efficient and effective manner.

Communication

A line of communication statewide between DOT offices and shops, and between the DOT and the Highway Patrol is vital to carrying out a consistent level of service. It is encouraged that all concerned keep the lines of communication open to meet the plan objective.

Road Condition Reporting

The Integrated Road Information System (IRIS) is a computerized system used to describe road conditions. Information input into IRIS is automatically used to update 511 and SafeTravelUSA, described in greater detail later in this plan. IRIS will be updated using maintenance forces. Women prison inmates in Pierre will be available from 4 am to 8 pm, 7 days a week to assist with IRIS when needed.

Reports are issued to the National Oceanic and Atmospheric Administration (NOAA), law enforcement, the DOT web site and e-mail subscribers every hour, if changes have occurred during the previous hour. Standard report times are 7:00 a.m., 11:00 a.m. and 4:00 p.m., even if conditions are unchanged. All times are Central Daylight or Standard, as applicable. NOAA packages our road condition report with forecast information and puts it on the wire, where the media picks up the information.

Reporting By Maintenance Units

- Road conditions will be updated a minimum of three times a day Monday through Friday -- before 7:00 am; between 11:00 am and 1:00 pm; and between 4:00 pm and 7:00 pm. These updates are initiated by the maintenance worker updating IRIS.
- Road conditions on Saturday, Sunday and Holidays will be updated twice a day – once before 9:00 am; and once between 4:00 pm and 7:00 pm.
- As road and weather conditions change, IRIS will be updated to reflect the current conditions.
- At a minimum, each unit shall have one person assigned to report weekend road conditions. Additional personnel may be assigned if necessary due to geographic size of the unit, forecasted weather conditions or other factors.

Social Media Outlets

The South Dakota Department of Transportation has a presence on Facebook and Twitter. These media outlets will offer official DOT information on severe road conditions. In addition, the DOT also has a road reporting medium called ClearPath 511 to help notify the public of adverse road conditions. ClearPath511 is a free subscription service that will allow users to receive e-mail or text messages for major events on routes or route segments they specify. Major events include road closures, road blockages, no travel advised, and flooding.

Highway Patrol Coordination

Area Engineers, Region Engineers and staff should meet with the Highway Patrol District personnel before the winter season to discuss procedures for accidents, call outs, closures, the exchange of contact numbers, dynamic message sign use, etc. A good working relationship between the DOT and HP should be established and maintained.

Highway Patrol contacts:

	Office	Fax
Pierre (Headquarters)	(605) 773-3105	(605) 773-6046
Aberdeen:	(605) 626-2286	(605) 626-2662
Sioux Falls:	(605) 367-5700	(605) 367-5705
Rapid City:	(605) 394-2286	(605) 394-5483

Motor Carrier contacts:

Port of Entry	Office	Fax
Pierre (Headquarters):	(605) 773-4578	(605) 773-7144
Jefferson:	(605) 356-0124	(605) 356-0126
Sioux Falls:	(605) 757-6406	(605) 757-6407
Sisseton:	(605) 698-3925	(605) 698-7665
Tilford:	(605) 347-2671	(605) 347-0072

Interstate and Road Closures and Openings

SDCL 31-4-14.1 grants the SDDOT Region Engineers and Highway Patrol Captains, through their respective Department Secretaries and with approval from the Governor or his designee, authority to restrict traffic on, or to close, a section of a State Trunk highway. The procedure to carry out the closure is detailed in DOT Policy OS-OM-6.0 and displayed as an attachment to this plan. {SDCL 31-4-14.2 allows closures or restricted use notices to be accomplished in generally available media outlets. SDCL 31-4-14.3 provides for civil penalties for rescue of persons in violation of this statue in amounts of $1000 - $10,000}.

Although not addressed in Policy OS-OM-6.0, considerable attention to details and communication within DOT and between DOT and the Highway Patrol needs to be done prior to opening each segment of highway. It is crucial that a stretch of highway is not opened, only to have traffic run into another closed section a few miles later.

Closures

Interstate closures will be done by predetermined segments from population center to population center. This is being done so as not to strand motorists at rural locations. When a determination has been made to close a segment of the Interstate, one of the first public notices of the closure should be a message on the fixed Dynamic Message Signs (DMS). The Region Engineer or his designee will be responsible for placing the appropriate message on the appropriate signs and contacting DOT personnel at the Emergency Operations Center (EOC), if it's been activated, regarding the use of the DMS. When closures need to be coordinated with or communicated to bordering states or other Regions, the Region Engineer will make these contacts.

The Region Engineer will also ensure that 511 and IRIS are updated with information regarding the closures. The Region Engineer will have on hand phone numbers of local community emergency contacts and be responsible for advising the emergency contacts of pending closures. These contacts should be given as much advanced notice as possible so they can make adequate arrangements to accommodate the motel overflow of stranded motorists.

In general, the message boards immediately adjacent to each end of the closed segment will be used to notify motorists of the closure. Additional boards may be used as warranted by the Region Engineer to further warn or advise motorists. For example, if the Interstate is being closed from Wall to Murdo, the DMS boards at Wall and Murdo should be activated. The DMS boards at Rapid City and Chamberlain should also have a message posted regarding this closure if they are not being used to warn motorists of other local conditions.

A typical message for an interstate closure would be:

I90 CLOSED	CALL 511
WALL TO MURDO	FOR INFO

The Region Engineer will determine if portable message signs or other contact methods are needed on interstate access roads. They will determine the timing, location, and duration of the contact and advise the DOT EOC person of the same.

While the roadway is in the process of being closed, or just after the roadway has been closed, the DOT and Highway Patrol typically performs a sweep of the closed roadway to ensure that there are no remaining motorists on the roadway.

New road closure signs and gates were installed in 2011 and 2012 to help facilitate interstate closures. These new "drop down" style gates will facilitate a much faster and safer closure process. By the winter of 2012-2013, all of the planned road closure gates were installed at key interstate entrances.

Openings

Opening the interstate perhaps takes a more coordinated effort than closing the interstate. It is imperative that opening times be accurate and well-coordinated. An expected opening that is delayed causes problems and frustrations with the lines of motorists that assemble at the closure gates. Also, it does little good to open a section of road only to detour traffic off at the next town.

The Region Engineer will be responsible for coordinating the opening of closed road sections with the Highway Patrol and other Region Engineers, county sheriffs, bordering states, etc. The Region Engineer or his designee will be responsible for placement of the proper DMS message and notification of the DOT EOC person of the message. The Region Engineer will also ensure that 511 and IRIS are updated as appropriate.

The Region Engineer will be responsible for the removal of the interstate access road portable message boards and other contacts and notification of the DOT EOC of the same.

Dynamic Message Signs (DMS)

South Dakota has 30 fixed and 43 portable DMS's. The fixed signs are strategically located along the Interstate. A prime factor in determining their locations was to warn motorists of road closures while allowing them the opportunity to exit to a population center with food and lodging.

The DMS Location map, in the attachments at the end of this plan, shows their locations.

Budget

The Department's Winter Maintenance Plan shall be performed in accordance with budgeted amounts in the Department's Maintenance Management System. These amounts are:

Fiscal year 2016

Description	Budgeted Amount DOT Forces
Snow and Ice Control	$ 19,443,710
Contract Snow Removal	$ 77,000
Total	**$ 19,520,710**

Fiscal Year 2015

Description	Budgeted Amount	Actual Used Amount
Snow and Ice Control	$ 19,032,725	$ 15,108,050
Contract Snow Removal	$ 77,000	$ 66,798
Total	**$ 19,109,725**	**$ 15,174,848**

Chapter 2. Administration and Management

Policy Guidance for Program Planning

Policies and guidelines that document the intent, capabilities, and procedures of a snow and ice control program provide an understanding of what can be expected when weather and pavement conditions warrant implementing snow and ice control activities. An effective snow and ice control program includes:

- A set of goals and expectations, including the level of service that should be documented in agency policies and guidelines used as a basis for all planning and snow and ice control operations
- Assignment of priorities for snow and ice control resource allocations and maintenance activities to achieve the established service levels
- Fiscal accountability to the users/providers of funds (elected and appointed officials and the public) to ensure that agencies use labor, equipment and materials efficiently and effectively in achieving the service level goals
- Understanding of legal responsibilities and constraints with respect to snow and ice control
- Protection of the environment through wise use of chemicals and abrasives to minimize the impact on soil, vegetation, water, animals, and the infrastructure
- Education of the public to ensure understanding of the capabilities and limitations of snow and ice control, thus creating a positive relationship and fostering public support
- Willingness to implement changes and innovations to improve operations by adopting technological advances in equipment, chemicals, and methods for improving the overall operation of snow and ice control.

Level of Service (LOS)

Snow and ice control programs establish a level of service that satisfies the customers and is attainable with available budget and resources. LOS refers to operational guidelines establishing maintenance activities associated with the removal of snow and ice from roadways. LOS generally establishes an end-of-storm condition, intermediate stages acceptable while obtaining that condition, or the frequency of snow and ice control maintenance operations. LOS results from an analysis of:

- Agency snow and ice control policy
- Road classifications
- Traffic data
- Maintenance coverage time periods defined for various operations, including clean-up operations
- Equipment types and amounts
- Location of facilities
- Personnel rules and regulations
- Materials used
- Special circumstances and conditions

A level of service is defined as the desired result of services provided. The ultimate result is a driving surface free of snow and ice. SDDOT's interest of practicality and economics, has established intermediate objectives, or levels of service. The intermediate objectives are defined by road classification and describe conditions that are acceptable levels of service. Two levels of road classification have been established with levels of service goals for both during and following an event.

PRIORITY ROUTES

Goal during the event - provide service to remove snow and ice from the pavement surface and shoulders and apply chemicals and abrasives as needed to provide safe passage. The goal of Priority service typically is a cycle time of approximately 2 hours.

Goal after the event – provide service to remove snow and ice in a manner such that the driving surface will be 80% clear of snow and ice within 18 hours.

NON-PRIORITY ROUTES

Goal during the event - Provide service to remove snow and ice from pavement surface and apply chemicals and abrasives as needed to provide safe passage. When possible, final clean-up will be deferred to normal working hours. Non-priority routes are typically serviced approximately every 4 hours as equipment is available.

Goal after the event – provide service to remove snow and ice in a manner such that the driving surface will be 80% clear of snow and ice within 36 hours.

During severe storms or when trucks or drivers are not available to service all routes, service may concentrate on roads with higher classifications due to their higher traffic volumes. However, field supervisors may assign trucks to problem areas regardless of classification.

For example, a Non-priority road might be in danger of becoming impassable while a Priority route is providing adequate service. The trucks assigned to the Priority route can be temporarily assigned to the Non-priority route to relieve the problem.

Clean-up includes plowing and spot use of materials to remove all snow and ice from the driving surface. This work also includes plowing back shoulders, crossovers and approaches, cleaning and opening frozen drains, and equipment clean-up.

Public Information Officer

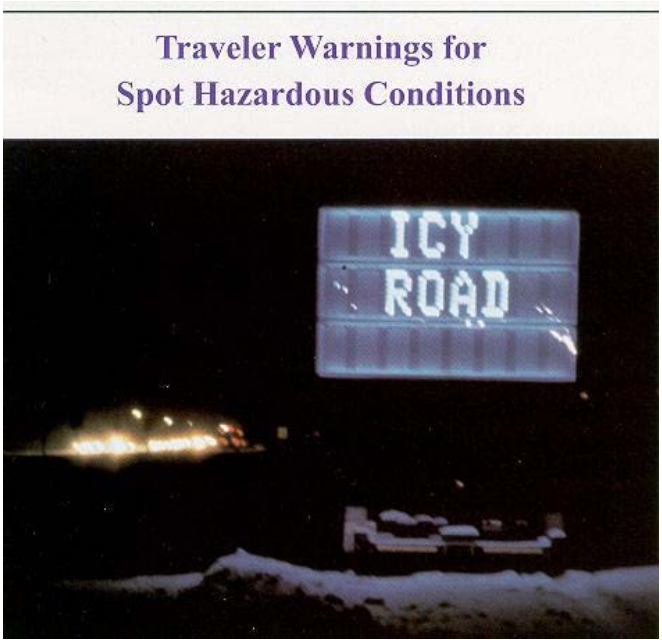
The Public Information Officer (PIO) exists to assist in promoting news of SDDOT's programs and accomplishments. The PIO will prepare news releases regarding winter operations that will be issued statewide or regionally as needed. These releases typically deal with the annual winter storm advisories, sharing the road with snowplows and other releases as conditions warrant.

Cooperation with the media is fundamental to positive public relations. The best approach is to be honest and helpful. In dealing with the media, be cooperative, respond in a timely fashion, never speculate or offer personal opinions. It is always okay to say, "I don't know, but I'll try to help you find out."

Region Engineers, Operations Engineers, Area Engineers, and Traffic Engineers are expected to speak directly with the news media to provide information specific to their areas of responsibility. These Managers may delegate a subordinate to respond on their behalf.

Intelligent Transportation Systems (ITS)

SafeTravelUSA and 511 are South Dakota's intelligent transportation system designed to make driving easier and safer. SDDOT is turning to technology to help improve highway safety. SafeTravelUSA & 511 http://www.SafeTravelUSA.com use technology from a variety of sources as well as human input. The system provides information to the people who need it – drivers, dispatchers, emergency responders, as well as winter operations personnel.



During the winter months, all of the above tools assist Department personnel with keeping roadways operating at the highest possible level of service.

Radio Communications

Radio communication is critical to SDDOT operations – and the winter season is no exception. Radio communication allows:

- Instructions and re-assignments to be communicated to snow plow drivers
- SDDOT managers to stay in contact with snow plow drivers for safety purposes
- Real time road and weather conditions to be communicated between management units
- Timely reporting of accidents so that South Dakota Highway Patrol, towing services, or emergency services may be notified

SDDOT's radio network is composed of base units located at the Region and Area offices and local shops, mobile units in management vehicles and snowplows, and handhelds. State Radio operates 24 hours/day year round.

Snowplow drivers should perform routine checks of basic radio features at the beginning of each shift. Basic features include the antenna, mic cord, channel, and power (fuse). If any problems are noted, a repair appointment should be scheduled right away. A back-up radio or a handheld should be utilized until repairs are completed.

Liability and Risk Management

Vehicle accident, incident, unsafe condition, property damage or loss reporting and general liability

Definition of an Accident:

Accidents are caused by unsafe acts and unsafe conditions or a combination of both. Investigation, analysis and interpretation of the facts surrounding accidents are used to help prevent similar accidents from happening again.

All accidents or occurrences in connection with the Department of Transportation, organizations, operations or equipment will be categorized in one of the following ways:

1. Vehicle Accidents - Accidents occurring in which damage is caused to or by a Department of Transportation owned vehicle. Use the State Vehicle Accident Report Form for licensed vehicles. Use the Report of Accident, Incident, or Unsafe Condition Report Form for unlicensed equipment. The employee involved in the accident should sign and date as Reported By. The employee's supervisor should sign and date as Authorized Agency Signature.

   State employees using rental vehicles on official State business are covered by Public Entity Pool for Liability (PEPL); however, this coverage is not in effect should the use of the rental car be extended for personal reasons.

2. Property Damage or Loss - Those accidents occurring in which damage to or by any Department owned piece of equipment (other than a vehicle as defined by the vehicle insurance policy), privately owned equipment, or tools rented or used for Department purposes as well as fires, and other mishaps which cause damage to Department owned property. Use DOT-307.

3. Personal Injuries - Personal injury accidents in which any bodily injury is inflicted on a Department of Transportation employee in the course of his employment. Use DOL-LM101 (Revised 06/03/2003) Employer's First Report of Injury Form.

4. PEPL - Occurrences which may include an accident, injury or loss, to any person, in which there is a possibility that an employee of the Department of Transportation or a DOT operation may be connected in any way. Use Report of Accident, Incident, or Unsafe Condition (Non-Automobile) Form.

<u>Involved in an Accident</u>:

If you are behind the wheel of a vehicle that comes in contact with another vehicle, pedestrian or object, you are involved in an accident.

If you are driving a vehicle and cause or contribute to a crash by another vehicle you are involved in an accident, even though there is no physical contact with your vehicle. For example, if you pass a car and force it off the road, you are involved in an accident. Being involved in an accident has nothing to do with your causing it. This type of an occurrence must be reported to alert our insurance company, PEPL to the fact a liability situation may exist. It is up to each individual to make sure the proper forms are filled out and submitted for each accident involved.

Do not make any statement to anyone that you were at fault or liable for the accident.

Reporting Accidents:

All vehicle accidents, personal injuries and liability occurrences, as previously defined, must be reported in writing. In addition to the need to report accidents and/or injuries for insurance coverage purposes, these reports are used to determine causes, eliminate the hazards and prevent accidents from reoccurring.

All reports must be filled out accurately, completely and promptly after the accident and/or injury. If exact damage loss or personal injuries cannot be determined soon after the accident, fill in the best estimate of this information that is available and submit the report. This information can be corrected later by memorandum.

All supervisors are responsible to see that employees working under their supervision understand the obligations and the reasons for filling out accident, injury and liability reports. Employees should be aware that there might not be workers compensation coverage on unreported accidents and/or injuries.

All accidents should be reported on the same shift as the accident occurred.

Employees who fail to report accidents or other property damage or loss within the limits established, shall be subject to disciplinary action as provided by the Department of Transportation Safety Guidelines or Bureau of Personnel Rules and Regulations.

Post Accident Testing

Federal drug testing laws require tests to be conducted after certain accidents where an employee is operating a commercial motor vehicle. The following criteria is used to determine if a post-accident test is required:

1. Testing is required if the accident involves a fatality;
2. Testing is required if the DOT driver receives a citation, or is likely to receive a citation, for a moving violation arising from the accident. In addition to the citation, the accident must also involve one of the two following things to require testing:
   A. Bodily injury resulted where someone receives medical treatment away from the scene of the accident; or
   B. Any vehicle involved in the accident is damaged to the point of requiring towing.

Refer to the State Policy on CDL Drug and Alcohol Testing Handbook for specific information on the program. This handbook is available through the SDDOT Human Resource Office.

Accident Investigations:

Supervisors will seek out the facts contributing to accidents and/or injuries occurring within their group, determine the underlying causes of these accidents, and take the actions necessary to prevent the occurrence of similar accidents and/or injuries. It is the supervisor's responsibility to fill out the proper forms within three business days and to conduct a thorough accident investigation in a timely manner. A copy of the DOT Accident Investigation Form is to be forwarded to the Department of Transportation Safety Coordinator and the Region Safety Committee Chairman prior to the next scheduled Safety Committee meeting.

Steps to perform an Accident Investigation:

All accidents should be investigated regardless of severity of injury or amount of property damage. The extent of the investigation depends on the outcome or

potential outcome of the accident. An accident involving only first aid or minor property damage does not have to be investigated as thoroughly as one resulting in death or extensive property damage; that is, unless the potential outcome could have been disabling injury or death. The individual with primary responsibility to complete the accident investigation is the immediate supervisor of the individual involved in the accident. Depending on the severity of the accident, the supervisor may require assistance from other sources such as the Safety Coordinator, Safety Committee Chairman, Region or Area Engineer, Central Office staff, outside safety professionals, etc. These individuals will act as advisers to the supervisor on accident investigations. The Safety Coordinator and Safety Committee shall review the supervisor's findings and the adequacy of his or her investigation.

Supervisors shall use the DOT Accident Form Quick Reference Chart and the DOT Accident Investigation Form as a guide when conducting an accident investigation. The amount of information gathered and documented in each step will depend on the severity of the incident. Accident investigation shall begin immediately. In the case of a very serious accident involving a private party that is transported away from an accident site by ambulance, supervisors shall only complete Step One on the DOT Accident Investigation Form. Photographs taken at an accident site shall remain in the supervisor's possession and shall not be copied without the permission of the DOT Safety Coordinator, Office of Risk Management (605) 773 - 5879 or Claims Associates Phone 1 - 888 - 430 - 2249 .

1) Gather all information and determine the facts.

When any accident, injury or safety related incident occurs, the supervisor shall conduct an in-depth investigation to collect all the facts related to the accident or incident. The investigation shall include the employee involved in the accident and employees or individuals that have involvement in or knowledge of the accident. These interviews should be done separately. In many instances the supervisor and the employee involved in the accident will need to visit the accident scene. When conducting an accident

investigation step back and look at the overall picture. Document only the facts and initial observations. Photographs or sketches of the accident scene may be used. If equipment is involved all maintenance should be reviewed. Safety guidelines, policies and procedures shall be reviewed. Facts gathered during the accident investigation will determine whether the accident was Preventable or Non-Preventable. If, at the conclusion of the investigation, it is determined that an employee's actions constitute a safety violation, further action will be taken according to Department of Transportation Safety Accountability Guidelines. The accident report form should be completed by both the employee involved and the supervisor. Serious accidents may also draw upon the experience of others such as the Safety Coordinator, Safety Committees, Central Office Staff, outside agencies, etc.

2) Determine all the contributing factors.

All accidents are composed of one or more contributing factors. These factors can be broken down into three basic areas - direct causes, indirect causes and basic causes. Direct causes are those that directly caused the accident or injury. An example may be a pickup backing into a post. Indirect causes are those unsafe conditions that are present in the workplace and/or unsafe actions employees perform.

Generally there are more than one or two indirect causes for every accident. An example of an indirect cause may be a cracked mirror causing poor visibility prior to backing into a post. Basic causes are poor management safety policy or procedures, personal factors, or environmental factors. An example of a basic cause may be the employee hurrying to park the pickup and failing to check behind the vehicle for the presence of obstacles, such as the post. The more causes and contributing factors for each accident that can be determined, the greater the likely hood of preventing future accidents. Again, the immediate supervisor will have primary responsibility for determining contributing factors but all who review the investigation report will aid in determining contributing factors.

3) Suggest corrective actions.

After the causes and contributing factors have been determined, each one should be analyzed by the supervisor to determine what, if any, corrective action should be taken. Everyone who is involved with the accident investigation can play a role in suggesting corrective actions with the supervisor making the final decision.

4) Implementation of the corrective actions.

Perhaps the most critical step is implementing the suggested corrective actions. If an accident investigation has been done perfectly up to this point, then no corrective action is taken, then no implementation is done, the accident is doomed to be repeated.

Inquiries about Claimant's Forms:

Contact: Claims Associates, Inc.
PO Box 488
Sioux Falls, SD 57101-0488
Phone: (605) 333-9810
After Business Hours: 1-888-430-2249
FAX: (605) 333-9835

Also, notify Operations Support (605) 773- 3704

For complete information on required forms see "Vehicle Accident, Incident, Unsafe Condition, Property Damage or Loss Reporting, and General Liability" located in the attachments.

Emergency Assignments

At the direction or request of the Secretary and/or Director of Operations via the Region Engineer, persons may be temporarily assigned to other locations anywhere within the state to address the emergency needs of that location. The following is intended to address the likely questions and concerns that may arise before, during, or after such emergency assignments. The following is intended to reflect the provisions and intent of Department Policy or State Policy, and therefore, does not supercede any such policy.

These procedures and guidelines shall apply to emergency situations, including but not limited to a winter storm, flood, or other natural disaster.

(a) Temporary assignments shall be accomplished (1) via a call for volunteers, and (2) via mandatory Overtime procedures. Such assignments shall be determined by the Region Engineer / Area Engineer.

(b) Temporary employees shall work at the direction of the Maintenance Supervisor or other supervisory / management staff at the temporary location. The duration and work schedules during the temporary assignment shall be at the direction of the temporary location's Region or Area Engineer.

(c) Employees on emergency assignments shall utilize state vehicles for any travel associated with the assignment. When employees on emergency assignments are not able to bring a state vehicle for incidental transportation during off-duty periods, the Region or Area that is the temporary location of work should make an effort to furnish a vehicle to that employee. If vehicles are not available, transportation to and from lodging and eating establishments should be arranged.

(d) Region / Area personnel shall arrange lodging and payment from Department funds for the emergency assigned personnel. Whenever possible, costs for lodging will be direct billed to the State. Such costs shall be paid from the temporary locations (Area or Region) budget as a cost of operations for that Region.

(e) Where practical and possible, employees shall be allowed reasonable opportunity to take meals of their choice at their expense with reimbursement in compliance with the State Travel policy.

(f) Upon return from an emergency assignment, each employee may submit a claim for travel reimbursement (i.e. lodging and per diem). Such claim must exclude any amounts for lodging and/or food that were provided without cost to the employee. The 'home' Region or Area will process the reimbursement request, and the costs shall be paid from the temporary location's budget as a cost of operations for that Region.

Chapter 3- Personnel Issues

This chapter covers personnel issues encountered in the winter storm effort. Issues covered include the following: management issues, drug and alcohol issues, safety for road users and crews, preseason issues, personnel transfers, commercial driver's license, and postseason issues.

Personnel Management Issues

The Region shall coordinate winter personnel assignments. It is the Area Engineer's responsibility to call out the right number of people at the right time. The Area Engineer may delegate authority to call out people to another designee.

Drug Free Workplace Policy

The State of South Dakota has a drug free workplace policy for all state employees. As a condition of your employment with the state, you must agree to abide by the terms of this policy.

The dangers of drug abuse in the workplace include accidents and injuries; reduced productivity; absenteeism and increased health care costs; loss of public confidence in the State; and adverse effects on the abuser, family, friends, co-workers, and persons receiving services from the State.

The policy prohibits the unlawful manufacture, dispensation, possession, or use of a controlled substance by an employee in the workplace. If you are convicted of a violation of a criminal drug law or admit in court to a criminal drug law violation, you will be subject to appropriate disciplinary action, which includes termination. You must comply with the arrest policy if you are arrested, charged, or believe you may be charged with any crime involving illegal drugs.

Any employee who has a commercial driver's license (CDL) as a requirement to perform any part of their duties will be subject to drug and alcohol testing. Refer to the State Policy on CDL Drug and Alcohol Testing Handbook for specific information on the program.

Safety for Road Users and Crews

Crew Safety

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

Drivers should be aware of the following:

- Seat belt usage is a requirement (it's also the law)
- Practice defensive driving
- Work in a safe, productive manner and maintain safety awareness at all times
- Properly inspect, maintain and operate assigned vehicles/equipment and report defects
- Handle snow and ice chemicals by the manufacturer's guidelines available in the Safety Data Sheet (SDS) book that should be available at all unit buildings
- Increase the visibility of the lights by cleaning off salt residue and crusted snow and ice regularly
- When stopping at intersections, be sure the plow doesn't extend into the intersection. Begin slowing a distance back from the sign/signal because a loaded plow truck will not stop as easily as an unloaded one.
- Report accidents and injuries immediately
- Complete safety forms as required

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

Public Safety

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

- Being aware of and obeying all traffic laws and avoid making sudden or unannounced moves.
- Avoid pushing snow off of overpasses and into other lanes of traffic.
- Try to avoid throwing materials onto vehicles or pedestrians.

Temporary Personnel Transfers

SDDOT typically needs additional personnel during the winter to augment its maintenance staff to provide required levels of service. To accomplish this, workers from various sections are reassigned to plow snow and do other related duties. SDDOT also hires seasonal and reserve operators to supplement the work force when necessary.

Commercial Driver's License (CDL)

SDDOT requires that specified classifications possess a commercial driver's license valid in the State of South Dakota. A CDL is required at time of employment or must be obtained within 30 days after employment, and is a pre-requisite for operating SDDOT commercial grade equipment. Inability to obtain or maintain a valid CDL will result in termination.

Federal Law mandates that all employees who are required to maintain a commercial driver's license (CDL) to perform their job duties must be subject to drug and alcohol testing. Refer to the State Policy on CDL Drug and Alcohol Testing Handbook for specific information on the program. This handbook is available through the SDDOT Human Resource Office.

Summary

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

Chapter 4 – Equipment

This chapter addresses mobile and special support equipment for snow and ice control, and maintenance.

Mobile Snow and Ice Control Equipment

A variety of mobile snow and ice control equipment is used on a routine basis. The most common types are trucks, plows (front mount, wing, and under-body), sanders, front-end loaders, and anti-icing systems.

The nature and range of tasks the equipment will be performing and the environment in which it will be operating determine selection of appropriate equipment. Snow and ice control operations are the primary function of the equipment. Therefore, the equipment should be designed to perform this difficult function over much of its service life. However, the equipment is used for many non-snow and ice activities, such as hauling equipment and personnel for non-snow and ice control highway maintenance activities. The key to successful equipment utilization is to balance the design so that even the least common tasks can be accomplished adequately. By choosing multipurpose equipment appropriately, an agency can optimize its equipment budget.

The use of attachments is an excellent way to make equipment more versatile. Front plows, "V" plows, wing plows and under-body plows can be attached to trucks. Sanders and anti-icing tanks can be attached to truck beds. Effective use of attachments can be achieved through uniformity and ease of the attachment system from vehicle to vehicle.

Rental / Contractors

Occasionally, SDDOT equipment resources are not sufficient to adequately perform snow and ice removal activities. To supplement SDDOT resources, equipment may be rented (refer to policy DOT-OS-OM-14.0). Snow removal contractors are also utilized to supplement this effort (refer to policy S-2002-02).

Fleet Management Requirements

During the winter season, maintaining snow and ice removal equipment shall be given the highest priority.

Equipment Management System

Preventive maintenance (PM) is essential to the reliable performance of snow and ice removal equipment. As a support system for equipment maintenance, the Department uses an automated Equipment Management System (EMS). This system contains detailed records on all SDDOT fleet equipment and tracks all usage and maintenance costs associated with the equipment. One of its most important components is automated preventive maintenance scheduling.

Preventive Maintenance

EMS contains PM schedules for all vehicles and many other types of equipment. When a previously determined interval is reached, EMS can be used to generate a report for the preventive maintenance to be performed. The scheduled PM activities are most often based on usage intervals such as miles or hours of usage. In addition, the intervals may be based on number of days since the last PM, or on the amount of fuel used.

The preventive maintenance of a piece of equipment is the responsibility of the Maintenance Supervisor, Lead Worker or their designee that the equipment is assigned to. The assigned driver/location should be aware of an approaching PM and schedule it accordingly. The PM should be scheduled at the shop that is responsible for the equipment's maintenance.

If a PM is not performed, a notice will be given to the appropriate personnel to schedule it. The PM must be scheduled within five (5) working days of this notice.

Hour Meters

Hour and mileage readings will be loaded in EMS from an operator's timesheet. This is automatically done twice a month.

Repair of Equipment

The Maintenance Supervisor, Lead Worker or Operator is responsible for equipment repairs. The Maintenance Supervisor, Lead Worker or Operator will be responsible for working with the Shop Foreman to get the needed repairs done on a piece of equipment. The Shop Foreman, Maintenance Supervisor, Lead Worker or Operator shall be responsible for deeming a piece of equipment as "temporarily out of service".

Assignment of Equipment

If possible, each person will be assigned to one vehicle. This person is responsible for reporting all maintenance needs and for keeping the equipment clean. Any person operating that piece of equipment shall complete an inspection before use. The Maintenance Supervisor and Lead Worker are responsible for making sure that reported maintenance needs are performed and equipment is in good working order.

Snow and Ice Inspection of Equipment

Prior to Winter, an inspection by Region/Area personnel should be made of the equipment to ensure it is properly repaired and ready for snow and ice removal. If defects are found, then repairs are to be scheduled. The inspection covers cosmetic items, engine and hydraulic operation, safety equipment in the vehicles, and proper paperwork to be completed.

To ensure consistency, a team at each Region will travel and inspect the same items at each Area. The inspection shall include, but is not limited to: dump trucks, snow plows, sanders, loaders, graders, conveyors, and ground speed control units. Liquid distribution systems, liquid storage systems, temperature sensors, and weather data systems (ESS) may also be inspected. Each dump truck, sander, and snowplow should be inspected. Each Region's Maintenance Coordinator or his or her designee may perform these inspections.

Equipment not ready for snow and ice operations shall be removed from service until it has been repaired. Unsafe equipment shall not be used.

Additional Inspection Requirements

Sanders

All material sanding equipment must be calibrated prior to the winter season with assistance by Region personnel, as needed. Each sanding unit shall be calibrated to provide an accurate rate of application.

Sprayer

Both pre-wetting and anti-icing equipment must be calibrated prior to the winter season to provide accurate application rates.

Temperature Systems

Pavement temperature, not air temperature, is a critical factor in determining whether or not to apply chemicals and if applied, at what rates. SDDOT uses a variety of devices that measure pavement temperatures, but most of them are infrared thermometers. The most common are mounted on the outside of vehicles and others are handheld. To ensure that accurate measurements are obtained, the sensors need to be checked periodically, at a minimum annually. The Region Materials & Tests Section can provide calibrated surface thermometers that give accurate pavement readings. The following process should be used to check the sensors.

1. Determine the known pavement temperature at a designated location with the calibrated thermometer. Wet pavement in the shade at colder temperatures is desirable.
2. Take a reading at the same location with the infrared device.
3. Document the results.

This will provide a conversion factor for a comparison to a known temperature. Expect to have minor variations from true temperatures. Any wide variation may be a reason to discard the device for winter operations use.

Weather Data Systems

Weather Data Systems, commonly known as Environmental Sensing Stations (ESS), can be periodically checked with infrared thermometers. As with the temperature systems, a wet pavement in the shade is better for calibration.

Storm Issues

Pre-Trip Inspection

Prior to any SDDOT vehicle leaving the shop, a pre-trip inspection must be performed in accordance with SDDOT's Safety Manual. Equipment preventive maintenance ensures that vehicles will operate at optimum performance levels and will contribute to the equipment's future durability. Employees are to report any problems to the Maintenance Supervisor.

Maintenance Supervisors inform the Lead Workers or their designee of impending weather and the work crews are then requested to do an initial equipment check, prior to precipitation. That inspection may include: examining plows for wear and damage (especially excessive blade wear propagating into the frog), refueling the trucks if needed and inspecting circuit breaker continuity. The other important piece of equipment to check is the loader. The basic checks such as lights and tires are similar to that of the pre-trip inspection. Checking fuel levels and reserve stores for refueling during the storm event are vital precautions.

Clean-up

The practice of vehicle clean-up is extremely important to the longevity of the equipment. After a storm, employees should unload as much material as possible back on the material stockpile. Then the remaining excess material between the hopper and the bed needs to be shoveled out and returned to the material containment area.

The first available lull in snow activity is the time for more thorough cleaning. If the vehicles cannot be cleaned on site, it is advisable to schedule cleaning and repairs at the same time. That will enable the mechanics to work on clean equipment and produce a faster turnaround time for reuse of the vehicle during a storm event. This eliminates the

need for a particular piece of equipment having to travel to and from the assigned location several times.

During the wash, special attention needs to focus on electrical connections, hydraulic fittings, the suspension, frame rails, brakes and transmission. The radiator requires special attention, and should be rinsed with low-pressured water. While rinsing, the suspension should be checked for damage. This is the optimum time to check the slack adjuster for the brakes. After the entire vehicle has been washed, the windshield, mirrors, and light lenses need to be examined to see if additional cleaning is necessary. Prior to scrubbing, the cab of the truck needs to be cleared of all trash and personal belongings. Anywhere salt may have come in contact with the interior needs cleaning; for example, pedals, sander controls and floor- boards.

Grease all fittings on the plow and sander box and check for wear, damage and adjustment of sander box chains. After washing the loader, special focus needs to be applied to cleaning the interior because of the high concentration of material tracked into the machine. The Maintenance Supervisor and Lead Worker are to be notified by the truck driver of any equipment needing service so that it can be scheduled for repair.

Postseason Issues

Equipment

It is important after the winter season to inspect and repair the snow and ice removal equipment and then store the equipment in a manner that makes it useable for the next winter season. This inspection will identify required cleaning and maintenance; required work shall be completed in a timely manner prior to storage. All equipment shall be thoroughly cleaned to remove all deposits of salt and sand. Special care shall be taken to clean salt from lights and other electrical parts, brakes, and all hydraulic couplings. Storage beds and plows shall be removed and properly stored. Chains and sprockets shall be lubricated. Make sure all ends of hydraulic hoses are covered. Sanders shall be greased as needed. All material handling equipment, including liquid pumps, storage tanks, sander chains and boxes, conveyors, beds, and plows shall be periodically maintained during the off-season as needed.

Chapter 5 – Snow and Ice Control Materials

A variety of materials are utilized by SDDOT for winter operations. Salt, chemicals and abrasives may be utilized individually or in combination given specific weather and road conditions. This chapter provides guidance relative to material acquisition, storage, handling, budget, and inventory. The budget source is discussed for each type of material. These discussions apply to all Regions.

Specifications

Salt Specifications Preparation

Operations Support compiles the specifications for the annual salt bid with input from the Regions. Revisions to the specifications are normally discussed and agreed upon at the Maintenance Standards Panel Meetings. Regions are requested to identify quantities needed for the next fiscal year.

Sodium Chloride (Salt) Specifications

Sodium chloride, typically referred to as salt, is SDDOT's primary snow fighting chemical. SDDOT used over 52,300 tons of salt last season accounting for an expenditure of approximately 3.54 million dollars. Because of these amounts, it is important that the salt used meets various specifications to ensure the highest quality. SDDOT contracts annually with salt vendors. Typically those vendors subcontract delivery and/or loading to other companies, and since each Region administers its contracts individually, there are various ways of communicating and coordinating deliveries. It is important that salt orders are received in a timely, professional manner.

Currently the only approved sodium chloride product is rock salt that conforms with ASTM D 632-01, Type I, Grade I or II specifications. There are minor variations that are contained within the Special Provisions that accompany the actual bid documents. Each Region should have a copy of these. Each Unit is responsible for the acceptance sampling of the salt, but assistance from Area and Region Operations is very important. Notification of salt deliveries as far in advance as possible assists testing personnel in scheduling necessary work.

Salt samples are submitted to independent testing labs where purity, gradation, and moisture tests are run. For any materials that do not meet requirements, adjustments to the unit price of the salt are imposed. Operations Support typically works with the Region to review failures and determine final payments. All of these details are contained in the Special Provisions of the contract.

Liquid Chemical Specifications

SDDOT purchases and uses several liquid chemicals for anti-icing and prewetting, as well as produces its own liquid salt brine. It is important that these are in compliance with required specifications to ensure that they will perform properly. Samples of the liquids may be taken at any time if there is cause for suspicion that something is wrong with them. Contact Operations Support for guidance. The basic tests that are run on the products include:

- Chemical percentages
- Weight per gallon
- pH
- Percent sulfates
- Corrosion Rate
- Settleable Solids
- Environmental limits

Salt brine is an inexpensive, viable chemical to use under certain conditions. Since it is produced "in house" it can readily be sampled and tested to verify its effectiveness. The key factor to check on brine is specific gravity. Normally it is required to have a specific gravity value of 1.18, which is 23.3 % concentration. This optimizes the product with a freeze point of minus 6° F. The test requires a hydrometer that reads in percentage and a cylinder that is filled with a sample of the brine. It is important that test results are well documented in case we need to show evidence of quality control at a future date.

South Dakota also uses over 405,000 gallons of Magnesium Chloride during an average year. At an average bid price for FY 2015 of $1.15/gallon, this will amount to over $465,750.

MgCl is used at 18.00 ppm of magnesium for a range of 28% to 32% brine concentration.

Eutectic Information Table for Various Snow and Ice Chemicals

A chemical that dissolves in water will lower the freezing point of the solution. As more and more of the chemical is added to the water, the freezing point of the solution decreases to a certain level and then begins to increase. The lowest temperature at which the chemical will melt ice (under steady state conditions) is known as the eutectic temperature, and the concentration of the solution (% dissolved solids) at this temperature defines a point of the chemical solution called the eutectic composition. Refer to the attachments for eutectic information. One attachment graphically illustrates the lowest effective working temperature (°F) for each chemical at a given percent of solution, another attachment gives a tabular representation. Both the graphical version and the tabular version can be consulted for making decisions on material use.

Handling and Inventory of Materials

Material Ordering

Salt and chemical supply is critical. Prior to the winter season, each Region evaluates inventories to determine early-fill requirements. Orders are then placed with the appropriate material vendors, specifying the material type, quantity and point of delivery.

Reordering of salt during the winter season is handled similarly with new orders based on material usage obtained from Area salt inventory reports and visual inspections. Lead-time should be considered when placing orders. It is likely that other locations are also trying to replenish materials which could cause delays.

Material Delivery

Material vendors communicate delivery schedules for salt and chemicals to the appropriate Area. The Area makes arrangements for their employees to receive materials. Specified employees are responsible to visually inspect material and delivery trucks; collect delivery tickets; obtain Safety Data Sheets (SDS); and take appropriate storage action.

Storage Facilities

Treated winter sand is stored inside abrasive sheds at most facilities. Leftover winter sand should be relocated in the pile to ensure it's used first during the next snow event.

Liquid chemicals are typically stored in outdoor bulk tanks, although some new prototype storage facilities have indoor tanks. If more than one liquid is maintained at a particular site, care should be taken not to mix incompatible liquids. Liquids require special consideration during the off-season since many require periodic circulation to prevent settlement of solids.

Subsequent Material Handling/Loading

It is a good practice to handle all materials as little as possible. Excessive handling increases the chances of spillage, material degradation, unwanted moisture, and inadvertent injuries.

There are many potential hazards involved in loading. The following guidelines should be considered when working in a loading area:

- Load vehicles on a level surface
- Do not overload trucks
- Load and distribute loads evenly
- Avoid striking the truck, sander box, warning lights or flags
- Never leave a running vehicle unattended
- Keep the loader bucket as low as possible at all times
- Never allow people on the truck or hopper while loading
- Avoid spillage on vehicles
- Clean up after loading
- Do not leave material hanging on the sander

Material Inventory Recording & Reporting

Recording

The accuracy of material recording directly affects our historical data used to plan for future year's material purchasing. If balances are not correctly recorded, inventories will be affected during the storm fighting season and could potentially hamper our snow fighting efforts. It is critical for tonnages to be accurate, so SDDOT personnel continually strive to maintain their records.

Winter Materials Usage Report

SDDOT tracks and maintains data on winter materials used for clearing snow from the roadway. Maintaining a record of materials used is essential for a variety of reasons including; justifying material expenditures and estimating quantities needed in future years.

The materials to be reported include:

- Salt
- Magnesium Chloride
- Agricultural de-icer
- Salt brine
- Other

Chapter 6 – Weather Information Systems

SDDOT utilizes many resources to predict and track winter storms; these include the National Weather Service, Environmental Sensing Stations (ESS), satellite weather images, weather warning service, the internet, television, and other media sources. Good weather information is critical in making timely, effective, and efficient decisions to employ limited and costly resources.

South Dakota Dept. of Transportation & Iteris, Inc. (formerly Meridian Environmental Technology Inc.)

Iteris, Inc. (formerly Meridian Environmental Technology Inc.) is currently providing our weather service on the Internet. This site is for the use of SDDOT employees only. Radar and satellite images, National Weather Service Watches and Warnings, pavement forecasts and warnings are available.

The following weather Information for the State of South Dakota is available from this website:

- Regional Radar
- Regional Observed (this is available within the last 6-hours or past 24-hours)
- National Weather Service Watches & Warnings (this includes Tornado Warnings and Severe Thunderstorm Warnings)
- Winter Operations & Iteris Notices

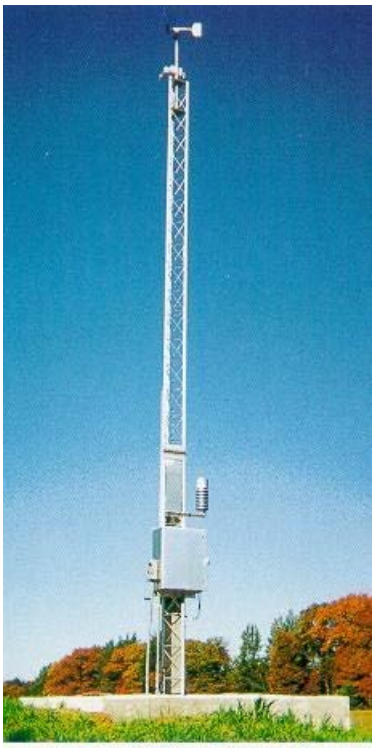
National Weather Information that is available from this website is:

- Observed (this is available within the last 6-hours or past 24-hours)
- Forecast (this includes current surface temps, winds, cloud cover, relative humidity, jet stream, and forecast precipitation.)
- Radar Imagery
- Satellite Imagery

It is strongly recommended that users get familiar with the Iteris site prior to the start of winter weather. Iteris will be available 24-hours a day, seven days a week for technical assistance and weather related questions.

Environmental Sensor Stations (ESS)

The system allows highway maintenance managers to retrieve current data on pavement and weather conditions at bridges and other trouble spots.



Each ESS includes pavement sensors, which measure the temperature of the road surface, determine whether the pavement is wet or dry, and measure the amount of de-icing chemical on the road. Atmospheric sensors that determine air temperature, wind direction and speed, precipitation, and relative humidity. Finally, the sites typically include video cameras that display current road and weather conditions.

Data from these sites is sent to a central computer that maintenance supervisors and lead workers can access to get information on roadway and /or bridge conditions, which is critical for deciding when and where to send the plows or to apply anti-icing and de-icing chemicals.

ESS has helped maintenance crews do a better job of scheduling winter maintenance operations. The timely, site-specific information means crews no longer have to guess when bridge decks require attention. Thus, this should save the State money on equipment, personnel, and materials, and reduces wear on roadway surfaces and bridge decks.

Chapter 7 – Storm Operations

Storm Management

Storm management in the snow and ice control context is a bit of a misnomer. We cannot manage what the storm does – we manage the operational activities in response to the storm with respect to what is predicted, what is occurring, and the after storm conditions. Review of personnel, equipment, materials, weather conditions, and road conditions is a constant cycle. Through continual monitoring, adjustments to the efforts are made as needed to get the maximum benefit.

Many "tools" are available to aid in storm management; they include but are not limited to:

- Accurate weather forecasts
- Current road conditions and traffic information
- Patrol observations
- Expertise (Area, Region, and Central Office)
- SDDOT's Winter Highway Maintenance Plan
- Other references (from FHWA or other States)

The key to South Dakota's Winter Highway Maintenance Plan's success is to utilize the tools listed above in conjunction with experience to fight winter events.

Storm Preparation

Through observations obtained while monitoring the various weather services, pre-storm preparations begin for an impending event.

Depending on the time of day or night, the appropriate personnel are contacted by following the call-out procedures specific to their unit. If the warnings are obtained prior to the end of the work-day, the Maintenance Supervisor or Lead Worker is contacted and a personnel, equipment, material and weather data strategy is formed.

The Maintenance Supervisor will inform personnel as the shift begins of which equipment and material to use, weather information and the expected shift strategy. The driver conducts the pre-trip inspection, completes a radio check, and is ready to begin his shift duties.

Choosing and Applying Materials for Various Storm Conditions

There are varieties of products available that can be used for anti-icing and de-icing. Sodium chloride, sodium chloride with additives, or abrasive/sodium chloride mixes are used for de-icing. As in de-icing with salt, there are various application rates that work best at different temperatures.

Strategies for Storm Management

Several strategies will be used to accomplish department objectives. These strategies include anti-icing, de-icing, plowing, and sanding. The appropriate timing of any strategy requires the use of sound judgment, interpretation of weather data, and prompt action. While de-icing is SDDOT's most common management tool, anti-icing is also being used when conditions allow.

Anti-icing

This is the proactive effort to prevent bonding of snow and ice to the pavement by timely placing chemicals prior to a storm or before frost conditions. Less chemical is needed to prevent ice from forming than to melt it once it has formed, and less plowing will be required to remove ice and snow that has not bonded to the pavement. Anti-icing liquids are typically placed at 20 to 40 gallons per lane mile based on the predicted event. Anti-icing requires about one-fifth the amount of chemicals that is required to destroy the bond in de-icing operations. The potential benefits of anti-icing are based on economics (efficient use of materials and manpower) and quality of service (motorist convenience and safety). However, conditions in South Dakota are not always conducive to an anti-icing strategy.

The application of a chemical freezing-point depressant on a highway or bridge prior to, or quickly after, the start of frozen precipitation minimizes the formation of a strong ice-pavement bond. This anti-icing technique reduces the effort of clearing the highway to bare pavement and requires lesser amounts of materials than are generally required using de-icing practices. Anti-icing also makes the cleanup process easier, reduces the frequency of slippery conditions, and lessens the environmental impact of winter maintenance operations.

One of the biggest benefits to be derived from anti-icing is the increased traffic safety from fewer hours of exposure to snow and ice-covered pavements and a faster restoration of pavement friction. There is also cost reduction when fewer passes and fewer materials are used.

Anti-Icing Choices for Various Storm Conditions

Costs of materials range from less than ten cents per gallon for brine to nearly one dollar per gallon for some of the second- generation agriculturally based products. It is important to assess the overall economics in using liquids. Certain products perform better under differing conditions. Product concentrations, temperatures, traffic, the environment, and equipment all play a role in selection of what optimally should be used. There are some circumstances where anti-icing may not be the most effective treatment no matter what the material is.

Sodium Chloride (Salt) Brine

When salt is dissolved in water it forms brine. This is what happens when de-icing is utilized. Before it works, salt needs to be in a liquid state. SDDOT has commercial and homemade brine machines that basically function similar to coffee makers. Water runs through a bed of salt and comes out as brine. The final solution is diluted to 23 percent and it is ready to apply. At this concentration, brine will stay liquid to minus 6 degrees. It has been used for anti-icing for pavement temperatures higher than about 15 degrees. Because of the relatively low cost of salt, brine has the least cost of anti-icing liquids.

In addition to temperature considerations, dew point is routinely considered before anti-icing. If it is within 2 degrees of the pavement temperature, application of brine is not recommended. For example, if the pavement is 30 degrees and the dew point is 29 degrees, do not apply. If the pavement is 25 degrees and the dew point is 15 degrees, spraying may be used. Salt brine similar to magnesium chloride brine will draw moisture from the air creating an extremely slippery condition where one may not have otherwise existed.

Magnesium Chloride (Mag Chloride)

Because of its low transportation costs and availability, most Western States use magnesium chloride as chemical of choice. Mag Chloride is a good performing liquid that has a very low freeze point. At a 28 percent concentration, magnesium chloride will stay liquid to minus 18 degrees. South Dakota uses MgCl at concentrations of a minimum of 28% to a maximum of 32%.

Agriculturally Based Products

There are a number of materials that are on the market that use byproducts from corn production that work extremely well in anti-icing applications. From ten to 50 percent of the raw product is blended with magnesium or calcium chloride. Freeze points are normally lower than magnesium chloride and approach or even surpass those of calcium chloride.

The latest generation of agricultural products is chloride free. To date there is little knowledge of these. They appear to have promise if they are competitively priced and readily available. They would be a product of choice in environmentally sensitive areas or where other circumstances would warrant their use.

South Dakota has tested Geomelt (a derivitative of sugar extraction from sugar beets) and other agriculturally based products for their benefits to our snow removal efforts.

De-icing

The application of a freezing point depressant on a highway to break an existing snow/ice bond to the pavement is called de-icing. Operations typically consist of plowing and treating the highway with chemicals or abrasives, or both. De-icing is a reactive strategy, and therefore can be more costly than an anti-icing strategy. Winter in South Dakota often dictates a de-icing strategy over an anti-icing strategy.

De-icing Choices for Various Storm Conditions

A variety of products are available to be used for de-icing. SDDOT generally utilizes sodium chloride, enhanced sodium chloride, or abrasive/sodium chloride mixes for de-icing. Material selection is based on the goal of the intended application, current road conditions, temperature and forecast.

Sodium Chloride

SDDOT's prevalent de-icing material is sodium chloride (salt). Sodium chloride's eutectic temperature is -6°F (at a 23% solution), although its effectiveness is reduced below 15°F. In order to break the snow/ice bond with the pavement, the material must first dissolve into solution and then penetrate the snow and ice pack. Given this information, the application rate will vary dramatically depending on how much snow pack is on the pavement; as the pack melts, the solution is diluted (commonly called "DOS" or "Dilution of Solution"). Additional material must be applied in order to maintain optimum concentration at the given temperature and prevent re-freezing. Once a bond has formed and the temperature falls, the amount of chemicals required to break the bond increase dramatically.

Sodium Chloride with Additives

Enhanced sodium chloride refers to salt that has been pre-wet with a liquid. SDDOT has used enhanced sodium chloride for some time; enhancement may include pre-wetting truckloads or pre-wetting at the spinner. Regardless of the enhancement, the objective is the same: to increase the effective temperature range of sodium chloride and to provide moisture, thereby increasing salt's ability to "stick" to the pavement, and reduce the roll and bounce that typically occurs with the use of dry material.

Liquid enhancement is the addition of chemical to sodium chloride. Liquids include magnesium chloride, agricultural products, and salt brine. Liquid enhancement can be done in several ways. The most common is to spray a liquid onto the sand/salt stream as it enters the spinner. This requires the truck to be equipped with a pre-wetting spray system and some sort of controls. This provides the most consistent method of wetting the salt. A variety of products may be used to wet the salt; however, care must be taken to select a liquid that will flow through the spray nozzles.

Most liquid enhancement is done at 8 to 10 gallons of liquid per ton of dry salt. This is enough to make the salt adhere to the road.

The lowest temperature at which enhanced sodium chloride may be used depends on the eutectic characteristics of the additive. The effective temperature of enhanced sodium chloride typically extends down to 0°F.

Abrasive/Sodium Chloride Mixes

Mixes are the prevalent choice for de-icing strategies. The sole function of abrasives (typically sand) is to improve traction, which may be short-lived because traffic will rapidly disperse abrasives and additional frozen precipitation will cover the application.

Abrasives or mixes are routinely used for treating snow-packed and icy roads; also, they may be used on any road to improve traction when pavement temperatures are so low that chemical action is slow. It must be noted, however, that abrasives are not ice-control chemicals and, as such, will not support the fundamental objective of either anti-icing or de-icing strategies.

Application of De-icing Materials

Chemicals are typically applied by means of a hopper-type spreader. These devices are capable of spreading free-flowing granular material over a width ranging from three feet to forty feet; typically applications are concentrated on the upper 1/3 of a lane - the idea being that as brine is formed, it will migrate to the edge of pavement, facilitating de-bonding.

One “new” placement practice is to apply salt on the road at what is called “zero velocity.” Special sanders are equipped with various devices that place material at a negative speed equal to the forward rate of speed of the truck. The result is that material is placed at a net zero miles per hour that is similar to the truck standing still, ensuring more material stays on the roadway.

Application Rate for Chemicals

Application rates (for chemicals, not mixes) range between 50 to 400 lbs per lane-mile, depending on conditions, temperatures, and whether the treatment is an initial or subsequent application. Initial applications may need to be heavier to guarantee the material reaches the pavement, while subsequent applications may typically be lighter to maintain an achieved level of service.

Plowing

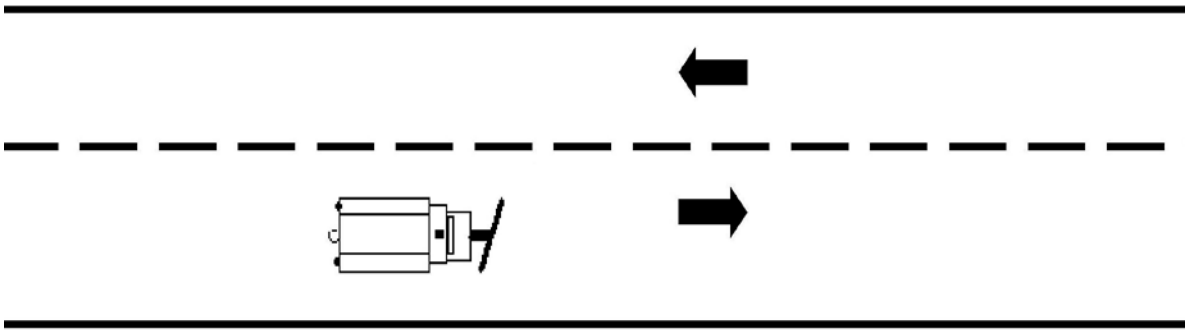
The role of snowplowing in de-icing operations is to remove as much snow and loose ice as possible before applying chemicals. Plowing is all that will be necessary if the pavement and snow are both cold and dry or if the snow is blowing across the pavement; material application in this condition will promote bonding of the precipitation to the roadway.

There are many types of snowplows. These include one-way front plows, reversible front plows, deformable front moldboard plows, underbody plows, v-plow, and side-wing plows. SDDOT typically utilizes reversible front plows with carbide cutting blades.

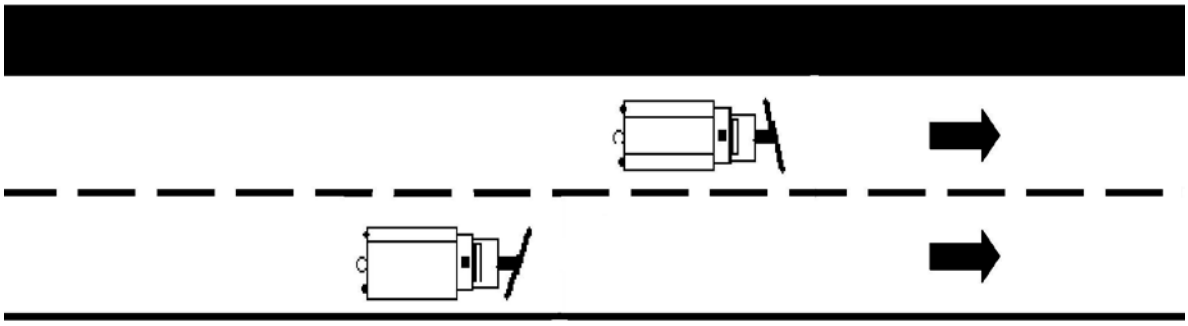
Typical plowing patterns are shown in the following diagrams:

Diagrams

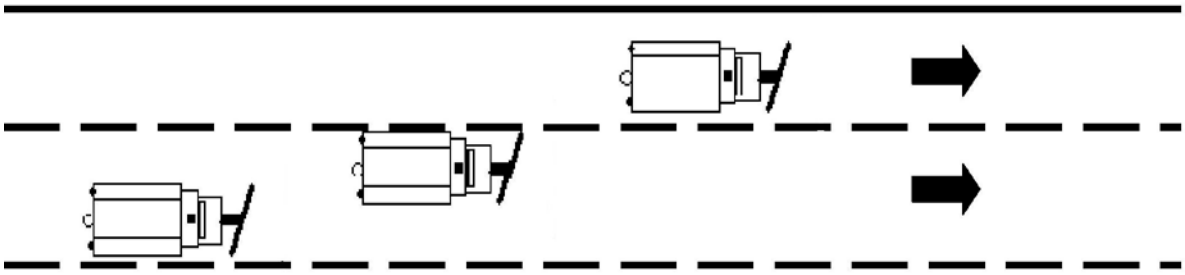
A. TWO LANE, TWO WAY TRAFFIC



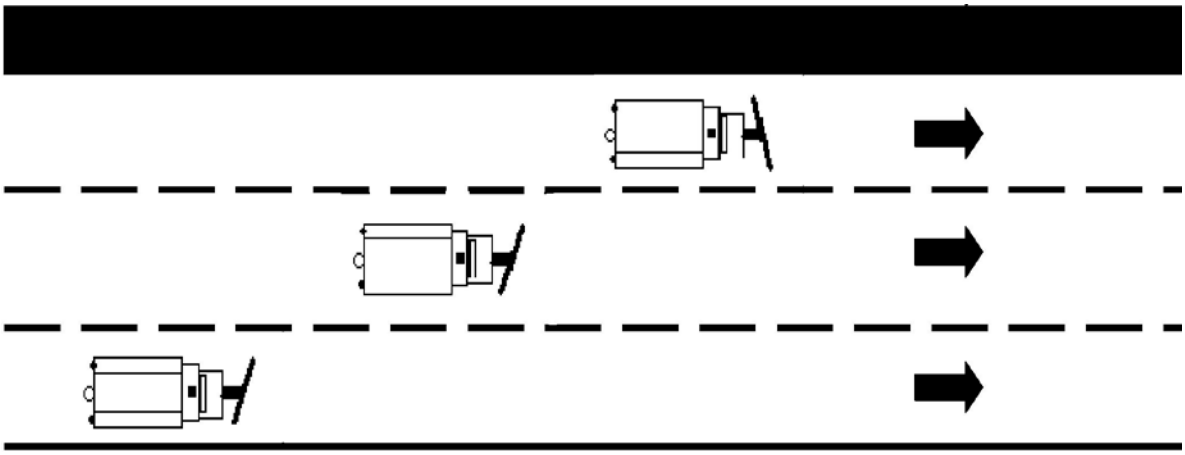
B. TYPICAL DIVIDED HIGHWAY WITH MEDIAN STORAGE



C. MULTI-LANE, NO MEDIAN STORAGE



D. MULTI-LANE WITH MEDIAN STORAGE



Other Storm Considerations

Coordinating Plowing and Sanding Activities

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

Hills, Curves, and Intersections

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

Bridges and Other Structures

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

Strong Crosswinds

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

Super-elevated Curves

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

Disabled or Abandoned Vehicles

Vehicles are often disabled or abandoned in storm events. Typically, snowplow drivers notify the Area of the vehicle's location and the status of occupants, if any. Occupants may be transported to the nearest phone to call for assistance. Note policy DOT-OS-OM-5.0 for additional details.

At-grade Railroad Crossings

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

Do Nothing

If the initial or previous treatments have done their job, the pavement temperature is around 28ºF and holding steady or rising, and no additional precipitation is occurring or forecast, there may be no need for further action. This is especially the case when the pavement temperature is above 32ºF and steady or rising, whether it is during or after the precipitation. Recognition of such conditions and communication of these conditions to snow plow operators can result in significant material savings. However, it is important to monitor conditions closely using information when pavement temperature is below or slightly above 32ºF and to be aware of the potential for "quick or surprise" freeze-ups.

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

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

Ice Control

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

Post-Storm Activities

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

Melt Water Control

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

Shoulder Clearing

Shoulders should be cleared to their full width to accommodate disabled vehicles and provide snow storage for the next snowfall. Areas beyond the shoulders can also be pushed back to accommodate future snow and minimize the potential of drifting. Shoulder condition relative to softness or its ability to support the weight of the snowplow, especially in the springtime, should be considered prior to these activities.

Intersection and Crossover Clearing

Intersections and crossovers should be cleared to their full width to accommodate the traveling public. Care should be taken to eliminate site distance restrictions caused by plow accumulations. Extended hours priority removal has been assigned to specific routes in the Sioux Falls and Rapid City areas.

Restoring Highway Safety Features

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

Loading, Hauling, and Disposal of Snow, Ice, and Abrasives

Loading, hauling, and disposal of snow, ice, and abrasives is routinely required in areas with no snow storage areas, urban areas, and some drainage sensitive areas. Generally these activities are required only after heavy snowfall or abrasive use; however, drainage sensitive areas may require attention in typical winter storms. Inlets must be open to facilitate drainage; care must be taken to keep them open during clean-up operations.

Loaders, graders, and trucks are typically used to relocate the snow build-up well away from the road. However, specialty equipment such as snow blowers may also be used.

Clearing of Special Areas

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

Material Management

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

Equipment Repair and Maintenance Activities

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

Facility Clean-up

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

Snow Blowers

South Dakota is known for extreme snow conditions, particularly at higher elevations. There are occasions when heavy accumulation coupled with high winds result in mountains of snow that must be removed. Front-end loaders are typically used in such cases, but this operation is usually slow and costly. A viable option is to use snow blowers.

Blowers come in a variety of shapes and sizes but basically are rated by the tons of snow per hour that they can move. There are self-contained units and units that mount on the front of a loader and snow can be thrown 100 to 150 feet. *(Be careful of mailboxes, vehicles, and surrounding houses!)* Many blowers have chute attachments that allow snow to be loaded into trucks for disposal. This option is valuable in urban areas or along medians where there is no storage space for snow.

Snow Fence

The prevention of snowdrifts requires close and continuous study. Very minor windbreaks, such as stubble, uncut weeds, brush or fences along the roadway, may cause drifts. Any obstruction that decreases the velocity of an air current may cause drifting snow, and the removal or control of the obstruction is essential to the control of drifting. Snow fence should be erected during October and November and taken down and properly stored during March and April.

Emergency Operations Centers

During severe winter storms the Emergency Operations Center (EOC) may be activated to coordinate the activities of various State Agencies. The Agencies normally involved are the Department of Public Safety, Department of Transportation, Department of Environment and Natural Resources, the South Dakota National Guard, and other agencies. Each agency has a representative present in the EOC to facilitate communication and decision-making.

Snow Plow/Sanders - Staffing Report

Aberdeen Region

Shop	Plows/Sanders (routine & daily)	Plows/Sanders (spares)	Permanent Employee Operators	Seasonal Operators (routine & daily) (Needed)	Reserve Operators (spare plows) (Needed)
Aberdeen Area:					
158 Aberdeen A	11	3	5	1	0
153 Britton	4	0	3	0	0
154 Faulkton	4	0	4	0	0
155 Ipswich	4	0	4	0	0
156 Leola	4	0	4	0	0
157 Webster	7	0	6	1	0
Sub-total	**34**	**3**	**26**	**2**	**0**
Watertown Area:					
177 Brookings	7	0	5	0	2
178 Clear Lake	6	0	4	0	2
173 Hayti	5	0	3	0	2
174 Milbank	6	0	4	0	2
175 Sisseton	8	0	6	0	2
176 Watertown	7	1	5	0	2
Sub-total	**39**	**1**	**27**	**0**	**12**
Huron Area:					
197Clark	5	0	4	1	0
198 DeSmet	4	0	3	1	0
193 Highmore	4	0	3	1	0
194 Huron	6	1	4	2	0
195 Miller	4	0	4	0	0
196 Redfield	6	0	5	1	0
Sub-total	**29**	**1**	**23**	**6**	**0**
Region-Total	**102**	**5**	**76**	**8**	**12**

Snow Plow/Sanders – Staffing Report

Mitchell Region

Shop	Plows/Sanders (routine & daily)	Plows/Sanders (spares)	Permanent Employee Operators	Seasonal Operators (routine & daily) (Needed)	Reserve Operators (spare plows) (Needed)
Mitchell Area:					
261 Armour	3	2	3	0	2
262 Bonesteel	4	1	4	0	1
263 Chamberlain	5	1	5	0	2
254 Mitchell A	5	1	4	0	2
255 Mitchell B	5	1	5	0	0
256 Plankinton	4	1	4	0	3
257 Platte	3	2	3	0	2
258 Salem	4	1	4	0	2
259 Woonsocket	4	1	4	0	1
Sub-total	**37**	**11**	**36**	**0**	**15**
Sioux Falls Area:					
276 Lennox	7	0	6	0	1
277 Flandreau	6	0	4	0	2
273 Madison	5	0	3	0	2
274 S. Falls A	12	0	7	4	2
275 S. Falls B	11	0	8	2	2
Sub-total	**41**	**0**	**28**	**6**	**9**
Yankton Area:					
297 Beresford	6	0	4	1	5
293 Menno	5	0	3	1	4
294 Tyndall	5	0	3	1	4
295 Jct. City	10	0	8	1	5
296 Yankton	6	0	4	1	3
Sub-total	**32**	**0**	**22**	**5**	**21**
Region-Total	**110**	**11**	**86**	**11**	**45**

Snow Plow/Sanders – Staffing Report

Pierre Region

Shop	Plows/Sanders (routine & daily)	Plows/Sanders (spares)	Permanent Employee Operators	Seasonal Operators (routine & daily) (Needed)	Reserve Operators (spare plows) (Needed)
Pierre Area:					
356Gettysburg	4	1	4	0	1
357 Hayes	4	1	3	1	0
353 Philip	4	1	4	0	1
354 Pierre A	4	1	4	1	0
355 Pierre B	5	1	4	0	0
Sub-total	**21**	**5**	**19**	**2**	**2**
Mobridge Area:					
377 Eagle Butte	4	2	4	0	0
378 Isabel	4	0	4	0	1
373 McIntosh	4	0	3	1	1
374 Mobridge	5	0	4	0	0
375 Herreid	4	1	3	1	0
376 Selby	4	0	3	1	1
Sub-total	**25**	**3**	**21**	**3**	**3**
Winner Area:					
398 Kadoka	6	1	6	1	0
399 Martin	4	1	4	0	0
393 Mission	4	0	4	0	0
394 Murdo	6	1	6	0	0
395 Presho	6	1	6	0	1
396 White River	4	0	4	0	0
397 Winner	8	0	5	1	1
Sub-total	**38**	**4**	**35**	**2**	**2**
Region-Total	**84**	**12**	**75**	**7**	**7**

Snow Plow/Sanders – Staffing Report

Rapid City Region

Shop	Plows/Sanders (routine & daily)	Plows/Sanders (spares)	Permanent Employee Operators	Seasonal Operators (routine & daily) (Needed)	Reserve Operators (spare plows) (Needed)
Rapid City Area:					
456 Deadwood	8	1	6	2	4
457 R. City A	10	1	5	0	4
453 R. City B	10	0	5	1	4
454 Sturgis	9	2	7	1	7
455 Wall	5	1	5	0	2
Sub-total	**42**	**5**	**28**	**4**	**21**
Belle Fourche Area:					
476 B. Fourche	7	1	5	0	2
477 Bison	7	1	5	2	3
473 Buffalo	5	1	4	0	1
474 Faith	5	1	4	1	1
475 Newell	6	1	4	0	2
Sub-total	**30**	**5**	**22**	**3**	**9**
Custer Area:					
496 Custer/H City	10	2	7	2	1
497 Edgemont	3	2	3	0	1
494 Hot Springs	6	0	6	0	1
495 Oelrichs	4	2	4	0	2
Sub-total	**23**	**6**	**20**	**2**	**5**
Region-Total	**95**	**16**	**70**	**9**	**35**

Snow Plow/Sanders – Staffing Report

STATE TOTALS

Shop	Plows/Sanders (routine & daily)	Plows/Sanders (spares)	Permanent Employee Operators	Seasonal Operators (routine & daily) (NEEDED)	Reserve Operators (spare plows) (NEEDED)
Aberdeen Area	34	3	26	2	0
Watertown Area	39	1	27	0	12
Huron Area	29	1	23	6	0
Aberdeen Reg.	**102**	**5**	**76**	**8**	**12**
Mitchell Area	37	11	36	0	15
Sioux Falls Area	41	0	28	6	9
Yankton Area	32	0	22	5	21
Mitchell Region	**110**	**11**	**86**	**11**	**45**
Pierre Area	21	5	19	2	2
Mobridge Area	25	3	21	3	3
Winner Area	38	4	35	2	2
Pierre Region	**84**	**12**	**75**	**7**	**7**
Rapid City Area	42	5	28	4	21
B. Fourche Area	30	5	22	3	9
Custer Area	23	6	20	2	5
Rapid City Reg.	**95**	**16**	**70**	**9**	**35**
STATE TOTALS	**391**	**44**	**307**	**35**	**99**

Issue Date: 12-17-75
Revision: 07-10-10

SNOW AND ICE CONTROL

PLOWING, SANDING AND CHEMICAL APPLICATIONS

DESCRIPTION:

Removal of snow and ice from road surfaces and shoulders using truck-mounted equipment and/or applying an abrasive, a chemical-abrasive mixture or liquid deicing chemical to snow packed or icy road surfaces. Liquid chemicals may be used to pretreat dry pavements.

PURPOSE:

To prepare road surfaces and shoulders for safe passage. This performance standard is a guideline to be considered by the Maintenance Supervisor or his designee. The Maintenance Supervisor or his designee shall retain the authority to modify or deviate from this performance standard based on experience and judgment due to specific weather conditions, road conditions or other events impacting this performance standard.

SCHEDULING AND INSPECTION:

1. Plowing snow, sanding and chemical application are emergency activities having priority over all other activities. Items such as downed stop signs need to be reported to supervisors for timely action.
2. Daily inspections and reports will identify locations requiring additional effort to remove localized areas of snow and/or ice. Standard reporting times are: workdays Monday through Friday once before 7:00 am, between 11:00 am and 1:00 pm, and between 4 pm and 7 pm, even if conditions are unchanged; holidays and weekends twice daily, once before 9 am and again between 4pm and 7 pm. Weather conditions and events may require more frequent updates, depending on need.

Function 2740 should be used for reporting time and equipment usage on Time Keeping System (TKS). Local weather forecasts and existing weather and road conditions shall be used as a basis for general scheduling of work shifts.

3. During operating hours of 5:00 a.m. to 7:00 p.m., at the discretion of the Maintenance Supervisor or his designee, continue operations until either the highways are passable, headway can no longer be made, or conditions become too hazardous for continued operation. Operations may cease when road and weather conditions cause such operations to be ineffective.

4. Operations between 7:00 p.m. and 5:00 a.m. will be at the discretion of the Maintenance Supervisor or his designee. When highway and traffic conditions warrant, operations may continue after 7:00 p.m. if progress can be made and staffing is available. Use reserve operators to the maximum extent possible, so that regularly scheduled personnel are rested and available during their normal shifts. The Highway Patrol, local law enforcement or local dispatch, and State Radio should be notified immediately whenever winter maintenance activities are being suspended. Prevailing road and weather conditions will be reported at this time and the Road condition Reporting System (RCRS) should be updated indicating that winter maintenance has been suspended. Select routes may be designated to receive extended hours of operation on a routine basis. These routes will be identified on an as-needed basis by the Region Engineer.

PRIORITY:

1. Operations shall normally be performed in the following sequence, subject to being deemed appropriate within the discretion of the Maintenance Supervisor or his designee (note Level of Service Goals table on page 8):

   FIRST: Use sufficient equipment, as available, to apply continuous coverage to highways shown on the current Priority Routes Map once each two hours, or as near there as can be accomplished, given available manpower and equipment.

SECOND: On non-Priority One Routes use sufficient equipment to plow and/or sand at least once every four hours, or as near there as can be accomplished, given available manpower and equipment. Apply additional coverage as equipment and manpower become available.

THIRD: Use remaining equipment to address service roads, local intersections and other areas.

2. Traffic lanes on all routes shall be plowed before removing snow from the shoulders or winging snow back from the shoulders.

Note: The above-identified frequencies are guidelines for when conditions dictate continued operations. Modifications or deviations from these guidelines are permitted within the discretion of the Maintenance Supervisor or his designee, due to weather or road conditions.

PROCEDURE:

1. Complete the Equipment Preseason Checklist and correct any deficiencies before winter.
2. Calibrate sanders before they go into service. Check sanders and prewet equipment annually for changes that could possibly affect application rates.
3. Apply material as per table 1 and repeat applications as needed to meet existing and forecasted weather conditions to obtain desired road conditions.
4. On V-plows, snowplow shoes shall be used and adjusted to hold the cutting edge clear of the road surface.
5. One-way and reversible snowplows with shoes or casters should be adjusted so that the blade contacts the pavement surface.
6. Snowplows, when used on gravel surfaces, shall have plow shoes adjusted to hold the cutting edge clear of the road surface.
7. For efficiency of operations, snowplows should be operated at speeds of 15-35 mph **except** when clearing snow from a structure over another road

or railroad. While cleaning structures, reduce speed to avoid any snow falling over the edge. Cleaning the snow off the structure shall be done by moving the snow past the end of the structure, then into the right of way. Note: It is recognized that under certain conditions, it may be advisable to operate at speeds less than 15 mph. For sanding or salting operations, operating speeds may be up to 30 mph. For all spreader operations, operating speeds should be slow enough to keep abrasive on the driving surface.

8. Plowing snow into an opposing lane of traffic or driving a plow in an opposing lane of traffic is not allowed, unless the road is closed to traffic.

9. When driving and road conditions warrant, snowplows shall pull over periodically to let traffic pass.

10. Units should communicate with each other to determine the limits and needs of plowing for each unit.

11. Extra care should be taken to prevent wings from digging in to gravel shoulders. This can happen at any time, but typically happens when the ground has thawed and the outside edge of the roadway is soft.

    On roads with narrow or no shoulders, trucks should stay on the hard surfaced roadway. Wings may be deployed beyond the shoulder provided they are not coming into contact with the ground.

    On roads with wide paved shoulders, trucks may be allowed to operate on the shoulder. Wings may be deployed beyond the shoulder provided they are not coming into contact with the ground.

    On roads with wide gravel shoulders, trucks may be allowed to operate on the shoulder provided the ground is frozen. Wings may be deployed beyond the shoulder, provided they are not coming in contact with the ground.

    When winging on unpaved shoulders, speed should be reduced to minimize damage from hitting unseen obstacles.

MATERIAL RATES

Below are guidelines for material use rates. The maintenance supervisor or his designee have the discretion to make changes to these rates and the kind of material mixtures based on weather or road conditions.

1. Typical salt additive mixed into the abrasive material should be at a rate of approximately 250 lbs per ton of material.

    - More or less salt may be added to the abrasive material based on local conditions.

2. The application rate for all sanding and salting operations and use of liquid chemical deicing should be within guidelines shown on Table 1.

3. The kind of material mixture to be used shall be determined by the maintenance supervisor for present and/or expected conditions.

4. Application of materials should be confined to the center 6 to 10 feet of a two-lane road. As an alternative, the salter can be adjusted to apply the material directly behind the truck in the lane being plowed to reduce the amount of material being plowed off on the return pass.

5. A card or salter chart (DOT-819) showing the truck speeds, salter gate openings and/or salter speeds needed to deliver specific rates of material shall be available for the operator. If vehicles are equipped with ground speed control, the chart is not required.

6. For pretreating or direct application, use rates as shown on Table 1 for liquid magnesium chloride or salt brine.

    *Notes:

    - Use lower rates on smooth-textured surfaces or on winding roads. Higher rates may be used on concrete or with colder temperatures.

- It is not recommended to apply liquid deicers when pavement temperatures are below mid-teens. It is also recommended to not overdo the application rate. More is not necessarily better.
- Pretreatment - Rates of 10-20 gal/lane mile may be used as a maintenance application to areas that have some residual from previous applications.

TABLE 1

DEICING GUIDELINES

Pavement Temp	Weather Condition	Maintenance Actions	SOLID CHEMICAL	SALT/ABRASIVE MIX	DIRECT APPLICATION	
			Prewet Salt*	Dry or Prewet**	Salt Brine	Mag. Chloride
			# of salt per lane mile	# of salt per lane mile	gal/ lane mile	gal/ lane mile
30 +	Light Snow	Plow, Chemical, Abrasives	50-150	50-150	30-40	20-25
	Freezing Rain	Apply Chemical, Abrasives	50-150	50-150	30-40	20-25
25 - 30	Light Snow	Plow, Chemical	100-200	100-200	30-40	20-25
	Freezing Rain	Apply Chemical, Abrasives	100-300	100-300	30-40	20-25
20-25	Light Snow	Plow, Chemical	100-200	100-200	30-40	20-25
	Freezing Rain	Apply Chemical, Abrasives	100-400	100-400	30-40	20-25
15-20	Light Snow	Plow, Chemical	200-300	200-300	30-40	20-25
	Freezing Rain	Apply Abrasives	100-400***	100-400	30-40	20-25
Below 15	Light Snow	Plow, Chemical	X	****	X	20-25
	Freezing Rain	Apply Abrasives	100-400***	****	X	20-25

NOTES

An "X" denotes that this activity is generally not the most efficient use of materials.
Snow pack should be treated similar to freezing rain
During periods of heavy snow accumulation (greater than 1" per hour), chemical or abrasive application should be limited to hazard areas.

* Prewet rates are 15-30 gallons per ton for Mag Chloride and Salt Brine.
** Prewet rates are 4-8 gallons per ton for Mag Chloride and 8-10 gallons per ton for salt brine
*** When prewet with Mag Chloride, this may be a viable option to consider.
**** Provide abrasive coverage to provide traction.

Level Of Service Goals

Classification	* Desired Coverage Times During an event	Desired Pavement Condition During an Event	** Desired Pavement Condition After an Event
Priority Routes	Once every 2 hours	Maintain safe passage when practical	Driving Surface is 80% clear of snow and ice within 18 working hours
Non-Priority Routes	Once every 4 hours	Maintain safe passage when practical	Driving Surface is 80% clear of snow and ice within 36 working hours
Shoulders, Low Volume Service Roads, Local Intersections, etc.	Minimal Coverage as necessary to prevent drifting onto driving lanes, etc.	Minimal coverage as necessary to prevent drifting on to driving lanes, etc.	Begin clearing these areas as soon as practical for safe passage.

Note: Interstates and priority routes will be given first attention when weather conditions become severe and/or equipment availability becomes limited.

* Coverage times are goals. Actual coverage times may vary depending on storm severity and availability of manpower and equipment. When conditions allow, an attempt shall be made to make one round of coverage on all routes near the beginning of a shift. Coverage times specified in the table are intended to be subsequent coverage times.

**Pavement conditions are goals. Actual pavement conditions may vary depending on storm severity and availability of manpower and equipment.

MATERIAL SPECIFICATIONS FOR SAND AND ROCK SALT

1. Use of the following gradation is recommended when purchasing abrasive material or for inclusion in abrasive material contract specifications:

Sieve Size	% Passing
3/8”	100
#4	80-100
#10	40-80
#40	5-35
#200	0-10

Liquid Limit not to exceed 26
Plastic Index not to exceed 3

Region Engineers are authorized to deviate from the above gradation.

2. The gradation for rock salt shall be as follows:

Sieve Size	% Passing
½”	100
3/8”	95-100
#4	20-90
#8	10-60
#30	0-15

RECOMMENDED:

Jason Humphrey
Construction & Maintenance Engineer

APPROVED:

Greg Fuller
Director of Operations

Issue Date: 04-01-69
Revision: 10-11-05

DRIFT PREVENTION

DESCRIPTION:

Erecting, maintaining and removing snow fences, as well as plowing snow ridges near the road, establishing living snow fences or leasing row crops to minimize drifting snow.

PURPOSE:

To minimize snow or sand drifting onto the right of way. The Maintenance Supervisor or his designee retain the authority to modify or deviate from this performance standard within their discretion based on their experience and judgment due to specific weather conditions, road conditions, or other events that affect this performance standard.

QUALITY AND WORKMANSHIP:

1. All snow fences, living snow fences, row crop leasing and snow ridging locations should be determined by inspections from both past experience and topographic conditions.

2. Permission should be obtained from the landowner before drift prevention work.

3. Series of snow windrows should be placed in adjacent fields whenever conditions warrant.

4. Snow fences, when removed, should be stacked on mud sills or other framework to prevent rotting.

5. Fence lines within 75 feet of center lines should have weeds removed where conditions could cause snow drifting within the right of way. Burning is not allowed.

Living snow fence agreements should follow established guidelines and rules through the Office of Local Government Assistance.

SCHEDULING AND INSPECTION:

1. Work under this standard is not an emergency and should be scheduled.
2. Erect snow fences in the fall (October through November).
3. Remove snow fences before spring fieldwork.
4. Schedule snow ridging to be done as soon as practical after the snowfall ends and only in locations necessary to minimize snow drifting.

PROCEDURE:

1. Locate drift prevention sites.
2. Place snow fence at a minimum of 30H (30 x the height in feet of the snow fence) from the right of way line.
3. Obtain the landowner's approval, if on private land.
4. Perform snow ridging, or install and remove snow fences.
5. Snow fences that have been removed will be hauled into storage and stacked on pallets or other framework.

RECOMMENDED:	APPROVED:
_____	_____
John C. Forman	Darin P. Bergquist
Construction & Maintenance Engineer	Director of Operations

MEMORANDUM

To: SDDOT Region Engineers
SDDOT Operations Engineers
SDDOT Area Engineers

From: Greg Fuller, SDDOT Director of Operations

Date: January 30, 2011

Subject: Winter Operations Priority Routes Designation Procedure

The Winter Operations Priority Route System, for the most part, consists of a series of interconnected loops. The system also includes certain extensions from these loops that serve as connections to various municipalities and to routes in adjacent states receiving similar treatment.

All sections of state-maintained highways with winter traffic counts of 1,000 or more vehicles per day should be designated as Priority Routes. Exceptions to this would be sections with dead ends at some point beyond a municipality, and sections parallel to, and close to, another section already designated a Priority Route.

A section of highway with a winter traffic count averaging less than 1,000 vehicles a day can be assigned a Priority Route designation if it meets one or more of the following conditions:

- Completes a leg of a Priority Route loop
- Connects with a section of highway in an adjacent state that receives treatment similar to our Priority Routes
- Extends a Priority Route a short distance so it terminates at a municipality or location where shelter is available
- Meets a particular local condition
- Providing the section Priority status fulfills needed service to all parts of the state.

SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION
POLICY LETTER

Policy Number: OM-2005-08

Title: Snowplow Accident Reduction Policy

Purpose: Reduction of snowplow accidents.

Key Topic Areas: Maintenance, Safety

Responsible Program: Operations Support

Supercedes Policy Numbers or New Policy: OM-2002-05, Foreman's Policy #14

Effective Date:10-07-2005
Expiration Date:
Last Review Date: 10-06-2005
Next Review Date: 10-01-2010
Superceded by Policy #

Related Documents:

Recommended:

John C. Forman
Construction & Maintenance Engineer

Approved:

Darin P. Bergquist
Director of Operations

Policy Statement:

DOT snowplows are rear-ended every year. To reduce these accidents, the following precautionary operating procedures should be considered when plowing on four-lane divided highways.

1. When fluffy/powdery snow conditions exist, every effort should be made to plow snow off the passing lanes early in the morning or during other low-traffic periods.
2. When plowing snow in the passing lane, the snowplow operator should always try to keep in sight any traffic approaching from the rear. To do this, the snowplow operator may have to reduce operating speed in order to increase rear visibility. Caution needs to be used when reducing operating speeds, as speed reduction can also create a hazard.
3. If a snowplow operator cannot keep traffic approaching from the rear in sight when plowing snow in the passing lane, plowing of the passing lane should be discontinued, or the snowplow should be accompanied by a second snowplow equipped with flashing warning lights.
4. Snowplows should be equipped with lights meeting current DOT uniform lighting requirements.
5. Extreme caution should be exercised when making left-hand turns onto median crossovers. When visibility conditions are poor, consideration should be given to using interchange ramps and crossovers to change plowing direction, instead of using median crossovers.
6. Snowplow operators are advised to daily inspect their snowplow lights and mirrors to confirm they are in good operating condition.
7. Before each winter, each Maintenance Supervisor should discuss with his snowplow operators the special procedures and precautions to take when plowing fluffy/powdery snow in order to reduce visibility problems.

Although the above suggestions apply to plowing of snow on four-lane divided highways, they also are good guidelines for all other types of plowing operations.

SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION
POLICY LETTER

Policy Number: OM-2005-09

Title: Reassignment of Equipment During Winter Storms

Purpose: To provide guidelines for the interaction of personnel to accomplish temporary reassignment of snow removal equipment during winter storms.

Effective Date: 10-07-2005
Expiration Date:
Last Review Date: 10-06-2005
Next Review Date: 10-01-2010
Superceded by Policy #

Key Topic Areas: Administration, Maintenance, Safety

Responsible Program: Operations Support

Supercedes Policy Numbers or New Policy: OM-1996-04, OM-04-96

Recommended:

John C. Forman
Construction & Maintenance Engineer

Approved:

Darin P. Bergquist
Director of Operations

Policy Statement

It is the policy of the Department to reassign equipment to areas of need during winter storms.

Preceding or during major winter storms, equipment may be reassigned between Maintenance Units, Areas and Regions.

Movement of equipment between Maintenance Units. Maintenance Supervisors shall provide assistance to neighboring units when requested, provided they can reasonably be assured that they will not neglect storm and road conditions that may occur within their units.

Movement of equipment between Areas. Maintenance Supervisors and Area Engineers shall provide assistance to other Areas when requested, provided they can reasonably be assured that they will not neglect storm and road conditions that may occur within their Areas.

Movement of equipment between Regions. Area Engineers and Region Engineers shall provide assistance to areas in other Regions when requested provided they can reasonably be assured that they will not neglect storm and road conditions that may occur within their Region.

Prior to and during winter storms, Maintenance Supervisors, Area Engineers, Region Engineers and the Director of Operations shall discuss and agree upon the reassignment of equipment and personnel to those areas that are expected to be impacted with the heaviest storm conditions. Equipment and personnel shall remain in the re-assigned area until normal traffic flow is restored or there is greater need in other areas. When a determination for reassigning equipment cannot be arrived at, the issue shall immediately be referred to the next highest level of authority. The next level of authority shall immediately decide on the utilization of equipment, so that equipment is utilized in a manner that best addresses storm and road conditions. The basis for determining the likelihood of a storm event and the need for reassign equipment will be the Weather Forecasting systems and weather radar provided by the Department for winter operations practices.

Title	**Assisting Motorists and Pulling Vehicles During Winter Months**
Policy No.	**DOT—OS—OM—5.0**

Persons Affected	DOT
Policy Owner	Division of Operations
Effective Date	10/2006
Supersedes	OM-2005-11
Next Review Date	10/2007

Purpose

To provide guidelines for South Dakota Department of Transportation (SDDOT) employees when they help stranded motorists or move stuck vehicles during winter months.

Policy

SDDOT snowplow operators are mainly responsible for providing the traveling public with the best possible winter driving conditions by plowing and sanding roads. However, when weather conditions are bad enough to threaten the safety and well-being of travelers who are stranded or stuck, snowplow operators may take travelers, or arrange to have them taken, to a nearby facility with food and telephone service. Pulling of stuck or abandoned vehicles is limited to specific circumstances outlined below.

Procedure

I. Assisting Stuck or Stranded Travelers

Responsibility	Action
Snowplow Operator	1. Make sure the snowplow/sander units are equipped with either Grade 80 chains or nylon tow ropes with a minimum rating of 55,000 pounds. 2. If weather conditions are dangerous, may take stuck or stranded travelers to a nearby facility with food and telephone service, or make arrangements to have them transported to such facilities.

II. Removing Stuck or Abandoned Vehicles

Responsibility	Action
Snowplow Operator	1. Do **NOT** pull a stuck vehicle that doesn't pose a hazard to other drivers when the delay in doing so causes poor driving conditions for the traveling public. 2. May pull stuck vehicles under the following conditions:

- The stuck or abandoned vehicle is partly or entirely on the road and is a hazard to other drivers, or
- When a motorist in a rural area asks to be pulled back to the pavement and is willing to sign the attached waiver releasing the State from claims for damages and:
    - When pulling the vehicle does not jeopardize the safety of the traveling public; and
    - The stuck vehicle is a car or pickup; and [Note: Do **NOT** attempt to pull trucks, except when the truck is a hazard to the traveling public.]
    - The snowplow can pull the stuck vehicle without getting off the road surface; and
    - When commercial towing services are unavailable locally--unless the stuck vehicle is a hazard to the traveling public.

3. If unable to pull out a stuck motorist, call and try to arrange for towing or other assistance, if the motorist wants it.

Related Documents

None

Revision Log

DOT-OS-OM-5.0: Reformatted. **Added**: strength specifications for chains and nylon ropes.
OM-2005-11: **Added**: a more-detailed release form for motorists whose vehicles are being pulled by an SDDOT vehicle.
OM-1996-03: Reformatted
OM-03-96: New policy.

Signatures

Judith M. Payne, Secretary of Transportation	Date
Darin Bergquist, Director, Operations	Date
Greg Fuller, Construction and Maintenance Engineer	Date

RELEASE

By my signature below, on behalf of myself, my heirs, next of kin, successors in interest, assigns, personal representatives, and agents, I hereby:

1. Waive any claim or cause of action against and release from liability the State of South Dakota, its officers, employees, and agents for any liability for injuries to my person or property.

2. Agree to indemnify and hold harmless the State of South Dakota, its officers, employees, and agents for any claims, causes of action, or liability.

I HAVE READ THIS RELEASE AND WAIVER OF LIABILITY, ASSUMPTION OF THE RISK AND INDEMNITY AGREEMENT, FULLY UNDERSTAND ITS TERMS, UNDERSTAND THAT I HAVE GIVEN UP SUBSTANTIAL RIGHTS BY SIGNING IT, AND HAVE SIGNED IT FREELY AND VOLUNTARILY WITHOUT ANY INDUCEMENT, ASSURANCE, OR GUARANTEE BEING MADE TO ME AND INTEND MY SIGNATURE TO BE A COMPLETE AND UNCONDITIONAL RELEASE OF ALL LIABILITY TO THE GREATEST EXTENT ALLOWED BY LAW.

Signed: _____

Address: _____

Veh. Lic. No.: _____

Date : _____

Title	**Inclement Weather Travel Restrictions**
Policy No.	**DOT—OS—OM—6.0**

Persons Affected	DOT, South Dakota Dept. of Public Safety
Policy Owner	Division of Operations
Effective Date	11/2006
Supersedes	OM-2004-04
Next Review Date	11/2007

Purpose

To provide procedures for temporarily restricting traffic on a section of State trunk highway, or closing the highway, during inclement weather.

Policy

South Dakota Codified Law 31-4-14.1 grants the South Dakota Dept. of Transportation (SDDOT) Region Engineers and Highway Patrol Captains, through their respective Department Secretaries, authority to restrict traffic on, or to close, a section of State trunk highway because of inclement weather. This authority will be carried out by the procedure below.

Due to the large number of access points on non-Interstate highways and associated difficulty in controlling access to these highway segments if closed, non-Interstate highways shall be closed to traffic only in the most extreme of circumstances. Instead of closing non-Interstate highways, "no travel advised" warnings for these highway segments will be issued when appropriate and necessary.

Procedure

Restricting Traffic on a State Trunk Highway

Responsibility		Action
Region Engineer or his designee, and local Highway Patrol Captain	1.	Determine when weather and driving conditions are such that traffic should be restricted on a section of highway, and then notify the Highway Patrol Superintendent and the DOT Director of Operations, or their respective designees, of the need for the restriction.
Highway Patrol/ SDDOT	2.	Discuss the current situation and weather conditions.
	3.	Seek approval of the Governor or his designee for the intended restriction or closure.
	4.	If the Governor or his designee are unavailable, the decision will be based on the combined approval of the DOT and the Highway Patrol.
Director of Operations	5.	Notify appropriate Federal Highway Administration and SDDOT officials.

Highway Patrol	6.	Notify affected sheriff's departments and any other local law enforcement as needed in the affected area.
Region Engineer	7.	Upon agreement to restrict travel on a section of highway, notify the public by one or more of the following actions: • Erect suitable barriers on the highway to restrict or prohibit travel. • Post warnings and notice of the condition of the highway for travel in generally available media outlets. • Post signs directing traffic how to use or not use the highway. • Place warning devices on the highway. • Place flagmen to warn, detour, or direct traffic.
	8.	If conditions allow, patrol the closure area to ensure that no motorists are stranded within the closure area. Knowelable violations of these closures are a Class 2 misdemeanor, punishable by a civil penalty of up to $1000 and the actual cost of any such rescue, in an amount not to exceed $10,000.
South Dakota Dept. of Public Safety	9.	Coordinate the advising of broadcast media and State Radio of the new or discontinued travel restrictions.
Region Engineer	10.	When the emergency is over and the highway is safe for traffic, remove the restriction and allow traffic to proceed.
	11.	Inform the Highway Patrol that the highway section has been reopened.

Related Document

SDCL 31-4-14.1

Revision Log

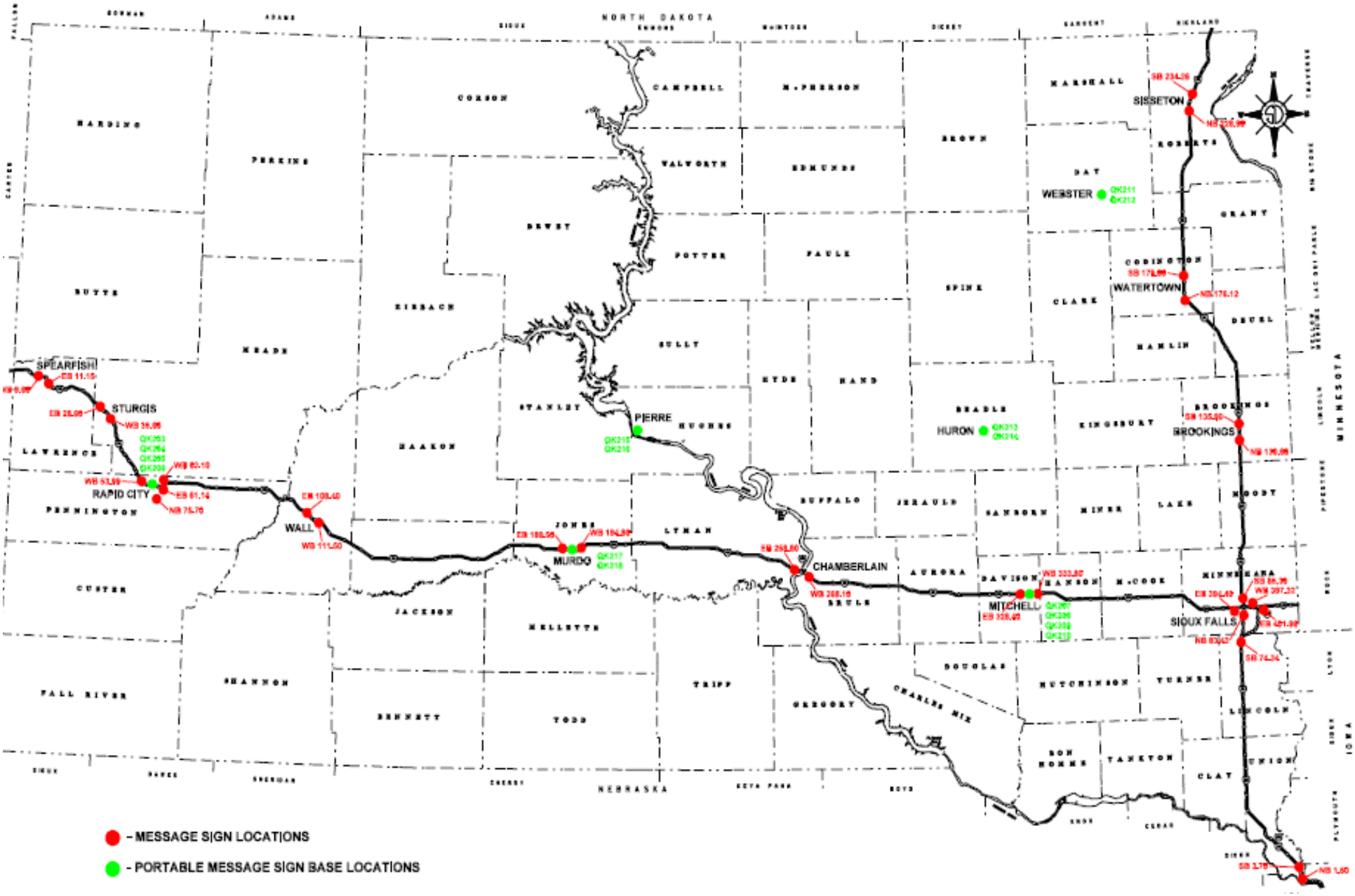
DOT-OS-OM-X.0: revised to comply with new law, which states the Governor's approval is no longer required to restrict traffic on, or close, sections of State trunk highways during bad weather. **Deleted**: requirement for Highway Patrol to consult with county sheriffs on restrictions in their jurisdictions. Requirement for flagpersons. Language about variable message boards.
OM-2004-04: **Changed**: reference to teletype to SDLETS. **Deleted**: language requiring that points of travel restriction be established and clearly identified at locations allowing the traveling public to use an

alternate route to bypass the restricted area. Requirement for Maintenance Engineer to tell Tourism to announce the closure on the lighted billboard at the Minnesota border rest area. **Added**: requirement that Region Engineers use dynamic message boards, where appropriate, to advise traveling public of the closures.
OM-1996-01: **Changed**: reference to State Police changed to State Radio. **Added**: requirement to advise media specifically about closure limits, that snow removal operations have been discontinued, and that motorists who travel on closed highways are subject to a Class 2 misdemeanor. **Deleted**: language about Highway Patrol and SDDOT staff working alternating shifts as flagpersons. Language about having flagpersons present after the road is reopened.
OM-1-89: Earliest available policy.
OM-2-88: Policy not found.

Signatures

Tom Dravland, Secretary, Department of Public Safety	Date
Judith M. Payne, Secretary, Dept. of Transportation	Date
Darin Bergquist, Director, Operations Division	Date
Greg Fuller, Construction and Maintenance Engineer	Date

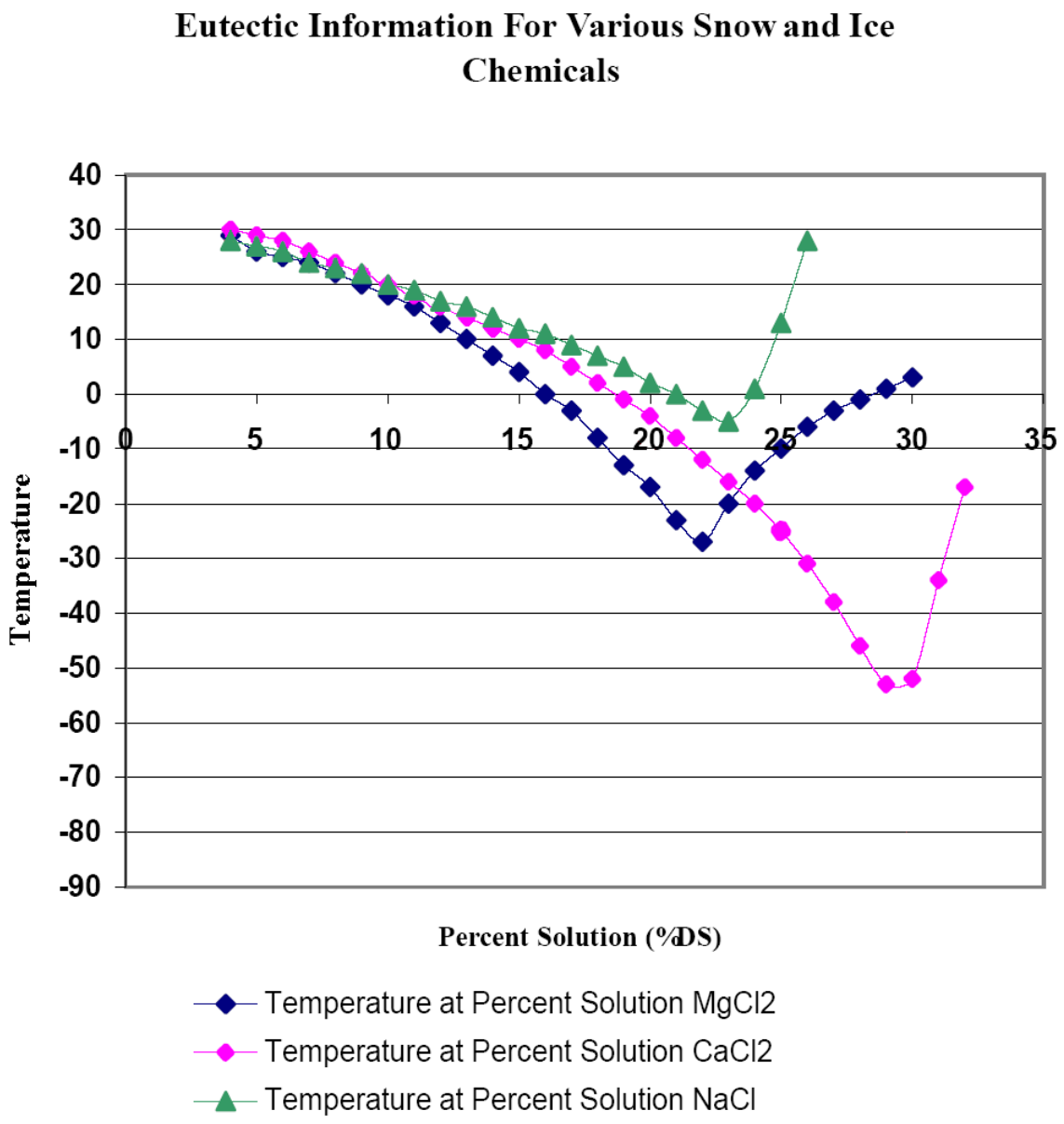
DYNAMIC MESSAGE SIGN LOCATIONS



ROAD CLOSURE GATE LOCATIONS

Tabular Representation of the Lowest Effective Working Temperature

Percent Solution					
				Ice Ban	Caliber
% DS	$MgCl_2$	$CaCl_2$	NaCl	M50	M1000
4	29	30	28	30	29
5	26	29	27	30	27
6	25	28	26	29	26
7	24	26	24	29	25
8	22	24	23	28	23
9	20	22	22	27	22
10	18	20	20	26	20
11	16	18	19	25	18
12	13	16	17	24	16
13	10	14	16	23	14
14	7	12	14	22	11
15	4	10	12	21	8
16	0	8	11	20	5
17	-3	5	9	19	2
18	-8	2	7	17	-2
19	-13	-1	5	15	-6
20	-17	-4	2	13	-11
21	-23	-8	0	12	-17
22	-27	-12	-3	10	-23
23	-20	-16	-5	9	-29
24	-14	-20	1	7	-35
25	-10	-25	13	6	-42
26	-6	-31	28	5	-49
27	-3	-38		4	-56
28	-1	-46		2	-63
29	1	-53		1	-71
30	3	-52		0	-79
31		-34		-3	-82
32		-17		-6	-85
33				-9	
34				-12	
35				-15	
36				-17	
37				-21	
38				-28	
39				-35	
40				-40	


Eutectic Information For Various Snow and Ice Chemicals
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
0
5
10
15
20
25
30
35
Temperature
Percent Solution (%DS)
Temperature at Percent Solution MgCl2
Temperature at Percent Solution CaCl2
Temperature at Percent Solution NaCl

ACCIDENT FORM QUICK REFERENCE CHART

SITUATION	STATE VEHICLE ACCIDENT REPORT	REPORT OF ACCIDENT, INCIDENT, OR UNSAFE CONDITION	FIRST REPORT OF INJURY & BOP ACCIDENT & MEDICAL RELEASE	CLAIMANTS FORM	DOT ACCIDENT INVESTIGATION FORM	INSTRUCTIONS
Employee slips and falls on the ice causing a injury to himself.			X see instruction		X	Supervisor must fill out in 3 business days. Fill out the top header and sign form. DOT accident investigation investigation form must be attached.
While working in the shop an employee injures himself when using a powertool.			X see instruction		X	
While working on the highway an employee is overcome by heat stroke.			X see instruction		X	
Employee was injured when lifting.			X see instruction		X	
Employee twists knee while getting down from truck and shakes it off.			X see instruction		X	
A visitor (Non-State Employee) to a State office slips on some ice and is injured.		X			X	Claimants form if requested. Record crew location, weather & time of incident.
Employee backs into a private parked car.	X			see instruction	X	Claimants form if requested. Record crew location, weather & time of incident.
While mowing a rock hits a private vehicle, breaking windshield.		X		see instruction	X	Claimants form if requested. Record crew location & time of incident.
While sanding a rock hits a private vehicle, breaking windshield.	X			see instruction	X	Claimants form if requested. Record crew location & time of incident.
Employee is involved in a motor vehicle accident with a private vehicle.	X				X	Need CDL Drug Test? (see CDL Policy)& Include a DOT 307?
Private vehicle(s) are involved in an accident in a work zone.		X				
Private vehicle damaged state property other than a vehicle.		X				Include a DOT 307, if resposible party is known.
Private vehicle hit pothole and damaged personal vehicle.		X		see instruction	X	Claimants form if requested. Record weather & time of incident.
Private vehicle gets paint splattered on it from state paint crew.		X		see instruction	X	Claimants form if requested. Record crew location, weather & time of incident.
Employee is involved in a motor vehicle accident with another state vehicle.	X				X	Need CDL Drug Test? (see CDL Policy)
Employee backed into building with a truck while leaving the shop bay.	X				X	
Employee hit a pheasant while driving a state vehicle, causing damage.	X					
Employee failed to secure load properly causing an accident.	X				X	
Employee damaged state truck and property while plowing.	X				X	
Wing on plow hit side of truck while plowing.	X				X	
Employee may have failed to follow proper procedures and a **vehicle accident occurred**.	X				X	
Employee may have failed to follow proper procedures and a **injury occurred**.			X		X	
Employee may have failed to follow proper procedures and a **unsafe incident occurred**.		X			X	
If it is a State piece of equipment with a license plate.	X				X	
If it is a private vehicle or State piece of equipment ***without*** a license plate and you ride in or on it.		X			X	

Questions?? Who to Call??

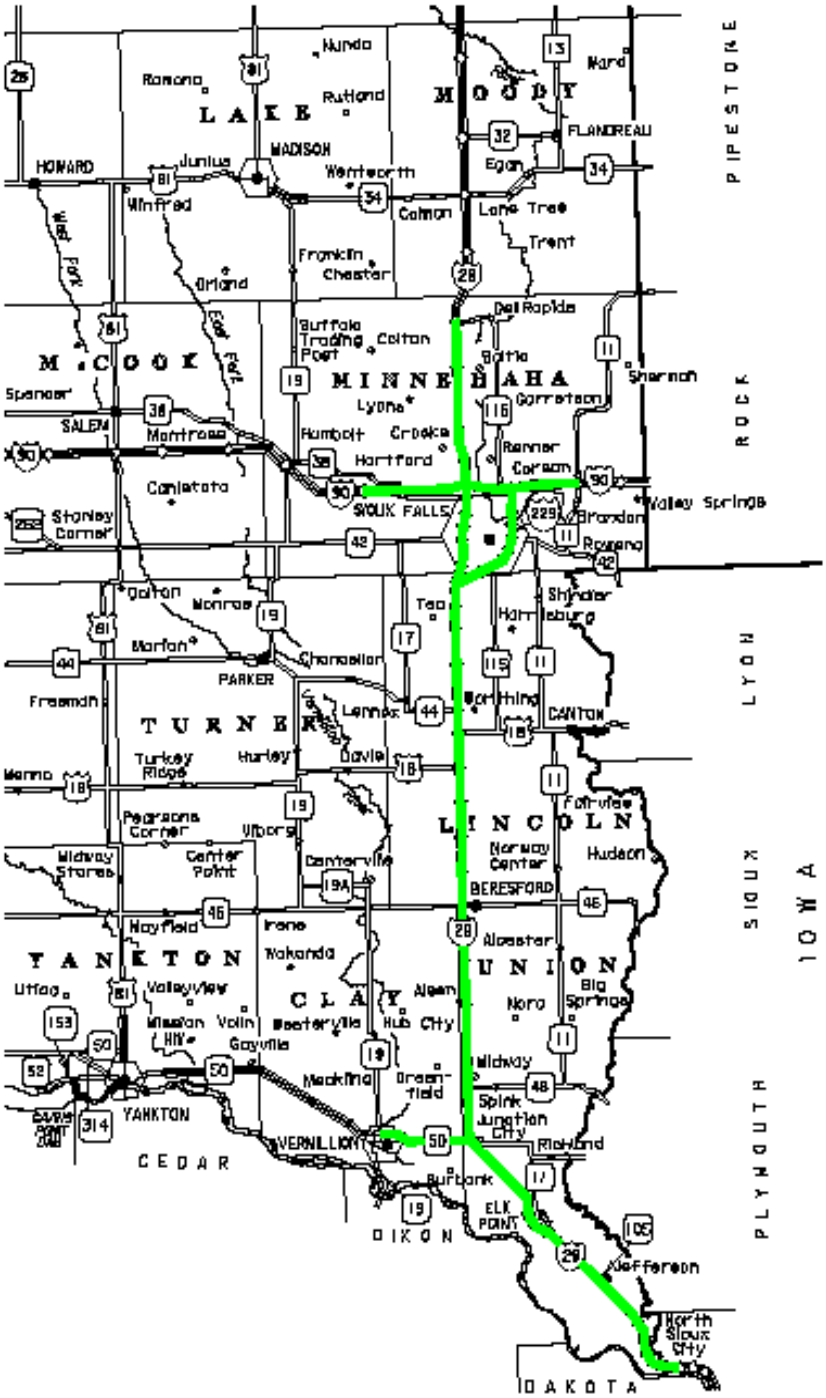
After Hours or Weekends - Claims Assoc. 1-888-430-2249

YOUR Area Office XXX-XXXX YOUR Region Office yyy-YYYY

Craig Ambach, Risk Management 773-5879

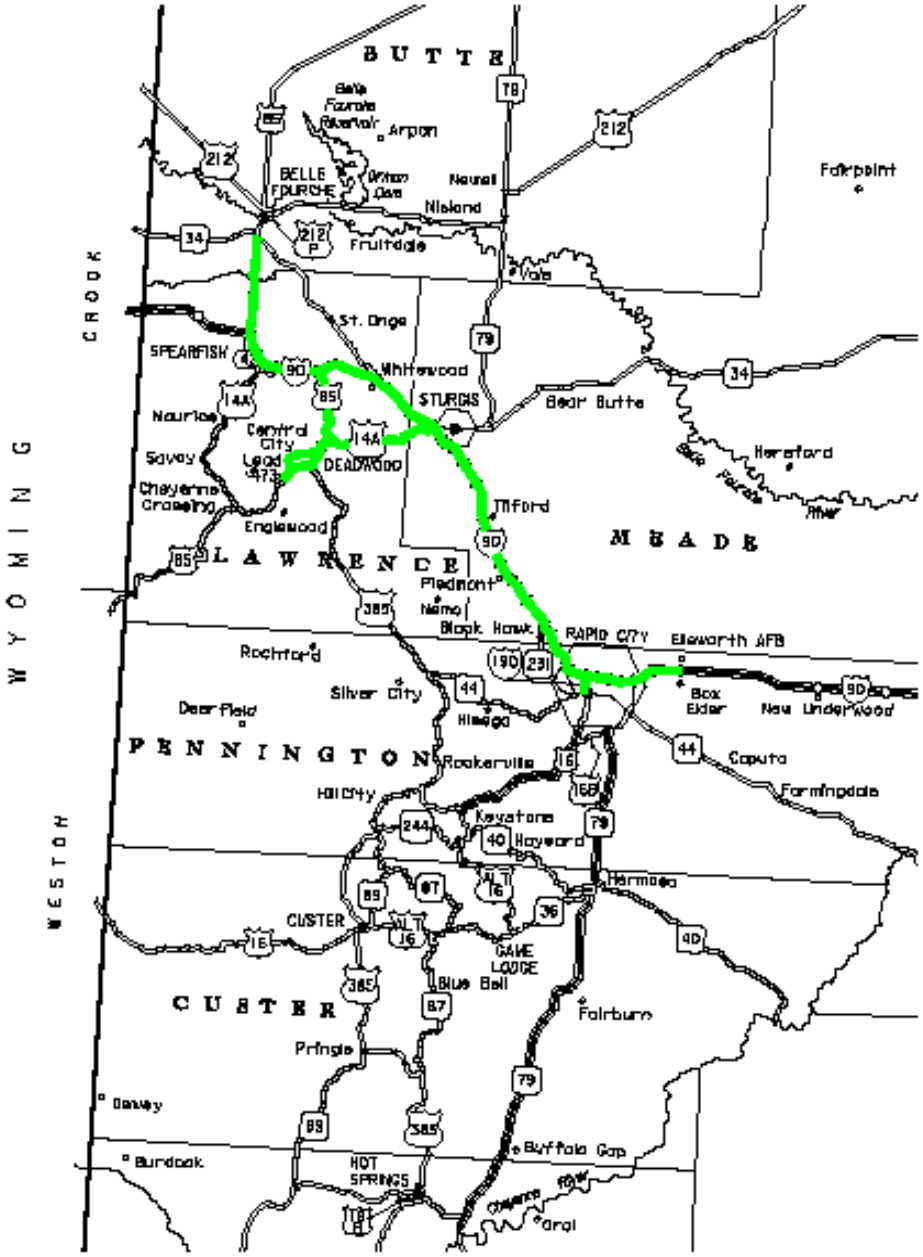
Joe O'Dell, D.O.T. 773-5059 or Peggy Laurenz, B.O.P. 773-6943

Extended Hours Winter Operations Map
Sioux Falls Vicinity



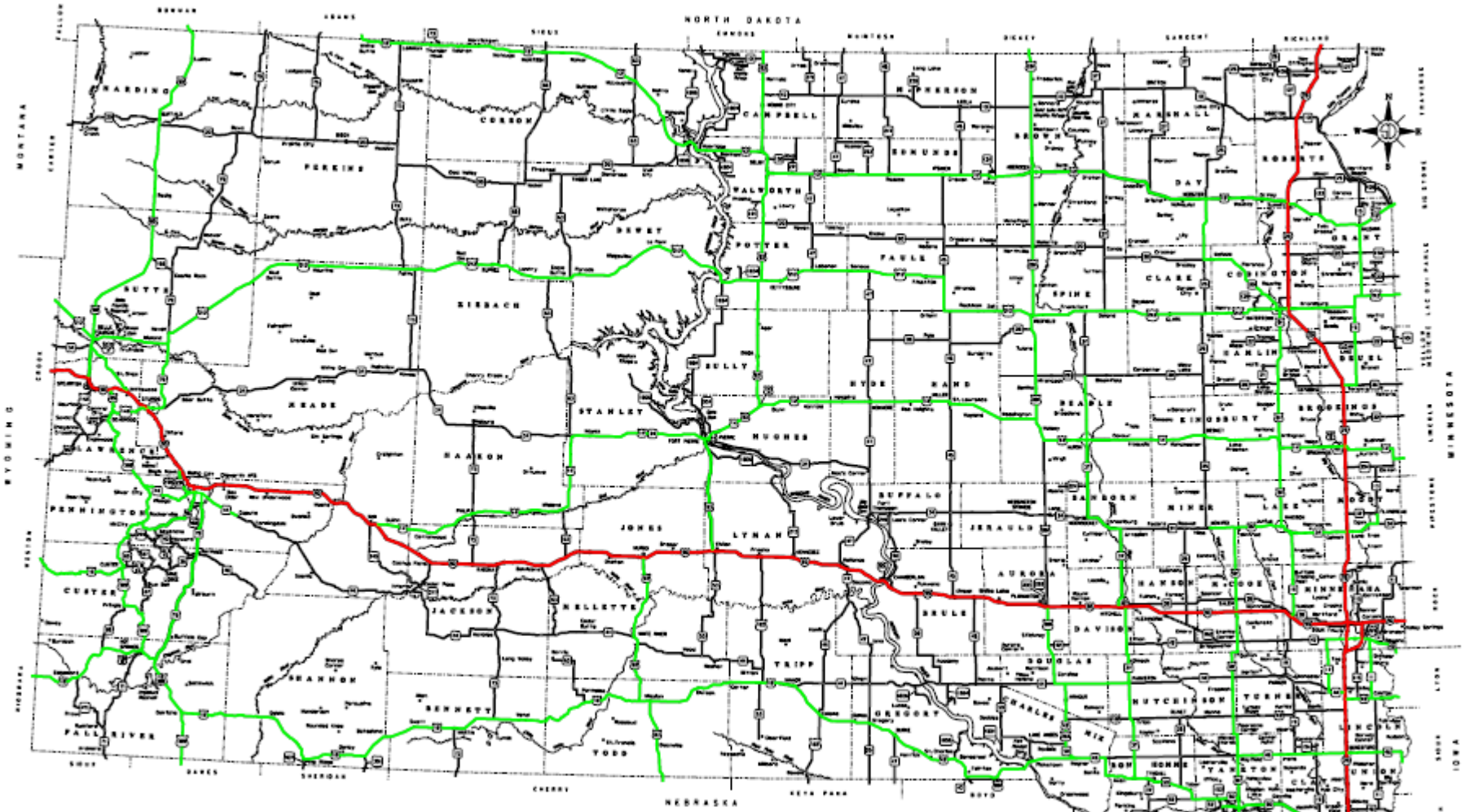
- Extended Hours Routes 2014-2015

Extended Hours Winter Operations Map
Rapid City Vicinity



- Extended Hours Routes 2014-2015

MAINTENANCE SYSTEM PRIORITY ROUTE MAP



– INTERSTATE SYSTEM

– PRIORITY ROUTES

ALL COLORED ROUTES SHOWN ON THE MAP ARE PRIORITY ROUTES
INTERSTATE AND PRIORITY ROUTES RECEIVE SAME LEVEL OF SERVICE

PREPARED BY
SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION
DIVISION OF OPERATIONS
700 BROADWAY AVE. EAST
PIERRE, SOUTH DAKOTA 57501
PHONE: (605)773-3704
FAX: (605)773-3921

SEPTEMBER 2008