



Total Storm Managment Manual



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This manual is a product developed by INDOT. The individuals listed above contributed by providing content. The members of the TSM committee spent many hours developing materials, reviewing, and editing. This manual would not have happened without their efforts. Your efforts help to make INDOT the great organization it is.

Bob McCullouch - Editor

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www.apwa.net

Aurora
<http://www.aurora-program.org/index.cfm>

Clear Roads
<http://www.clearroads.org/index.html>

Federal Highway Administration (FHWA)
“Manual of Practice for an Effective Anti-icing Program”
<http://ops.fhwa.dot.gov/Weather/index.asp>

Federal Highway Administration (FHWA)
Road Weather Management
<http://ops.fhwa.dot.gov/weather/resources/resdev.htm>

INDOT
Road Weather Sensors (RWIS)
<http://netservices.indot.in.gov/rwis/>

INDOT
Winter Driving Safety
www.winterdrivingsafety.in.gov

Joint Transportation Research Program (JTRP)
http://rebar.ecn.purdue.edu/jtrp_redesign/Home/default.aspx

Maintenance Decision Support System (MDSS)
<http://mdss.meridian-enviro.com/pfs/>

Midwest Snow & Ice
<http://rebar.ecn.purdue.edu/snownice/default.aspx>

Minnesota DOT
Snow Fences
<http://www.newsline.dot.state.mn.us/archive/07/feb/14.html>

Minnesota DOT
Standing Cornrows
<http://www.dot.state.mn.us/environment/livingsnowfence/scr.html>

National Climate Data Center

<http://www.ncdc.noaa.gov/oa/ncdc.html>

National Weather Service
Indianapolis, IN
<http://www.crh.noaa.gov/ind>

National Weather Service
Louisville, KY
<http://www.crh.noaa.gov/lmk>

National Weather Service
Northern Indiana
<http://www.crh.noaa.gov/iwx>

National Weather Service
Paducah, KY
<http://www.crh.noaa.gov/pah>

Purdue University Applied Meteorology Group
<http://climate.agry.purdue.edu/climate/index.asp>

The Salt Institute
<http://www.saltinstitute.org>

ScanWeb
<http://ssiweather.indot.in.gov/>

Snow and Ice Pooled Fund Cooperative Program (SICOP)
<http://www.sicop.net/>

TrafficWise
<http://www.state.in.us/dot/trafficwise/>

Transportation Pooled Fund Program (TPF)
<http://www.pooledfund.org/>

Transportation Research Board (TRB)
<http://www.trb.org/default.asp>

University of Iowa, Snow and Ice List
Snow-ice-request@list.uiowa.edu

The Weather Channel
<http://www.weather.com>

Chapter 1 – Purpose and Principles of a Winter Maintenance Program

Introduction

Winter storms significantly impact Indiana costing millions of dollars every year in removal efforts, increased transportation 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 Indiana 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.

The manual is a product of the Winter Operations Team (WOT). This team consists of employees from each of the Indiana Department of Transportation (INDOT) Districts, Central Office, Division of Research, and Purdue University. A list of individuals from the WOT that contributed to this manual is found in the preface. This is the first update and replaces the original August 1, 2003 version.

Climate and Weather

The most important factor influencing snow and ice removal is the weather. Because of Indiana's geographic location there are considerable variations in winter weather events between the northern and southern parts of the state. Evansville gets considerably less snow than the lake effect amounts experienced in LaPorte or South Bend. However, the southern Districts can experience significant winter events, such as black ice, freezing rain and mixed precipitation for an extended period of time. Figure 1.1 shows the annual snow amounts across the state.



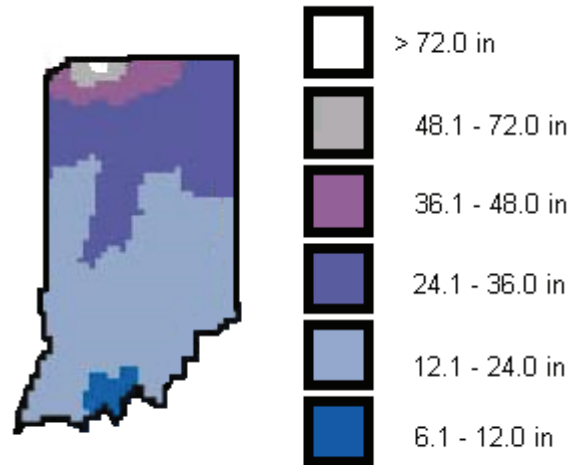


Figure 1.1 – Annual snow fall amounts

Objectives of Snow and Ice Control Programs

The Total Storm Management Manual 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 INDOT’s organization.

INDOT’s number one winter priority is snow and ice removal. INDOT efforts will maximize mobility of the traveling public and minimize accidents due to winter traveling conditions. INDOT will utilize all available resources to obtain the Department objective of keeping all INDOT roads and bridges open and passable during winter storm events.

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.



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 should include:

- 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 conduct of snow and ice control

Level of Service

Snow and ice control programs establish a level of service that satisfies the customers and is attainable with available budget and resources. Level of service (LOS) refers to operational guidelines establishing maintenance activities associated with the prevention and 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. See Appendix A2.1 for the Operating Memorandum No. 08-01 for levels of service. The eventual result is a driving surface free of snow and ice. INDOT'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. Three classes have been established.

Road Classes

Three classes of INDOT roads are identified to prioritize allocation of INDOT resources and to outline INDOT's snow and ice control service objectives.

The three classes of INDOT roadways are identified as follows:

CLASS I

Interstate routes and roadways with Average Daily Traffic (ADT) volumes over 10,000 vehicles per day, as well as other high priority roadways, including but not limited to those serving hospital facilities and other emergency service providers.

CLASS II

Routes with traffic volumes between 5,000 and 10,000 ADT.

CLASS III

Routes with traffic volumes of less than 5,000 ADT.

Service Objectives

The following snow and ice control service objectives are identified for each of the three roadway classifications:

CLASS I

INDOT shall provide service to mainline pavements, ramps, and turn lanes to remove snow and ice from pavement surfaces by plowing and chemical applications to achieve bare pavement conditions. Once bare pavement conditions are achieved, minimal plowing of shoulders should commence. All other cleanup will be deferred to normal working hours. Class I routes should be serviced approximately every 2 hours.

CLASS II

INDOT shall provide service to mainline pavements, ramps, and turn lanes to remove snow and ice from pavement surfaces by plowing and chemical applications to achieve bare pavement conditions. All other cleanup will be deferred to normal working hours. Class II routes should be serviced approximately every 2.5 hours.

CLASS III

INDOT shall provide service to remove snow and ice from mainline pavements to provide partial bare pavement. Final cleanup will generally be deferred to normal working hours. Class III routes should be serviced approximately every 3 hours.

Clean Up

Winter Storm Event cleanup activities begin after the storm ends and after the identified service objectives have been achieved. Normally, cleanup activities should be performed during normal working hours; however, under some circumstances, such as when another winter storm is approaching or sudden drop in temperature is anticipated, cleanup activities may occur during overtime hours.

Cleanup activities include plowing and spot use of materials to remove snow and ice from the driving surface. This work also includes plowing back shoulders, crossovers and approaches, cleaning and opening of frozen drains, and equipment cleanup.

Responsibilities

It is impractical to develop specific rules for every winter storm event situation due to the numerous variables involved in winter storms. The judgment of the District Highway Maintenance Director, Sub-District Operations Managers, and the Unit Foremen will govern the type, quantities and application schedules used for INDOT's snow and ice control services.

It is the intent of INDOT to use the appropriate amount of deicing and anti-icing chemicals needed to maintain and/or restore bare pavement conditions before, during and after winter storm events.

Definitions

For the purposes of this document, bare pavement is defined as a condition under which the roadway's driving surface is cleared of loose snow and ice. The driving surface may have isolated patches of snow, ice, or slush.

For the purposes of this document, partial bare pavement is defined as a condition under which the roadway's driving surface is partially cleared of loose snow and ice. The

driving surface may have some bare pavement, but the bare pavement may be limited to that portion of the pavement in the vehicular wheel paths.

Route Coverage

The routes are designed so that a truck is assigned to each driving lane on all roadways. Generally, trucks should remain on assigned routes. However, in 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 Class II road might be in danger of becoming impassible while a Class I route is providing adequate service. The truck assigned to the Class I route can be temporarily assigned to the Class II route to relieve the problem.

Office of Communications

The Office of Communications (OC) at Central Office and each District exists to assist in promoting news of INDOT's programs and accomplishments. OC will prepare news releases regarding winter operations that will be issued statewide or regionally as needed. These releases typically deal with the annual winter equipment inspections, sharing the road with snowplows and other releases as conditions warrant. OC will also place snow and ice information on the INDOT internet site including a link to www.winterdrivingsafety.in.gov. Since the Subdistricts are on the front lines of INDOT's snow-fighting efforts, if there is a need to reach the public with a specific message notify the appropriate OC and a release can be issued.

Media inquiries shall be referred to its appropriate District OC. Members of the news media are welcome to ride-along on snow fighting operations, but are required to sign a release and waiver of claims as shown in Appendix A2.4. These activities shall be coordinated by the Central Office or appropriate District OC.

Ice and Snow – Take it Slow Campaign

INDOT is using the Clear Roads Safety Program – “Ice and Snow ... Take it Slow.” It is a national driving safety campaign that has developed a logo and a slogan that is easy to remember.



Intelligent Transportation Systems (ITS)

<http://www.state.in.us/dot/trafficwise/>

TrafficWise is Indiana's intelligent transportation system designed to make driving easier and safer, particularly in the state's major metropolitan areas. INDOT is turning to technology to help ease congestion and improve highway safety. TrafficWise uses technology to detect highway congestion as it occurs and determines the reasons for it.

The system provides information to the people who need it – drivers, dispatchers, emergency responders, as well as winter operations personnel.

The Traffic Management Center operators monitor sensors and closed-circuit cameras that record traffic information. Information is also received from personnel in the field, Hoosier Helpers, law enforcement, and emergency responders. This information is used to assess and determine the causes of traffic congestion. Traffic Management Center operators respond to problems in different ways:

- Evaluate an incident and help coordinate the appropriate response. They can dispatch a Hoosier Helper van to clear debris in the road, call a tow truck to remove a disabled vehicle or work with police, fire and emergency medical services to respond to a serious accident.
- Convey information to the public. This can include activating dynamic (changeable) message signs or highway advisory radio to advise motorists of a problem and encourage them to seek alternate routes. Information also can be sent via alphanumeric pagers, the Internet or the Traffic Wise Web site (www.trafficwise.in.gov).

Starting November 1, 2009 INDOT will launch the 5-1-1 system, which provides web and phone access to winter road conditions.

During the winter months, all of the above tools can assist keeping high volume expressways operating at the highest possible level of service. In addition, Roadway Information System data can be used to help make decisions on adjacent highways.



(courtesy Indianapolis Star)

Radio Communications

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

- Instructions and re-assignments to be communicated to snow plow drivers.
- INDOT 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 Indiana State Police, towing services, or emergency services may be notified.

INDOT's radio network is composed of control stations located at the Districts and Subdistricts, mobile units in management vehicles and snowplows, and handhelds. District radios operate 24 hours/day year round. Although all Subdistricts do not operate 24-hour radios, they are manned during winter events. The network is entirely 800 MHz trunking.

Maintenance of the radio network is performed by contract. Subscriber radios are repaired by (MOL) Motorola on Line. Each Shop Foreman and District Inventory Administrator have been trained on how to obtain repair.

Snowplow drivers should perform routine checks of basic features at the beginning of each shift. Basic features include the antenna, mike cord, channel, and power (fuse). Each driver should also call in a radio test prior to leaving the Unit. If any problems are noted, a repair appointment should be scheduled right away. A back-up radio or a handheld should be utilized until the radio has been repaired.

When utilizing a radio, the following tips should be observed:

- Wait until the channel is quiet before beginning your transmission
- Keep your messages short, simple, and clear
- Know what you are going to say prior to saying it
- Use the radio for business purposes only
- If a radio user is having trouble reaching another radio, relay if possible
- Do not use slang, obscene, indecent, or profane language
- Use proper identification and acknowledgment procedures on every transmission

Responsibilities

A safe driving surface is of primary importance. The aim of snow and ice removal operations is to keep all INDOT roads and bridges open and passable during winter storm events.

The desired results can be obtained by proper use of storm forecasts, MDSS, personnel, equipment, and materials. A coordinated effort must be made between all Districts and Subdistricts to provide the public with a uniform driving surface. Listed below are responsibilities by areas.

Executive Office

- Provide Goals and Objectives
- Review and accept Operating Procedures

Winter Operations Team

- Review and disseminate snow and ice information
- Keep abreast of latest snow and ice removal technologies and developments
- Propose research projects
- Evaluate and optimize personnel, equipment, and material resources
- Develop and update Total Storm Management guidelines
- Develop Goals and Operating Memorandum recommendations

Divisions of Highway Operations and Equipment and Facilities

- Determine needs, write specifications, and develop repair and maintenance programs for snow and ice removal equipment
- Approve goals and Operations Memoranda recommended by the Winter Operations Team
- Provide assistance and guidance in implementation of operating memorandums
- Coordinate winter material procurement
- Coordinate contracts for MDSS, weather forecasts, RWIS maintenance, and related training
- Evaluate route design changes for concurrence
- Develop training materials and plan annual INDOT Snow and Ice Conference
- Participate in appropriate research studies and convey results to districts and subdistricts

District

- Provide assistance and guidance to Subdistricts to ensure implementation of Operating Memorandums and Total Storm Management
- Oversee the inspection of equipment to ensure fleet is prepared for winter
- Coordinate equipment allocation, routing and calibration
- Coordinate delivery and distribution of winter materials
- Coordinate training programs
- Assist in Quality Assurance program
- Coordinate winter personnel assignments
- Develop and coordinate route design changes for concurrence

Subdistrict

- Prepare equipment routing assignments
- Inspect and repair equipment to ensure fleet is prepared for winter
- Keep material quantities at adequate levels
- Implement Total Storm Management operations
- Conduct annual snow and ice removal training
- Call out personnel for winter operations
- Prepare needed snow and ice reports
- Determine material application and rate in accordance with Total Storm Management and District recommendations
- Provide routine weather updates to all drivers via radio
- Calibrate spreaders

Unit

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

Performance Measures

Factors That Influence Performance

Resource Requirements

Once route classifications are established for routes within a Subdistrict, the required personnel, equipment, and materials can be determined. INDOT strives to provide supervision, radio personnel, and adequate number of drivers per route during a storm. Additional personnel for loader operation are not always available. Drivers will load their own truck in this situation. Equipment is assigned to provide the minimum level of service as defined by route classification. Material stockpiles of varying size are provided at all Unit facilities. Ideally, two or more drivers per route are desired. However, a minimum of 1.5 drivers is required.

Contingency Resource Requirements

The availability of contingency resources to deal with emergency situations is an important consideration. In-house resources are sufficient in most situations; however, additional contingency resources may include:

- Stand-by or contingency contractors selected in advance on the basis of equipment rental availability. Equipment such as front-end loaders, motor graders, and tractor/trailer combinations with operators are typical.
- In-house resources from other Subdistricts or Districts throughout the state may be coordinated at the Central Office level for emergencies. Details of such actions are communicated within INDOT by the Operation Support Division and to the media through OC.

Route Optimization

Route optimization technology has been around for many years in the delivery business and is beginning to gain popularity in the snow and ice control field. Optimization may be achieved through the efforts of experienced personnel, the use of various software titles currently available, or a combination of both.

District Operations shall develop and coordinate route designs and changes. Routes shall be designed in accordance with the INDOT Total Storm Management Manual. All changes to routes should be made and finalized by October 15 of each year. Routes are to be well documented with copies sent to Highway Operations Support for their concurrence.

Key elements in route optimization are:

- Central Unit or Stockpile Locations
- Adequate Truck Capacity
- Consideration of Function Being Provided (Plowing, Spreading, Anti-icing, or a combination of these)
- Minimizing Dead-head Travel
- Maximizing Service Miles
- Fulfilling Level of Service Required

Special conditions beyond INDOT's control may limit the consideration of some key elements. See Appendix A2.2 for Planning Snow Routes Instructions.

Training Programs

Training programs are discussed in detail in Chapter 4.

Management Information Systems (MIS)

Good information is crucial to effective snow and ice control management. INDOT's Work Management System (WMS), Automated Vehicle Location (AVL), Maintenance Decision Support System (MDSS), Road Weather Information System (RWIS), and Ground Speed Control System (Muncie) can generate a wealth of information useful in judging crew performance, procedures, costs and benefits, and adequacy of resource expenditure.

Work Management System (WMS)

All INDOT employees involved in winter work activities are reported to WMS, at their assigned Maintenance Units. Labor, equipment, materials, rental equipment/operators, snow removal mileage, and snow routes are reported to WMS work orders. Snow removal; both anti-icing and de-icing are tracked as sub-activities to snow removal. Training, patrolling, brine making, winter equipment servicing/cleaning, and other winter maintenance such as winter inspection are all activities that work orders are reported to in winter operations.

Claims and Litigation

The most important factor in successful claim defense is good records. Radio and call-out logs, WMS data, ground speed system downloads, available weather information, and operator notes are all important to reflect what snow and ice activities were performed. Additional notes should be maintained to explain breeches of policy or other special events that may have occurred during a storm. District and Subdistrict can provide assistance with these forms.

Tort Claim Procedure

All INDOT vehicles should have a Tort Claim Form in the glove compartment. In the event that INDOT causes personal property damage, the claim may be given to the damaged party to request reimbursement. The damaged party should be advised to follow the instructions on the form explicitly and to provide as much supporting documentation as possible in order to expedite the processing of the claim. Note that this procedure does not refer to vehicular accidents, but instead to personal property damage such as mailbox knockdowns or broken windshields. Refer to Appendix A2.3 for the Tort Claim Form.

Budgeting

Due to the inability to predict weather for a winter season, developing accurate budgets for snow and ice control is difficult. Historical records are often used within INDOT to forecast necessary material budgets. The development of a Winter Severity Index may be of value in the future for developing and justifying budgets.

Winter Severity Index

The WOT determined that a Winter Severity Index (WSI) would be helpful for several reasons. A WSI could be used to compare the efforts of snow and ice removal between the different climatic zones in Indiana. Another is the ability to compare and analyze mild and severe winters. It will also provide a quantitative method for determining what relationships exist between different weather events and snow and ice removal. A subcommittee of the WOT was put together to study existing indices and determine if one or a combination of indices could be used for INDOT. It was recommended that if other Winter Severity indices did not work that an index for INDOT be developed. During development, the intent was to derive an index that did not require cumbersome and time-consuming data collection.

Indiana has basically four different winter climatic zones. The southern zone has milder winter weather and a considerably shorter winter season. The central zone is somewhat colder and experiences more snow. The northern zone is noticeably harsher in temperature and receives greater snowfall. Also, the northern zone can be further divided into two distinct regions; one being the northwest corner that typically receives Lake Michigan effect snows that drive up the average to twice the snowfall as the rest of the northern region. Because these four zones are different, winter weather data was collected for each of these areas.

The National Oceanic and Atmospheric Administration (NOAA) records weather conditions at various locations in the United States. A website has an on-line store where weather data can be purchased. The address is <http://www.ncdc.noaa.gov/oa/ncdc.html>. There are four Indiana locations available and they are Evansville, Fort Wayne, Indianapolis, and South Bend. Each one represents one of the four climate zones. Evansville for the southern zone; Indianapolis for the central zone; Fort Wayne for northeast Indiana; and South Bend for northwest with lake effect snow.

A statistical analysis was performed with costs and seven winter weather events experienced in Indiana: Frost day, Freezing Rain, Drifting, Snow, Snow Depth, Storm Intensity, and Average Temperature. Winter Severity Index equations were generated for each of the four climatic zones and a state index. The state index is shown below; the other equations can be obtained from the Snow and Ice Section in Highway Operations.

Statewide

$$WI = 0.71839 * \text{Frost} + 16.87634 * \text{Freezing_Rain} + 12.90112 * \text{Drifting} - 0.32281 * \text{Snow} + 25.72981 * \text{Snow_Depth} + 3.23541 * \text{Hour} - 2.80668 * \text{Average_Temperature}$$

Liability and Risk Management

Occurrence is a term utilized interchangeably to apply to accidents and personal injuries. All occurrence reports shall be completed utilizing the department's electronic Accident Reporting System (ARS) within seven (7) calendar days. Only authorized, properly trained INDOT employees shall enter occurrence reports.

Crash Reports are to be reported on INDOT Vehicle and Equipment Crash Reports. Completed INDOT Vehicle and Equipment Crash Reports shall be completed when:

1. Any collision or occurrence involves department vehicles / equipment and private vehicles, private property, or injury. Such crashes shall be reported regardless of amount of damages to department vehicles or extent of damages to private vehicles or property. A police report is required.

2. Any occurrence involving one or more department vehicles/equipment regardless of amount of damage. A police report is also required if it involves damage in excess of \$1,000.

All crashes involving INDOT equipment must be reported.

Timeliness is a key to occurrence reporting. From the occurrence, the Subdistrict only has seven (7) calendar days to submit the accident report to the District Safety Director. Original documents of the occurrence shall be kept at the originating locations, at the subdistrict or district level with the required signatures.

The paperwork and documentation presently required to process an INDOT occurrence is as follows:

1. "INDOT Vehicle and Equipment Accident form"
2. "Supervisor's Investigation Report" The immediate supervisor will complete this report.
3. "Estimate of Repairs" This form is to be completed by the Subdistrict Shop Foreman.
4. Any and all photographs taken at the scene of vehicle damage.
5. Copy of the Investigating Officer's "Indiana Officer's Standard Crash Report".
6. Copy of the "Indiana Operator's Vehicle Crash Report" This is simply the report that the driver mails to the Indiana State Police.

The above six items are required if the driver is not injured. But if the INDOT driver is injured and requires medical attention beyond basic first aid, the following must be included with the accident report.

"Report Of Attending Physician" The attending physician completes this report with the patient, accident, injury and treatment information. Finally this report states the date when the injured employee is able to resume regular work duties.

"Indiana Worker's Compensation, First Report of Employee Injury / Illness"

This report is completed by our Subdistrict office with the employee, employer, carrier / claims administrator and occurrence / treatment information.

This is a considerable amount of paperwork reporting to compile and complete accurately by the Subdistrict in the seven (7) calendar days allotted and it takes cooperation to get the report sent out in a timely manner. Some of these reports can be filed electronically, contact the District Safety Director for details.

See Appendix A2.5 for injury reporting procedures.

Emergency Assignments

At the direction or request of the Commissioner and/or Deputy Commissioner of Operations via the District Deputy Commissioner, 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 and to reflect the provisions and intent of Department Policy and/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 winter storm or flood.

- (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 District Deputy Commissioner / Subdistrict Operations Manager.
- (b) Temporary employees shall work at the direction of Unit Foremen 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 District Deputy Commissioner / Subdistrict Operations Manager.
- (c) Employees on emergency assignments shall utilize state vehicles for any travel associated with the assignment. When the emergency assignment involves the temporary reassignment of snow removal vehicles, such as Do-Alls, Single-Axles or Tandems, every attempt should be made to provide at least two (2) operators for each vehicle so that personnel from the loaning location may operate the vehicle. When two operators per vehicle are not available at the end of an individual's shifts and during off-duty periods, such vehicle shall remain available at the State / INDOT facility for use by other on-duty employees. Incidental transportation for meals and lodging may be accommodated via State vehicle as available.
- (d) Where practical, possible, and warranted under the circumstances, off-duty lodging will be provided for persons working at least 50 miles from their home and normal work location. Lodging may be provided for persons working less than 50 miles from their home and normal work location with prior approval from the Commissioner or authorized designate. District / Subdistrict personnel shall arrange lodging and payment from Department funds for the emergency assigned personnel. Such costs shall be paid from the temporary locations (or District) budget as a cost of operations for that District.
- (e) Where practical and possible, emergency employees shall be allowed reasonable opportunity to take meals of their choice at their expense with reimbursement in compliance with the State Travel policy. The District Deputy Commissioner may, with the approval of the Commissioner or Deputy Commissioner of Operations, utilize available Petty Cash funds to purchase basic groceries / food for consumption at the work

location. Receipts for such purchases shall be submitted for reimbursement separate from other petty cash activity. Such receipts must be supported by a written explanation of the circumstances, signed by the Subdistrict Operations Manager, and approved by the District Deputy Commissioner or District Finance/HR Manager.

If need exists, the District Finance/HR Manager may authorize a temporary transfer of Petty Cash to the location or request a temporary advance of additional Petty Cash from Central Office. To the extent warranted, such temporary advance shall be accommodated to the extent possible, subject to the approval of the Division Chief, Accounting and Control.

- (f) Upon return from an overnight assignment more than 50 miles from the home and normal work location, or requiring an authorized overnight stay, 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 and be processed through the 'home' District. The "temporary" District will supply the home District with a report of those employees of the home District that were provided food provided from petty cash and/or lodging from the temporary District. The District Finance/HR Manager may submit such claims to Accounting & Control with an explanation and request that such reimbursement shall be paid from the temporary locations (or District) budget as a cost of operations for that District.

In case of questions, contact Highway Operations and/or Accounting & Control.

Chapter 3 – Environmental Issues

This chapter covers environmental issues that are a part of the snow and ice effort. Issues include storage, chemical concentrations, disposal options, and other concerns.

Environmental Considerations

Pollution Control

INDOT has experienced a number of incidents involving salt pollution. In varying degrees, private properties and ground waters located adjacent to salt storage facilities and salt/abrasive mix locations have undergone pollution damage from the runoff of brine solution. Environmental concerns and media coverage have increased public awareness of the problems which salt runoff has created and mandated that appropriate action be taken at each and every location to create a clean environment. The extent of clean-up operations required at isolated locations may have influenced public opinion to the feeling that the problem is much more severe than actual. In this regard, it is imperative that every reasonable precaution is taken to insure that we have established a course of responsible salt management and instilled a level of conscious awareness within the work force.

Priority is centered on minimizing and controlling any and all undesirable situations, which might arise from the storage and/or handling of snow and ice chemicals. The plan is to control runoff to the extent that will reduce the influence on the pollution of the environment to below allowable levels. The purpose of this guideline is to establish and maintain pollution control as a top priority.

Guide lines concerning chloride levels should not exceed National Pollutant Discharge Elimination System (NPDES) standards as administrated by the Indiana Department of Environmental Management (IDEM). INDOT is responsible and accountable for activities in the areas of material storage and handling and will make a concentrated effort to promote a policy of sensible salting operations. INDOT will promote an image of concern and make a conscious effort to address the inherent problems of each facility on an individual basis. The subsequent suggestions and instructions will attempt to highlight many of the areas, which need to be addressed, but in no way are they intended to be all-inclusive.

Administration and Supervision

Exercising good practice and administering sound judgment in salt storage/handling requires some expertise and technical knowledge in the field. Although all administrators are not expected to be experts in the field, they should be knowledgeable of the sensible salting practices. Each District should identify at least one individual who has the responsibility to represent the District/Subdistrict in all issues regarding pollution and the environment. This individual should be informed in this field, having the ability and

expertise to address problems and also know where to seek assistance when it is required. In order to accomplish this, this person should participate in training courses, seminars and other informational sources to expand his/her resources and keep abreast of new techniques and technology.

INDOT's Division of Facilities and Equipment Management, Office of Facilities Management conducts annual assessments for environmental compliance at all INDOT facilities. The results of these assessments help prioritize facility expenditures and manpower efforts. It is the goal of the agency to be leader in environmental compliance.

The following is a list of responsibilities for the designated individual:

- Identify and assess the needs of salt storage facilities in regard to environmental engineering aspects.
- Provide input in design, preparation of plans, specifications, and provisions of new construction or reconstruction of existing facilities to the Central Office Division of Facilities and Equipment Management, Office of Facility Management.
- Assist in coordination of efforts between INDOT and other agencies at the local level regarding environmental or public health hazards for storage/handling.
- Ensure proper maintenance of pollution control devices and maintain the integrity of both the structure and the ecology.
- Ensure brine-makers are used and used properly. This includes the re-use of wash water from vehicles and equipment.
- Verify that units are pre-wetting the salt as recommended. This practice ensures that salt sticks to the road better and that some of the salt is already in solution when it hits the road. The result is a more efficient use of salt.
- Assist in the instruction and training of maintenance workers in sensible salting procedures including the protection of the environment during material delivery, handling, loading, and clean-up of equipment and staging areas. (Mixing and loading sites should be cleaned after each storm).
- Ensure that recommendations on de-icing/anti-icing application rates that come from the Maintenance Decision Support System (MDSS) are followed or exceptions are adequately justified. These recommendations minimize the amount of salt necessary to produce a safe roadway which not only produce the most economical use of materials, but also minimize environmental impact.
- Efficient, safe storage and handling of salt depends on the attitude and cooperation of the maintenance workers to achieve results. Their outlook on sensible salting and preservation of the environment will depend largely upon the attitude of their supervisors. If they receive a strong endorsement of good housekeeping practices, their efforts will be directed towards achieving the goals outlined within this guideline. In this regard, top management has taken a firm stand to support a policy of safe and proper salt storage and handling.
- Evaluate district-wide practices to ensure that uniform practices are conducted throughout the various units in the district.

Environmental Considerations in Facility Design

Site Analysis

Although federal and state authorities are requiring environmental impact statements for site selection, sound management practice dictates the consideration of the side effects of material storage facilities upon the environment. These considerations should be given to the construction of new sites, the enlargement of existing facilities, and operational activities at established locations.

Many problems can either be averted or created when a decision is being made regarding the location of buildings and work areas. To this end, a Long Range Plan has been developed by the Division of Facilities and Equipment Management, Office of Facilities Management with district input. New facilities will include covered salt storage (large enough to hold one years worth of salt – based on a five year average), a brine making facility, vehicle wash bays which capture wash water for brine making, and enclosed equipment storage facilities. All of these facilities include secondary containment features and have been designed to minimize the amount of salt released to the environment. In the Long Range Plan, sites are selected based on their size, i.e. their ability to house these facilities.

Management will continue to be involved and will provide additional expertise as may be necessary to ensure that proper coordination will occur at an early stage in order to effect a well organized, safe, functional, and environmentally acceptable operational Unit. All phases of planning, design, and construction will be coordinated with the environmental aspects of salt storage and will require the review of the designated individual responsible for representing the District in these matters.

Drainage Design

The new facility designs have made drainage a priority with the general features of the designs discussed in the previous section. More specifically, the designs ensure that the drainage of the storage site and mixing pad is as important to the environment as it is to providing a suitable working area. The building floor is impermeable and slopes towards the door so as to prevent the intrusion of rainwater and to prevent contamination of the underlying soil and groundwater. A seal coat is recommended to extend life and additionally protect the pad from water intrusion. The exterior pad is sloped away from the building to its outer limits and the water retained by means of curb or slope reversal of the pad itself in order that the runoff may be directed into a collection system. It is important that all brine runoff be retained in some form of impervious storage and/or evaporation facility and from that point, safely released into the environment. The most desirable situation is the usage of a sanitary sewer line, if available. The owner must give permission and some questions may arise as to the salt concentration of the brine. Use of proper housekeeping rules, Field Operating Procedure 22 in Appendix A.6.1, will ensure that the concentration of the brine is minimized. Drainage is especially critical where

maintenance units are located adjacent to ground water wells or near fresh water lakes or reservoirs.

It may be noted at this point that the topic of salt concentrations of brine solutions in the water and the soil has arisen. Acceptable chloride levels are easily addressed, but difficult to reasonably define. What may be within reason to one agency may be unacceptable to another. In this regard INDOT has established guidelines of the most widely acceptable levels, in an effort to meet most contingencies. These levels may be set at unattainable levels, in some instances. A target of approximately 1000 parts per million (ppm) or 1000 milligrams per liter (mg/l) for salt-water (brine) solution, in free form, should be the maximum discharge released from INDOT properties into the environment. There are however, exceptions to this rule. Heavier concentrations may be emitted into sanitary sewer lines. However, with the new brine making facilities, this should not be an issue.

Information such as average monthly rainfall, average monthly evaporation rates, soil conditions (percolation etc.) size of storage and mixing pad, number of snow/ice routes, and location and size of the equipment clean-up area are primary factors in the design of such a facility. Other, less obvious, factors must also be considered. Central Office Division of Facility and Equipment Management, Office of Facility Management will direct the plan development of such facilities with input from the District.

Collection facilities such as brine retention lagoons, constructed with impervious liners, which may be composed of dense graded bituminous mixes, geomembrane fabrics or a combination of these, may be used to reduce runoff. These lagoons must retain their imperviousness and durability when subjected to repeated clean-up and maintenance operations. Steel and/or concrete tanks should be bituminous coated.

In addition to salt pollution awareness, there are other environmental considerations that are indirectly related to the snow and ice control. One such example is in the equipment maintenance area. Oil used for the chains and sprockets should be handled in a proper manner so it does not drip on the ground. Saturation from this material can lead to environmental issues. New facilities are designed with impermeable floors and oil water separators in order to address this issue.

Anti-Icing and Deicing Guidelines

It is important to maintain a special environmental awareness and sensitivity among managers and operators in the use of chemicals and other products and procedures for snow and ice control. Special consideration should be given to:

- Minimizing runoff from roadway applications
- Proper storage of chemicals and abrasives
- Protecting groundwater, including wells and aquifers
- Protecting vegetation
- Protecting maintenance facilities and equipment against weather and corrosion
- Protecting transportation facilities (bridges, pavement, appurtenances) against corrosion

- Protecting employees from the potential dangers associated with snow and ice control materials
- Minimizing the use of abrasives
- Protecting surface water quality
- Protecting habitat quality
- Coordinating with permitting agencies
- Use of proper housekeeping rules (see Appendix A.6.1) to ensure that release of salt into the environment is minimized.

Highway Operations is charged with the responsibility of minimizing the harmful effects of chemical de-icers on the environment by addressing the manner in which plants, soils, and waters are affected by de-icing applications. Although chlorides are not reported to have harmful effects on soil characteristics, they have been found to exert a toxic (harmful) effect on plants.

Salt may travel more than 100 feet laterally from the roadway, even when the ground is very gently sloped. As a result, concentration levels along the roadside are increasing. Studies have determined that sodium levels from 0-18 years of salting at distances from 0 to 45 feet from the edge of pavement vary from 30 ppm to 488 ppm. Chloride concentrations in the same time frame and at the same distances have varied from a trace to 217 ppm. To minimize these conditions one goal of operations should be to minimize the use of salt and brine necessary to achieve the desired roadway conditions. Following recommendations from the MDSS will aid in attaining this goal.

Chapter 4- 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, Roadeo, and postseason issues.

Personnel Management Issues

The District shall coordinate winter personnel assignments. It is the Subdistrict Operations Managers' responsibility to call out the right number of people at the right time. The Subdistrict Operations Manager may delegate authority to call out people to the Unit Foremen, or another designee.

Scheduling and Reporting for Duty

Scheduling staff for a winter storm is a difficult, but necessary task. Call-out must be within the guidelines as set out in the current call out procedures. Appendix 4.1 is the current District Call-Out procedure.

Drug and Alcohol Issues

INDOT is committed to providing and maintaining a drug free workplace. INDOT employees need to be physically and psychologically fit to do their job. INDOT not only depends on, but also is very concerned about, the physical and psychological health of its employees. A working environment free of drug and alcohol use is healthier, safer, and more productive.

Federal regulations require INDOT to make all employees aware of the following:

- The unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance, is prohibited in the work place. Controlled substances include marijuana, cocaine, heroine, amphetamines and depressants.
- Any employee convicted of violating such a criminal drug statute in the work place must notify INDOT within five days of such conviction.

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 Indiana. Therefore, they must observe safe practice rules and follow instructions relating to the efficient performance of their job. No job is so important or service so urgent, that time cannot be taken to perform the work in a safe

manner. It is impossible to establish safety information which applies to every situation. There is no substitute for using sound judgment and good common sense.

Drivers should be aware of the following:

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

Being prepared for the long hours of work is also essential. Get adequate rest prior to the onset of a storm. Dress in layers to be comfortable in the truck and outside as the need arises. Safety items required include: accident forms - a charged fire extinguisher - reflective triangles or flares - first aid kit – flash light- safety vest and flags. Keep a list of radio numbers handy along with the phone numbers of surrounding Units and Subdistricts. 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 INDOT. The snowplow driver needs to constantly be on guard for unsafe acts of the public. Things that will help are: Being aware of and obeying all traffic laws and avoid making sudden or unannounced moves. Avoid pushing snow off of overpasses and into other lanes of traffic. Avoid pushing snow onto sidewalks and into storefronts. Try to avoid throwing materials onto vehicles or pedestrians.

Summary

Winter work at times can be stressful both mentally and physically. Drivers are on the road in the worst weather possible. Drivers have to be concerned with plowing the snow, putting down material, making sure the trucks are operating properly and the actions of the public. Employees can do the job in the safest way possible, but the inattentiveness of another driver can change a day from routine to a nightmare in seconds. Any of these are stressful, but combined with long hours of driving they can seem overwhelming. Take

breaks – Get out of the truck and stretch – Good nutrition is essential – Wear clothes in layers – Make sure the truck is equipped with the proper safety items – Get plenty of rest.

Preseason Issues

Emergency Contact Procedures

Districts will establish winter emergency contract procedures and distribute them to state, county, and local law enforcement agencies.

Snow and Ice Training Program

Each management level of the Operations organization has responsibilities for training in snow and ice removal. All employees involved in snow and ice operations shall attend annual snow and ice training coordinated by the District and conducted by the Subdistrict. Training shall include actual demonstrations with equipment, review of the Department Objectives and Procedures, Total Storm Management, and safety.

Each Subdistrict facility's date, time and location of Snow and Ice training will be circulated District-wide via a calendar of events to insure Subdistrict and District trainers' timetables. Snow and ice training will begin before the first week of October and end mid-November. Employees will be expected to report to their assigned Subdistricts for training. In the event of an emergency or prior assignment to an INDOT job causes an employee to miss the assigned Subdistrict's training session, training sessions will be held at other locations within the District. Employees selecting an alternate location for training will take the certification portion of their Driver Training Documentation form back to the facility where they are assigned for the winter season. The supervisor at the assigned location will then determine a certification date for that employee for completion of their form. A copy of the Driver and Loader Certification Form is in Appendix 4.2.

Training topics include, but are not limited to:
Maintenance Decision Support System (MDSS)
Safety Issues / Wind Chill Chart
Radio / Mobile Communications
Equipment Preventive Maintenance
Daily Check List / Repair Request
Fluid Chart
Spreader Installation
Calibration Charts
Plow Installation
Snow & Ice Control Materials
Muncie Systems Operation
Taper Log – Snow and Ice Removal Event Log
Route Familiarisation
Route Documentation

- Driver Certification
- Snow and Ice Removal Techniques
- Clean-up Operations
- Responsibilities
- Callout Procedures
- Work Reporting
- Supervisor's Investigation Report
- Vehicle & Equipment Accident Report
- Report of Injury
- Work Management data
- Public Relations
- Tort Claim Procedure
- Reports & Forms
- Fuel Stops
- Subdistrict Snow Routes
- Tips & Hints from Veteran Drivers

The day of training may include a multi-part comprehensive training video, during which “prompt pages” between segments will allow District, Subdistrict and Unit level personnel to make presentations or demonstrations covering related topics that were covered in the prior video segment. Also, the Snow and Ice Training Manual will be distributed. It will contain pertinent text related to all phases of a storm event, examples of the forms and reports used during the winter season, a list of local fuel vendors, that area’s snow routes and suggestions and tips from veteran plow truck drivers.

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

Personnel Transfers

INDOT 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, operate the radio, and do other related duties.

On or before November 1 of each year, each District needs to have winter reassignments finalized. This plan should allow for volunteers. Employees may be transferred full time into maintenance or called upon on an as needed basis. In locations with critical driver shortages, INDOT has encouraged employees that are not required to have a Commercial Driver’s License CDL for their regular jobs to obtain them.

Although every attempt should be made to keep people as close to their homes as possible; there are a number of instances where this may not work.

Commercial Driver's License (CDL)

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

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

The Federal Government mandates that all employees who are required to maintain a commercial driver's license (CDL) to perform their job duties, must be eligible for drug and alcohol testing. This testing includes pre-employment, random, reasonable suspicion, post-accident, return to duty and follow-up. Any CDL driver who tests positive for drugs or 0.02 blood alcohol content (BAC) and above or who refuses the test will be subject to dismissal.

Truck Safety Roadeo

The purpose of the INDOT Truck Safety Roadeo is to encourage safe snow truck operation, recognize the skills of INDOT snow truck drivers, and award their excellence; thereby boosting employee morale.

Department wide Roadeos may be held prior to the winter season. All INDOT personnel with a valid CDL driving license are encouraged to participate. Only employees with valid CDL licenses will be eligible for the District and State Final competitions.



Postseason Personnel Issues

Postseason begins after the threat of snow and ice is over in the spring. The District, local police forces and State Police are then notified that the emergency contact list is

void and they are issued new procedures to follow for emergency contacts. With the end of winter operations, the need for temporary/seasonal winter employees ends.

Office of Equipment confirms the final date for the last Weather and Truck Reports, each Subdistrict sends its data to the District. The District makes its last entries for its region, and the state-wide updates are compiled (on the 'Y' Drive) for postseason evaluation. The data can then be reviewed on the intranet.

There are occasional requests from the District for appraisals from the Subdistrict/Unit where transferred INDOT employees were assigned to work that season, after those employees have returned to their original sections.

At Unit locations, prior to the postseason inspection, all employees turn in any Operators Daily Checklists to Unit Foremen to have Work Requests turned in to the Subdistrict Shop. All winter-related personal items are taken out of the vehicles and trash is thrown out. Equipment is obtained to safely seal the salt domes for the warmer weather season, after the final salt report has been turned in to the Subdistrict.

Unit Foremen conduct postseason "tailgate" meetings to discuss successes or needed improvements for local winter operations and discuss the final standing of the call out list.

Chapter 5 – Equipment

This chapter addresses mobile and special support equipment for snow and ice control, its acquisition, 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), material spreaders, 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. Materials spreaders 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.

Acquiring Snow and Ice Equipment

Pre-winter preparations begin with the end of the previous winter. In March, the equipment is inspected to determine repairs and painting needs. A requisition is put together to promptly get a purchase order and start painting trucks as soon as possible. Major repairs are done as funds allow.

Snow and ice equipment is purchased out of the Equipment Budget. This budget is used to purchase all of the Department’s transportation vehicles, snow and ice removal equipment, mowing equipment, and other road maintenance equipment. The budget is appropriated annually and is administered by the District. At the beginning of each fiscal year, the total budget is divided between the Districts and Central Office locations. After each District is notified of its share of the total budget, a prioritized list of the vehicles and road maintenance equipment it would like to acquire from the current budget is prepared. This list includes the number of snow trucks, plows, spreaders and other snow removal equipment the District would like to replace. After these requests are prepared and approved by the District Deputy Commissioner, the Fleet Managers and Equipment Section specification writer in consultation with Central Office prepares specifications for the equipment. Requisitions for the equipment are prepared by District Fleet Managers

and submitted to the Procurement Section of their respective District. The Procurement Section is then responsible for advertising and receiving bids for the equipment. See Appendix 5.1 for a list of equipment, cost, and fleet size. Appendix 5.2 is a list of the dump truck types, cost, and recommended fleet size.

Rental / Contractors

Occasionally, INDOT equipment resources are not sufficient to adequately perform snow and ice removal activities. To supplement INDOT resources, equipment may be rented.

Procedure for Snow and Ice Equipment Rentals without Vendor Provided Operators

1. Determine what equipment is needed to augment current snow removal fleet. Keep in mind the availability of equipment such as loaders may be limited during the Fall and Winter months. The vendor is not obligated to hold equipment for INDOT even if there is a purchase order on file. Therefore it is important to rent pieces of equipment that are required, early in the season.
2. Check the current Quantity Purchase Awards (QPA) for Equipment Rentals to see if the desired pieces of equipment are on the QPA. If the equipment is on the QPA, the District/Subdistrict should contact the vendor for availability and prepare a QPA. If the equipment is not available on QPA, the District/Subdistrict must go through the bid process to acquire needed equipment. The INDOT Procurement Manual gives detailed instructions for processing a QPA or for processing bids.
3. After the funds are encumbered, contact the vendor for pickup or delivery of equipment. At the end of the rental period, the vendor will invoice INDOT.

Procedure for Emergency Snow and Ice Equipment Rentals with Contractors

1. In late summer contact contractors that do work within the District requesting their hourly equipment rental rates for their applicable snow and ice control equipment. Rates should include their equipment operator and any applicable overtime and holiday rates. The rental period should be for mid-November to mid- April. The contractor shall provide a list of personnel to be contacted when help is requested.
2. Compile the responses from the contractors and check rental rates against the current AED Green Book rental rates. The responses can then be summarized and distributed to personnel involved in contacting the contractors.
3. When a snow emergency develops and the Subdistrict has initiated a request for help, the District will authorize the equipment rental. The District/ Subdistrict will coordinate the equipment and keep track of the hours of use.

The contractor will invoice INDOT for equipment used, the hours of usage, appropriate hourly rate, and road location(s) worked on. After receiving it, the invoice will be processed in a timely manner.

Snow Blowers

Although Indiana is not known for the extreme snowy conditions that routinely batter parts of the country, 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.

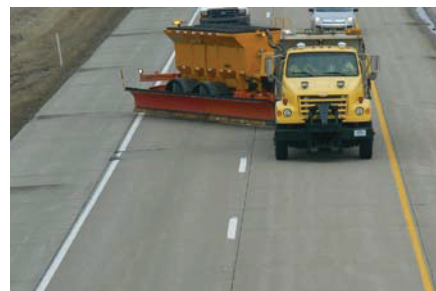


Blowers come in a variety of shapes and sizes but basically are rated by the tons of snow per hour that they can move. There are self-contained units and units that mount on the front of a loader and snow can be thrown 100 to 150 feet. (Be careful of mailboxes, vehicles, and surrounding houses!) Many 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.

Because of the fairly high cost and the relatively little use probability, it is not practical for each District to own a blower. The Equipment Section has approved one unit to be shared throughout the state. Blowers may also be rented and possibly borrowed from agencies such as the National Guard or local airports.

Tow Plow

The Tow Plow is a snow plow designed to tow behind a truck with a standard plow mounted on the front. This combination can increase the clearing path to as much as 24'. The primary use is multi-lane, high speed echelon plowing in which the Tow Plow replaces one standard plow unit. The tow plows can clear a huge swath through fallen and drifted snow. They combine conventional left- and front-mounted plow blades with a blade 26 feet wide that swings out from behind the truck like a scorpion's tail. When fully configured, a tow plow can clear two and half highway lanes or two lanes and part of the shoulder.



Fleet Management Requirements

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

Equipment Management System (M-5)

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, Fleet Focus (M-5). This system contains detailed records on all INDOT 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

M-5 contains PM schedules for all vehicles and many other types of equipment. When a previously determined interval is reached, M-5 automatically generates a repair order 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 person/location 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.

Refer to Appendix A5.3 for Preventive Maintenance Schedules.

Hour Meters

It is the Unit Foreman's responsibility to turn in the updated hour meter reading by the end of each month on dump trucks, loaders, tractors, crew cabs, stake beds, bucket trucks, full size pickups, or any equipment that has two meters. This enables the Shop Foreman to update the meter reading on the M-5 System.

Repair of Equipment

The Shop is responsible for equipment repairs. The Shop Foreman shall be responsible for deeming a piece of equipment as "temporarily out of service". Refer to Appendix A5.4 for Operator's Daily Checklist and A5.5 for Equipment Repair List.

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 Unit Foreman is responsible for making sure that reported maintenance needs are performed and equipment is in good working order.

Truck and Weather Reports

This is an optional report for each District. This report is done daily, by each District, starting in the late fall and ending each spring. The M-5 Program Coordinator in the Equipment Section of the Facilities & Equipment Management Division notifies the Districts of the exact date that this report is to start. This report shall originate at each Subdistrict, be compiled by the District, and be posted to the INDOT intranet, no later than 8:30 a.m. (Eastern time) daily. During snow events this information will be submitted every four hours through the length of the event. The exception to this will be if conditions change significantly between reporting times the sub-districts are to report this information more frequently. This information will be posted on the INDOT intranet to be reviewed by management and staff. The public information section will also utilize this information to create press releases, answer public requests and to create additional reports required during snow events. The Districts are requested to report the following in the comment section.

1. Current weather conditions
2. Time Snow Operations Began
3. All Road Closures including location of closure
4. Any power outages (if they are aware of any)
5. Accidents involving INDOT vehicles (no employee names)

Individuals that submit information to be posted on the intranet, must have the Truck and Weather Icon on their computer along with a password clearance. Password clearance can be obtained by contacting the M-5 Program Coordinator in the Facilities & Equipment Management Division. Each District should have at least one backup. Refer to Appendix A5.6 for a sample of the Truck Report.

Fall Snow and Ice Inspection of Equipment

Each fall, an inspection by District/Subdistrict personnel shall 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 District will travel and inspect the same items at each Subdistrict. The inspection shall include, but is not limited to: dump trucks, snow

plows, spreaders, loaders, graders, conveyors, and ground speed control units. Liquid distribution systems, liquid storage systems, temperature sensors, AVL systems and weather data systems (RWIS) may also be inspected.

A list of dates, times, and locations for these inspections shall be supplied to the M-5 Program Coordinator in the Equipment Section of the Facilities & Equipment Management Division by each District by September 7th each year. The inspections should be done between September 15th and November 1st every year.

Each dump truck, spreader, and snowplow shall be inspected using the Fall Snow and Ice Inspection Form. See Appendix A5.7 for the Fall Snow Removal Equipment VIP Inspection Report. All other pieces of equipment not part of the Fall Snow and Ice Inspection Form shall be inspected against a predetermined checklist.

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

Spreader

All material spreading equipment, including ground speed equipped vehicles, must be calibrated prior to the winter season with assistance by District personnel, as needed. Each spreading unit shall be calibrated to provide an accurate rate of application. For units with the Muncie Power Products ground speed control, a PowerPoint presentation has been prepared by Muncie explaining the calibration process. The PowerPoint presentation can be obtained from the District Muncie coordinator or Central Office, Office of Maintenance Administration. For units without ground speed control, a chart listing the various driving speeds and spreader setting combinations for the designed application rates should be prepared for each unit that spreads.

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. INDOT 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. Temperature

sensors are now included with the Muncie controllers. To insure that accurate measurements are obtained, the sensors need to be checked periodically, at a minimum annually. The District 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.

Road Weather Information Systems (RWIS)

INDOT maintains a network of weather systems called RWIS. Data from the RWIS can be seen on the MDSS website and/or the RWIS website. A RWIS maintenance contract is maintained by the Central Office Snow and Ice Section. Any abnormalities with RWIS data should be reported to the Snow and Ice Section.

Storm Issues

Pre-Trip Inspection

Prior to any INDOT vehicle leaving the Unit site for snow and ice related activities, a pre-trip inspection must be performed. Equipment preventive maintenance ensures that vehicles will operate at optimum performance levels and will contribute to the equipment's future durability. Employees are to fill out the Operator's Daily Check List and report any problems to the Unit Foreman on an Equipment Repair Request. A copy of each form can be found on A5.4 and A5.5 in the Appendix. Depending on the severity of the problem another vehicle may be assigned for that shift. The pre-trip inspections are also vital aspects of personnel safety; they could prevent a potentially dangerous snow-event breakdown. The Pre-Trip Walk-Around Checklist can be seen in Appendix 5.8.

Subdistricts inform the Unit Foremen of impending weather and the work crews are then requested to do an initial equipment check, prior to precipitation. That inspection may include: checking that all trucks are plugged in, examining plows for wear and damage, 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 truck inspection. Checking truck fuel levels and reserve truck mounted tanks for refueling during the storm event are vital precautions because INDOT facilities no longer have on site fuel pumps. If the truck fuel is not to capacity

and no reserve is readily available, valuable storm fighting time may be lost while obtaining fuel.

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. Also, the vehicles equipped with pre-wetting tanks need to be emptied.

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 applied 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, spreader controls and floor- boards.

Grease all fittings on the plow and spreader box and check for wear, damage and adjustment of spreader box chains. The last item of the clean-up as the truck is pulled up to plug in, is checking to see if the sticker from the shop requires a preventive maintenance check (PM). 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. Any equipment needing service, the Unit Foreman is to be notified and the shop contacted to schedule the work.

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. Although this inspection is not as elaborate or as structured as the preseason one, an independent team of District personnel needs to review all of the equipment. 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. Spreaders shall be re-greased as needed. All material handling equipment, including liquid pumps, storage tanks, spreader chains and boxes, conveyors, beds, and plows shall be periodically maintained during the off-season as needed.

Chapter 6 – Snow and Ice Control Materials

A variety of materials are utilized by INDOT 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 Districts. Refer to Appendix A6.1 for the Operating Procedure No. 22 for information on the following: pollution control guidelines, design of brine storage, mixing/handling of de-icing chemicals and clean-up of existing facilities.

Material Acquisition

This section describes the policies and procedures to follow in acquiring the various materials used in winter storm events.

Salt Purchase

INDOT's Division of Accounting and Control Purchasing Section sends the salt request to the Department of Administration to bid. A Quantity Purchase Award (QPA) has been used successfully in recent years. After QPA's are established, Districts initiate purchase orders. The purchase process is started no later than April 1st each year in an effort to have purchase orders in place by July.

The Central Office, Office of Maintenance Administration, Snow and Ice Section is responsible for collecting information from the Districts for the proposed purchase quantities, delivery locations, and early fill needs. The Snow and Ice Section applies this data to the appropriate forms and submits the forms along with any revisions to the INDOT Specifications and Special Provisions Document to the INDOT Procurement Section. Each individual District is responsible for budgeting for salt from the Work Program.

Quantity Purchase Awards for Chemicals

Quantity Purchase Awards (QPA) are established for most chemicals that are purchased. Based on input from District offices, the Purchasing Section establishes QPAs for Calcium Chloride, Magnesium Chloride and Agricultural Based De-icer. District offices prepare QPA releases. Chemicals are budgeted and purchased through the District Work Program.

Open-End Bidding for Abrasives

Abrasives are budgeted and purchased through the District Work Program. Subdistricts purchase abrasives through open-end bids.

Specifications

Salt Specifications Preparation

The Office of Maintenance Administration, Snow and Ice Section, compiles the specifications for the annual salt bid with input from the Districts. Revisions to the specifications are normally discussed and agreed upon at the Highway Maintenance Director's Meetings and or Winter Operations Team meetings. Districts are requested to identify quantities needed for the next fiscal year. The Deputy Commissioner of Operations approves salt quantities.

The contracts for salt require INDOT to purchase a minimum of 80% of the contract quantity. Bids are requested for a delivered (dumped) and loaded (conveyed) price per District. Variations of the maximum quantity may be requested, normally 120 to 150% of the contract quantity. If these quantities are exceeded, the Snow and Ice Section can assist with attempts to procure additional salt.

Sodium Chloride (Salt) Specifications

Sodium chloride, typically referred to as salt, is INDOT's primary snow fighting chemical. On an average, roughly 380,000 tons of salt is used every season accounting for an expenditure of approximately eighteen million dollars. Because of these huge amounts, it is important that the salt used meets various specifications to insure the highest quality. INDOT contracts annually with salt vendors. Typically those vendors subcontract delivery and/or loading to other companies, and since each District 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 AASHTO M 143, Type I, Grade I specifications. There are minor variations that are contained within the Special Provisions that accompany the actual bid documents. Each District should have a copy of these. The District Materials & Tests Section is responsible for the acceptance sampling of the salt, but assistance from Subdistricts and District 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 INDOT's Central Laboratory where purity tests are run. The gradation of the material, its size, is determined in the District. Moisture content is a critical factor and is likewise checked in the District. For any materials that do not meet requirements, adjustments to the unit price of the salt are imposed. Each District has a representative that oversees payments, and this person typically works with Materials & Tests to review failures and determine final payments. All of these details are contained in the Special Provisions of the contract.

All salt that is delivered must be inspected. This includes a visual inspection and/or testing. A stockpile test sample represents many tons of material and is at best a spot check on the vendor's quality control. The final acceptance must be done as salt is delivered. An INDOT employee must visually inspect the salt as it is being loaded into storage. Contamination may occur from the loading or trucking operations that would be missed by stockpile sampling. If inferior material is suspected, immediately contact the Materials & Tests Section.

Several other considerations include:

- All trucks making deliveries shall be tarped
- An INDOT representative shall sign all delivery tickets
- Legal load size
- Random weight check

Salt shall not be unloaded on the ground or outside a storage building without specific order by the Department

Liquid Chemical Specifications

INDOT 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 the Materials and Tests Section 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 value of 1.18, which is 23.3 % concentration. This optimizes the product with a freeze point of -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. Refer to Appendix A6.2 for a sample of how to document test results.

Eutectic Information Table for Various Snow and Ice Chemicals

Refer to Appendix A6.3 that graphically illustrates the lowest effective working temperature (°F) for each chemical at a given percent solution. A6.3 (graphical form) and A6.4 (tabular form) should both 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 District Highway Maintenance Division 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.

Re-supply during the season is handled similarly, with new orders being based on material usage obtained from Subdistrict salt reports. Lead-time should be considered when placing re-supply 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 District Operations; this information is then forwarded to the appropriate Subdistricts. Subdistricts make arrangements for their employees to receive materials. Specified employees are responsible to visually inspect material and delivery trucks; collect delivery tickets; obtain Material Safety Data Sheets (MSDS); and take appropriate storage action. Each District handles the processing of materials payment differently. Material tickets are filed; invoices are verified and processed for payment.

Material Loading and Storage

Front-end loaders or conveyors are used to load salt into storage buildings. Provisions are available to have the salt vendor unload for a nominal fee per ton. Some salt storage buildings are designed for direct loading by the salt delivery trucks, thus eliminating the need for a loader or conveyor.

Chemicals are loaded into tanks by the vendor with direction from Subdistrict personnel.

Storage Facilities

Solid chemicals shall be stored inside a building or under an appropriate weather-resistant cover, on an impermeable pad. Chemicals stored in the open absorb moisture, produce leachate that drains into streams and aquifers, and develop an outer crust that has to be wasted or broken up prior to use.

Solid chemicals shipped in bags shall be stored in a dry place, preferably in an enclosed building. Storage for more than one year is generally not recommended. Storage should be arranged so that the oldest material can be used first. Outside storage is possible if the bags are elevated on pallets and covered with a weather-resistant cover; this is not recommended for calcium chloride since it naturally draws moisture.

Liquid chemicals are typically stored in outdoor bulk tanks, although some recent 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 precipitation of solids.

If used during the winter season, treated winter sand is usually stored outside on an impermeable pad and covered if possible. Leftover winter sand should be relocated in covered storage buildings after the winter season. Bulk chemicals have the first priority for inside storage. Any winter sand that cannot be stored inside during the summer season should be placed on an impermeable pad and covered with a moisture-proof material.

All storage facilities shall have appropriate secondary containment and run-off control to meet current environmental requirements.

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, spreader 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 spreader

Material Inventory Recording & Reporting

Recording

The accuracy of material recording directly effects 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 cause a potential disruption of snow fighting efforts. It is critical for tonnages to be accurate, so INDOT personnel must continually strive to maintain their records. One source for material recording is the MM 359, Material Data Sheet (Loader Sheet). See Appendix A6.5 for the Loader Sheet form.

After the vendor's tickets for material received have been tallied, the Unit Foreman, WMS Clerk, or Operations Manager can then verify the tonnage and enter a material receipt to the WMS stock bin. Unit Foremen can also record their beginning balances either on the Material Data Sheet or an informal Unit Material log. During the storm event, drivers track the material types and amounts loaded. Materials used are entered in Material Day Cards of the Snow Removal Work Orders. If material is returned to the pile, the estimated amount is deducted from the total tonnage previously recorded. The Unit Foremen review the material information at the end of the shift and should verify the Unit Material log and approve the WMS Material Day Cards. Keeping a Unit Material log enables accurate records to be recorded during the time of immediate use. Prior to the Completion of the Snow Removal Work Orders, the WMS Clerk and/or Operations Manager should review the approved Material Day Cards for accuracy.

Once material records are approved and completed, the WMS Clerk and/or Operations Manager can edit the stock bin totals, by entering a Correction transaction. Periodic visual inspections of the material stock bins will allow for more accurate inventory management.

Winter Work Management System Reports

All winter WMS information is available in a query-type reporting environment called Tabular Reports. These reports can be filtered to the specific data desired for any information on work orders, day cards (labor, equipment, and materials), work activities, and/or material stock bins. There are also specific reports that have been built that are formatted the same for all users; these are Jasper Reports. The WMS staff pulls monthly Productivity Jasper Reports, which will show the number of miles a given location has serviced, on a snow removal work order, against the state production standard. The staff also pulls a weekly snow removal mileage report, in Tabular Reports, which showcases mileage, by equipment class, Unit, Subdistrict, and District. The Statewide Salt Report that is posted to the intranet is pulled from Jasper Reports as well. The Winter Materials Usage History and Five/Ten Year Averages are also pulled from Jasper Reports. Fiscal year 2010 will be the first winter that the Management Information Portal (MIP) will have a Salt Usage/Procurement report that shows PeopleSoft and WMS data, for cost and salt tonnages.

INDOT 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. Each District should identify an individual responsible for material coordination, in the District office, to review winter material stock bin transactions. They should also work with Subdistricts to ensure that material transfers are captured to the correct stock bins. District operators that deliver materials, District-wide, should have instructions that provide clear guidance on who is responsible for material delivery and recording. This individual should pull material usage reports, in WMS and review the posted Salt Report. The Salt Report is automatically graphed and generated in WMS, and then displayed on INDOT's INTRANET web site. Questions concerning materials reporting should be directed to the Work Management Section personnel or the District material coordinator.

The materials to be reported include:

- Salt
- Calcium Chloride (liquid)
- Calcium Chloride (solid)
- Magnesium Chloride
- Agricultural de-icer
- Salt brine
- Other

The reports are posted on the INDOT Intranet under Reports/Truck and Weather Reports.

Monitoring Chemical Usage with TAPER Logs

INDOT has been applying dry chemicals during the winter season for many years. Personnel are familiar with a wide variety of storms and conditions that have occurred numerous during this time frame and pretty much know what to do to provide the best treatments to restore pavements back to normal. As new products are being utilized, INDOT needs to become comfortable with these products and feel comfortable knowing that the treatments made are getting the job done. It is also important to use products that are both economically and environmentally correct. One method to document chemical usage and to gain a history of performance results is the TAPER log. Refer to Appendix A6.6 for a sample of the TAPER Log Report.

TAPER is an acronym for Temperature, Application, Product, Event, and Results. It was developed by Dale Keep, one of the nation's foremost experts on snow fighting, as an easy method to track experiences and establish guidelines that meet operational needs. No single application rate fits all storm events or environments. Application experience is the foundation for effective product use.

INDOT has made some minor modifications from the original form and has developed its own version of the TAPER log, "INDOT Snow and Ice Removal Event Log."

Although it is basically self-explanatory, some care is needed to fill out the log accurately. After reviewing the effectiveness of the treatments, application rate tables can be developed to summarize rates for various conditions. A hypothetical application rate table is shown in Appendix A6.7.

Chapter 7 – Weather Information Systems

INDOT utilizes many resources to predict and track winter storms; these include a Maintenance Decision Support System, the National Weather Service, Road Weather Information System (RWIS), 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.

Maintenance Decision Support System (MDSS)

Maintenance Decision Support System (MDSS) is an effective decision support tool for highway maintenance and operations. MDSS considers past, present, and future weather conditions, pavement conditions, and maintenance actions, as well as agency policies, practices and resources information, in the decision process.

Meridian Environmental Technology Inc. is currently providing our Maintenance Decision Support System (MDSS) service via the Internet. A Graphical User Interface (GUI) for INDOT's MDSS is available for download at <http://mdss.meridian-enviro.com/pfs/>.

MDSS incorporates observations from surface weather observing networks, Roadway Weather Information System (RWIS), and AVL, automated vehicle location system and integrates them with remotely sensed meteorological information collected from weather radars and satellites. MDSS takes the weather information combines it with pavement characteristics and available treatment options and creates a model for recommended treatments during the winter event. The recommendations are treatment types and the timing of these treatments.

MDSS uses map views to display the results of the server –side processing via a client-side graphical user interface, the map (GUI). The MDSS server continually updates weather data (current and forecasted) route conditions for all routes in the user's area, advisory messages, and user-supplied maintenance actions and is available to users through a web browser. MDSS information is stored in various layers and the user selects information layers, their parameters and time periods which can range from 24 hours before and after the event starts. The time displayed control permits looping, incremental transition in the user selected time intervals, and direct selection of a specific time. All layers update as the time slider changes. Users have the option to display various map features such as county boundaries, highways, rivers, towns, lakes, RWIS locations, and National Weather Service weather observation sites. MDSS also provides through email potential adverse weather conditions in four categories: weather, road conditions, blowing snow, and NWS watches, warnings, and advisories for the next 24 hours. The first alerts are route specific. By placing the mouse over the specific alert cell, the GUI will provide a text description of the alert criteria. The alert panel is area specific and can be defined by the user which can be state-wide, current map view, or a specific route or area.

The map view is a selection tool for greater detail regarding any of the display parameters. By using the mouse, users may display the details associated with a particular map icon. Drop-down windows contains the requested information for that specific site. Typically these drop-down displays contain another link that permits the user to switch from the map view to a presentation format that shows historical information or forecast information associated with a selected map view. The users can view cameras, AVL truck locations, route switch view of past & future forecast and weather information, treatment recommendation on specific routes, and RWIS information.

The following images are MDSS screens showing the type of map information available.

This is a current radar image. Like most MDSS screens the user has choices on display options.

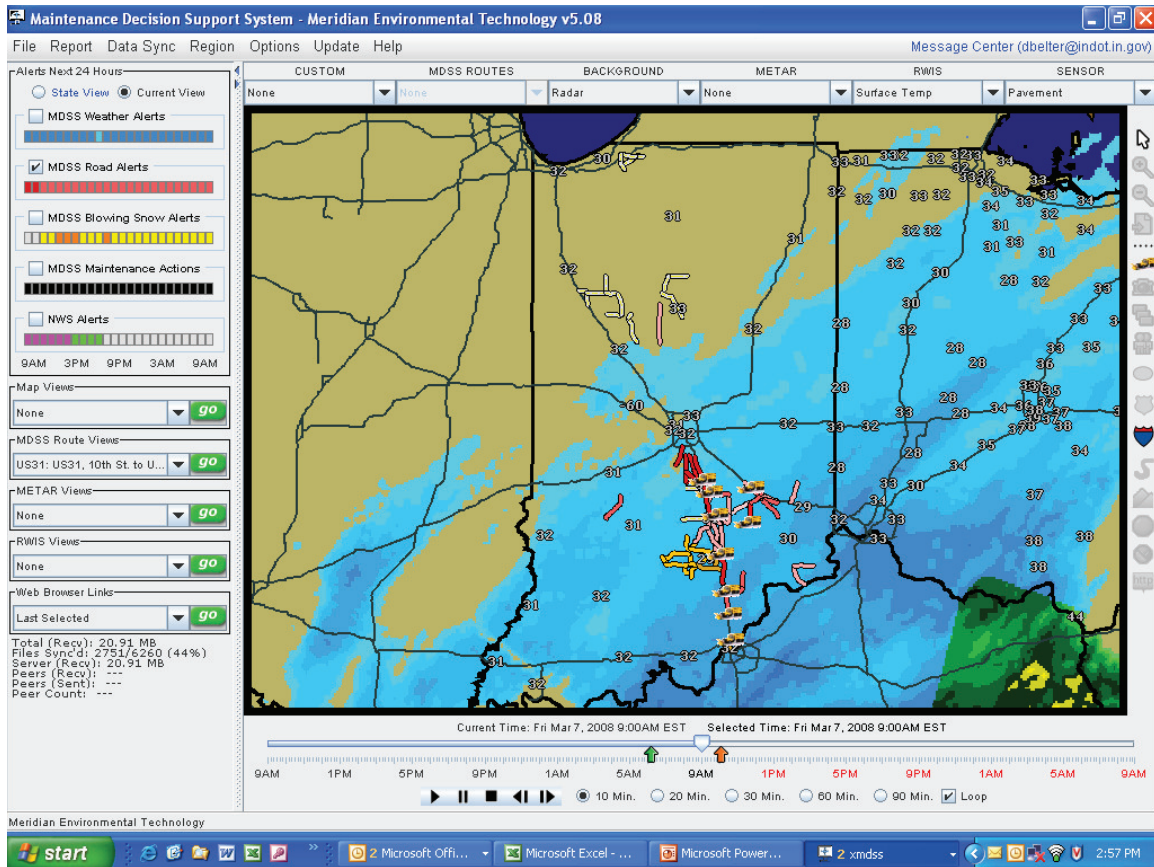


Figure 7.1 – Current Radar

Projected radar images are possible for a specified time interval that is controlled by the user.

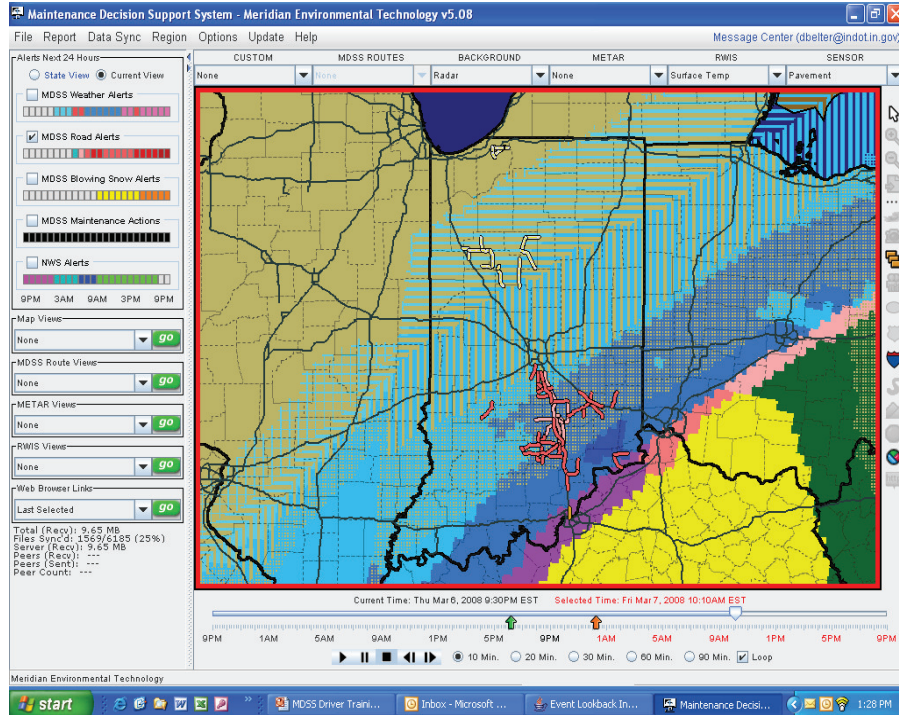


Figure 7.2 – Projected Radar

This table view shows expected conditions and recommended treatments during a specified time period.



Figure 7.3 – Table View

This table view displays various weather conditions in a graph format.

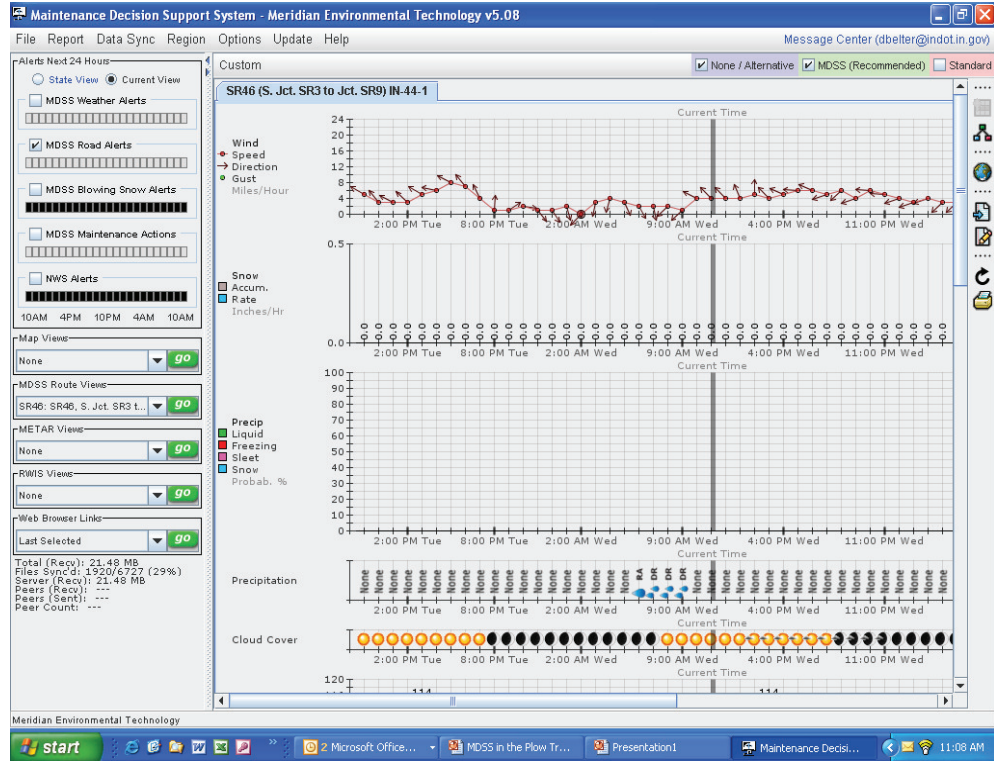


Figure 7.4 – GUI Graph View

This map shows the Indiana MDSS routes for FY 2009 and FY 2010.

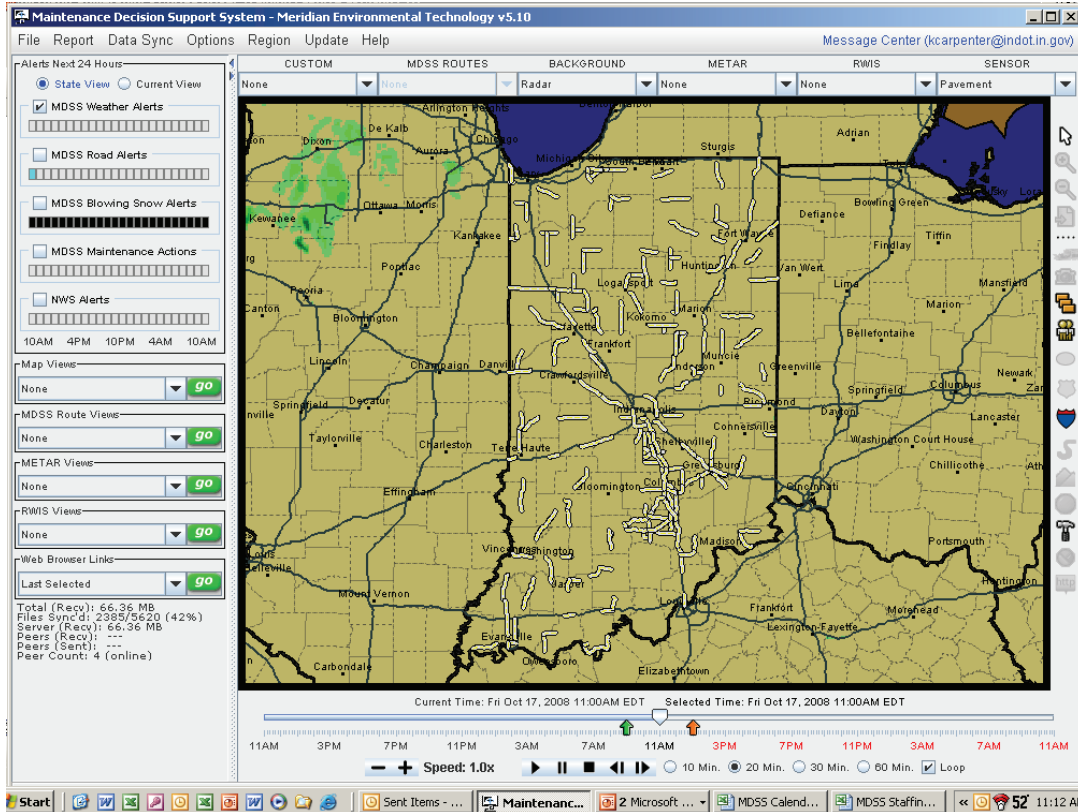


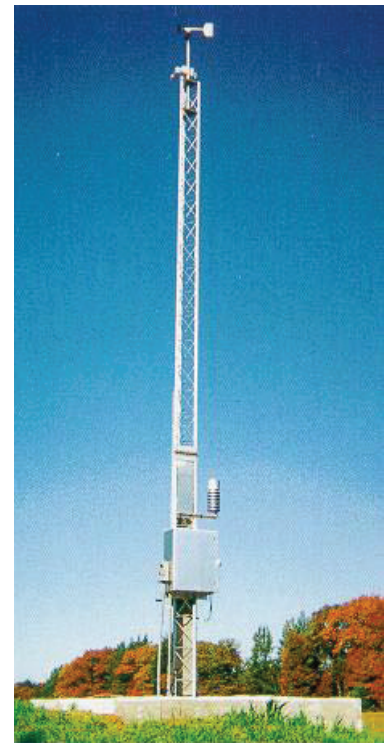
Figure 7.5 – MDSS Routes

Road Weather Information System (RWIS)

The system allows highway maintenance managers to retrieve up-to-the-minute data on pavement and weather conditions at bridges and other trouble spots. Maintenance managers can monitor the weather and see a projected freeze-up time for the roads. Thereby, crews can be mobilized to plow and apply materials when and where they are needed.

The Road Weather Information System (RWIS) technology can be put to use on roadways and on bridges. They are commonly installed in areas that are highly prone to accidents in the winter.

Each RWIS station 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. An atmospheric sensor determines air temperature, precipitation, and relative humidity.

Data from these RWIS sites is sent to a Central Office server and then accessed by SSI/Quixote Corporation via a Secure File Transfer Protocol (SFTP). SSI/Quixote Corporation then provides a website (ScanWeb) for INDOT to access INDOT's RWIS data.

District, Subdistrict, and Unit personnel can access ScanWeb 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. RWIS stations have 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 would save the State money on equipment, personnel, materials, and reduces wear on roadway surfaces and bridge decks.

The following IP address for INDOT RWIS is for INDOT use only and is not to be provided to the general public:

<http://ssiweather.indot.in.gov>. RWIS data is also available on INDOT's MDSS website.

An Internet site that may be accessed by the general public, which includes a legal disclaimer, is available at INDOT's Internet site. The IP address for the public site is:

<http://netservices.indot.in.gov/rwis/>.

Web Sites

The following are descriptions of other available weather data sources that can be accessed on the Internet. In general, free information obtained from Internet sites is not updated as frequently as weather services contracted by INDOT.

The Weather Channel

<http://www.weather.com>

This website offers a 10-day weather outlook per city. Acquiring this data is simple with either the input of the cities zip code or city name. For each of the 10-day outlook it gives the high and low temperatures. For that particular day it will give the following *daily reading*: wind, dew point, humidity, visibility and the barometer reading. Selecting the "Detailed Forecast" will give *half-day reading* custom for a morning and evening period.

A precipitation map of each state can also be obtained that is updated frequently in the day as weather conditions change. It gives a 600-mile Doppler Radar reading with the major cities in Indiana labeled. Fort Wayne, Lafayette, Bloomington, and Indianapolis are also available.

**National Weather Service (NWS)
Northern Indiana Weather Forecast Office**

Located on State Highway 13 between North Webster and Syracuse in Kosciusko County, this National Weather Service Weather Forecast Office provides weather and flood warnings, daily forecasts and meteorologic and hydrologic data for 24 counties in northern Indiana, eight counties in northwest Ohio and five counties in Michigan.

<http://www.crh.noaa.gov/iwx>

**National Weather Service (NWS)
Weather Forecast Office
Indianapolis Weather Forecast Office**

Located at the Indianapolis International Airport, this National Weather Service Weather Forecast Office provides weather and flood warnings, daily forecasts and meteorological and hydrologic data for 38 counties in central Indiana.

<http://www.crh.noaa.gov/ind>

**National Weather Service (NWS)
Weather Forecast Office
Paducah, Kentucky**

Located at Barkley Regional Airport in Paducah, this Weather Forecast Office provides weather and flood warnings, daily forecasts and meteorological and hydrologic data for 22 counties in western Kentucky, six counties in southwest Indiana, 19 counties in southern Illinois, and 11 counties in southeast Missouri; serving a population of more than 1,567,000.

<http://www.crh.noaa.gov/pah>

**National Weather Service (NWS)
Weather Forecast Office
Louisville, Kentucky**

The Louisville Weather Forecast Office provides weather and flood warnings, daily forecasts and meteorological and hydrologic data for 10 counties in southern Indiana and 49 counties in the central third of Kentucky; serving a population of more than 2,528,000.

<http://www.crh.noaa.gov/lmk>

Purdue University Applied Meteorology Group

<http://climate.agry.purdue.edu/climate/index.asp>

The Indiana State Climate Office (*Iclimate*) is the state archive of official daily and hourly weather observations recorded throughout Indiana. *Iclimate* maintains an online archive of many recent daily and hourly observations from both manual and automated

networks. Older observations are being converted to an online database as part of an ongoing national effort.

National Climatic Data Center

There are 568 weather stations located within the State of Indiana covering all 92 counties. Historical information is available from these stations at:

<http://www.ncdc.noaa.gov/oa/ncdc.html>

Indiana Normals

Climatologists often use the term “normal” to refer to weather statistics calculated over a standard 30-year time interval. Current normals are based on available weather observations taken during the years 1961-1990.

Normals are updated at the conclusion of each decade. New normals will be calculated based on observations made from 1971-2000.

Indiana climate normals are presented here in three geographical zones. Information is available from either a statewide perspective, the climate by region, or by the individual county of interest. All this information is provided in table format.

Chapter 8 – 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 after the 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 (Subdistrict, District, and Central Office)
- INDOT’s Operating Memorandum # 08-01 Snow and Ice Control Policy
- INDOT’s Total Storm Management Manual
- Maintenance Decision Support System (MDSS) and Automatic Vehicle Location (AVL) Technology
- Other references (from FHWA and/ or other States)

The key to Total Storm Management’s success is to utilize the tools listed above in conjunction with experience to fight winter events. Total Storm Management is a completely different philosophy to fighting winter events compared to the practice of “the way it has always been done.” In the past, INDOT’s policy has been to apply a predetermined rate of material regardless of the storm environment. Using MDSS with the TSM philosophy, environmental conditions (pavement temperature, precipitation type, humidity, etc.) are evaluated in combination with available materials to develop a storm-specific strategy.

Storm Preparation

Through observations obtained while monitoring the MDSS, pre-storm preparations begin for an impending event. The winter storm warnings are provided by e-mail and/or text messages. Individuals may request this notification through the Meridian Environmental Technologies website: <http://indot.meridian-enviro.com/login/>. Instructions on how to set-up this service can be found in Appendix 8.1.

The Maintenance Decision Support System tool will be used in planning for impending winter events. Depending on the time of day/night, the appropriate personnel are contacted by following the call-out procedures for their region. If the warnings are

obtained prior to the end of the work- day, the Unit Foremen are contacted and a personnel, equipment, material and weather data strategy is formed.

Continuing to monitor MDSS and other sources for developing weather information, the support communication network should begin with the Subdistrict radio operator. The Unit Foremen will inform personnel as the shift begins of which equipment and material to use, weather information and the expected shift strategy. The driver finishes the pre-trip inspection, completes a radio check, and the radio operator records the start times on the radio log.

Choosing and Applying Materials for Various Storm Conditions

There are varieties of products available that can be used for anti-icing and de-icing. INDOT normally uses liquids for the anti-icing effort. Sodium chloride, sodium chloride with additives, or abrasive/sodium chloride mixes, magnesium, calcium and agricultural based products are used for de-icing. As in de-icing with salt, there are various application rates that work best at different temperatures. The MDSS Product is a valuable assist tool in giving recommended material types and application amounts to the managers, foreman and operators. Refer to the Application Recommendations in the Tables in Appendix A8.2; these tables should be used in conjunction with the following strategies.

Strategies for Storm Management

Several strategies will be used to accomplish Department Objectives. These include anti-icing, de-icing, plowing, and spreading. The appropriate timing of any strategy requires the use of sound judgment, interpretation of weather data, and prompt action. In the following paragraphs, specific examples are given to illustrate different strategies and how they work:

The application of 400 lbs of salt per lane mile on the first round and subsequently applying a reduced rate of 100 lbs per lane mile may be applicable to maintain an optimum brine solution to prevent the bonding of snow and ice to the pavement. That is, the initial round provides an optimum brine concentration, but as precipitation continues to dilute the brine, reduced applications are made to offset dilution and maintain the optimum concentration.

Another example is the application of salt brine prior to events that result in black ice, such as frost or freezing fog. An initial application of 20 gallons per lane mile may be made on bridge decks days in advance of the forecasted event; as a result, brine residue on the bridge deck prevents the formation of black ice, reducing the need for night patrols or a full call-out.

A third example is a snow storm event where temperatures are forecasted to drop from the upper 20's to single digits during the snow event. Salt at an application rate of 200 lbs per lane mile pre-wetted with salt brine at 10 gallons per ton may be the proper

material combination for the beginning of the event. As the temperature drops into the lower 20's, salt applied at a rate of 300 lbs of per lane mile pre-wetted with salt brine at 10 gallons per ton may be used to fight the storm. At temperatures in the teens, salt applied at a rate of 400 lbs per lane mile pre-wetted with salt brine at 10 gallons per ton may be appropriate or salt applied at 300 lbs per lane mile pre-wetted with calcium chloride at 10 gallons per ton may be another option.

These examples illustrate that several options exist for given storm conditions. These options present solutions that can be more cost effective and provide a higher level of service than “the way it has always been done”. The Total Storm Management approach requires the use of available tools such as MDSS along with experience, technical advice, weather forecast, etc. to develop specific storm fighting strategies. In-depth strategy descriptions are outlined below.

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 80 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). Just like snow plowing routes, anti-icing routes need to be established. A number of states typically treat their routes twice a week throughout the season. This reduces the number of night callouts as well as providing better conditions for motorists. The MDSS Tool does not make Anti-Icing recommendations. That call is still made independently by management.

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

INDOT has Quantity Purchase Awards (QPA) for all the liquids listed below except for salt brine, which is produced in individual Districts. Costs of materials range from less

than ten cents per gallon for brine to nearly one dollar per gallon for some of the 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. And 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. INDOT 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.

Magnesium Chloride (Mag Chloride)

Because of its low transportation costs and availability, most Western States use magnesium chloride as chemical of choice. Most is obtained from the Great Salt Lake in Utah, which accounts for its higher price and thus makes it less desirable to use in Indiana. However, it 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.

Calcium Chloride

One of the “hottest” liquids that INDOT uses is calcium chloride. In liquid form at 30 percent dilution it freezes at minus 60 degrees. It is fairly inexpensive and readily available.

The solution process of calcium chloride takes place much faster than that of salt. This is because calcium chloride absorbs moisture from the air, rather than having to come in contact with moisture like salt. As calcium chloride dissolves, it releases a considerable amount of heat. Because calcium chloride continues to absorb moisture from the air, it may cause black ice in certain situations, which is a negative in regard to its use.

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.

Application for Anti-Icing Materials

As there are a number of anti-icing materials, there are likewise a number of anti-icing applicators. These range from a hundred-gallon unit that sets in the back of a pick up truck to a five thousand-gallon tanker pulled by a semi. Some of the applicators INDOT has used have been homemade but most have been specified and purchased from vendors. Plastic and stainless steel tanks are the ones of choice. Additional units may be justified as liquid usage increases.

There are a number of items that should be considered before obtaining an anti-icing system. For example, speed of application, width of application, lane miles to treat, costs, and usage documentation all play a part in selecting the ideal unit. Just as with material application, one size does not fit all. Because of economics, it is also desirable to be able to use the applicators for other work activities during the off-season. These may include bridge flushing, herbicide spraying, dust control, and others.

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. Contingent upon salt supply and availability, abrasives may be applied but this practice is not INDOT policy. Until the development of the anti-icing strategy, de-icing was the accepted method of snow and ice control. Usually beginning after an inch or more of precipitation has accumulated, de-icing is a reactive strategy, and therefore, more costly than proactive anti-icing strategy. Although de-icing cannot always provide reasonably safe road conditions during winter storms, it is a valid strategy in extreme weather events or unexpected events, as rare as they may be.

De-icing Choices for Various Storm Conditions

A variety of products are available to be used for de-icing. INDOT 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

INDOT'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.

Large amounts of rock salt are required to melt snow/ice pack, as shown on the table in Appendix A8.3. The table suggests astronomical application rates to melt thin layers of snow/ice pack; in fact, some of the rates shown are not only astronomical, they are impossible to apply. Two things should be noted:

- The thickness of the snow/ice bond to the pavement is very thin
- Complete melt is not required to break the snow/ice bond to the pavement

The table successfully illustrates that once a bond has formed and the temperature falls, the amount of chemicals required breaking the bond increase dramatically. It is due to this very fact that anti-icing and early applications are so critical to successful operations.

Sodium Chloride with Additives

Enhanced sodium chloride refers to salt that has calcium chloride flakes/pellets added or salt that has been pre-wet with a liquid. INDOT has used enhanced sodium chloride for some time; enhancement may include injecting liquids into salt stockpiles, pre-wetting truckloads, pre-wetting (preferred method) at the spinner via saddle tanks, or mixing solid chlorides into salt. Regardless of the enhancement, the objective is the same: to enhance the effective temperature range of sodium chloride and to provide moisture increasing salt’s ability to “stick” to the pavement, reducing roll and bounce that typically occurs with the use of dry material.

Liquid enhancement is the addition of chemical to sodium chloride. Liquids include calcium chloride, 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 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..

Spraying the top of each load after it is placed on a truck is also liquid enhancement. This may result in segregated wet and dry areas in the load, but an advantage is that no special on-board equipment is necessary. Another advantage is that any liquid can be used. There is no concern over clogging nozzles.

Another method of liquid enhancement is to treat the stockpile. This can be done by injecting liquids into the pile in place of spraying and mixing bucket loads, or spraying salt on the conveyor as it is being placed into storage. There is a wide range of consistency here, but again, an advantage is that no on-board equipment is required. Not all liquids can be used for this method. Typical ones are calcium chloride and agricultural-based products.

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. Illinois Department of Transportation (IDOT) has found that pre-wetting with up to 25 gallons per ton provided stunning results. The material was placed in more of slurry rather than a solid and began working almost immediately.

The State of Michigan recently found that typically 30 percent or more material might be lost when it is placed dry. They found that by pre-wetting salt, only about four percent is lost. The study was done on a road closed to traffic, so even more might have been lost due to blowing off. Example: Our experiences show that 250 pounds of dry salt per lane mile does a good job in treating a one-inch snowfall at 28 degrees. If that same material were pre-treated, only 175 pounds per lane mile would be required to obtain the same results. This calculates to annual salt savings statewide of up to \$2,500,000!

Solid enhancement is the addition of calcium chloride pellets or flakes to sodium chloride; rates generally range from 1-4 80# bags per ton of salt. Thorough mixing is critical for solid enhancement to provide uniform results.

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 were more frequently used in the past; however, mixes are no longer INDOT's prevalent choice for de-icing strategies. The sole intent and purpose 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. The major downside to using sand and other abrasives is that they do not melt snow and ice and cleanup and drain problems.

Abrasives or mixes are routinely used for treating snow-packed and icy lower volume roads in rural areas; 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 melt ice or snow and therefore do 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 placement practice is to apply salt on the road at what is called "zero velocity." Special spreaders are equipped with various devices that place material at a negative

speed equal to 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 100 to 200 lbs per lane-mile for a light snowstorm and 125-400 lbs per lane-mile for a sleet storm, depending on conditions 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. Management must play an active role in the selection of chemicals and application rates in order to prevent using material unnecessarily. Use of the MDSS tool can assist in management's analysis and decision making by giving recommended application rate and material selection. Recommended de-icing application rates for various storm conditions may be found in the Operations Guide for Maintenance Field Personnel in Appendix A8.2.

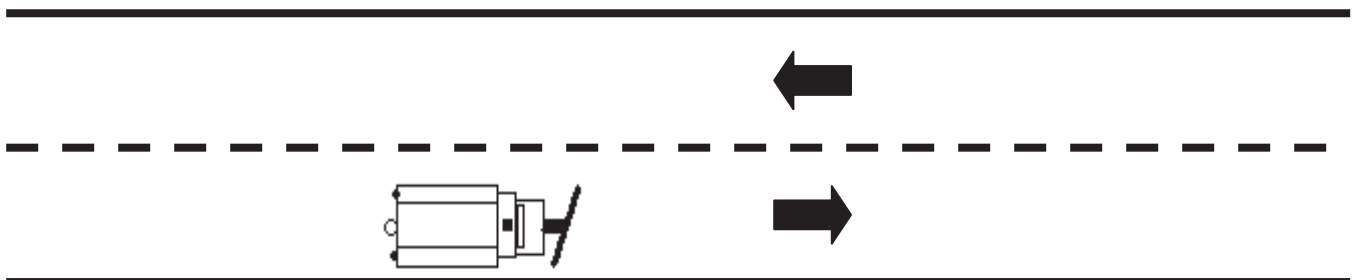
Plowing

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.

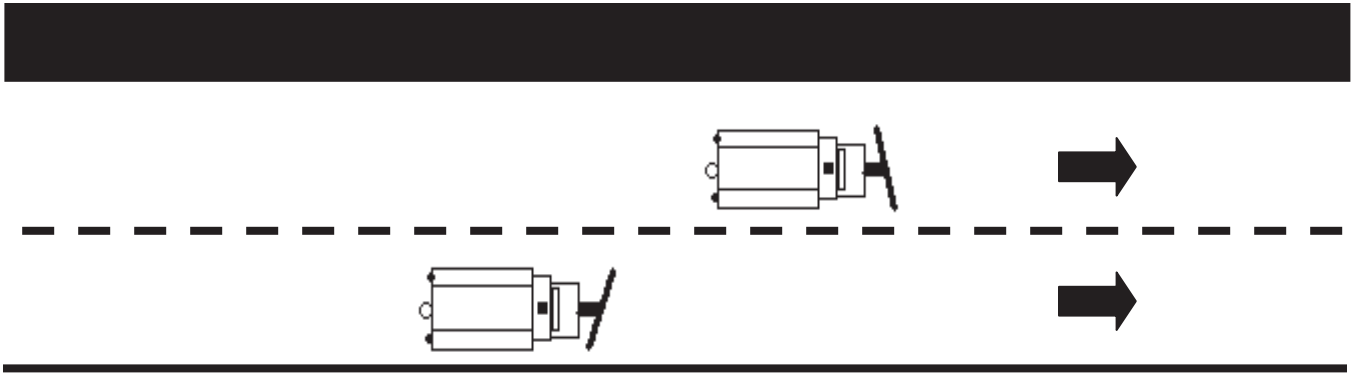
There are many types of snowplows. These include one-way front plows, reversible front plows, deformable front moldboard plows, underbody plows, side wing plows, and plows specifically designed for slush removal. There are new generation plow products that INDOT is testing and experimenting with; the tow plow and the triple blade plow (see equipment and research sections). INDOT typically utilizes reversible front plows with carbide cutting blades.

Typical plowing patterns are shown in the following diagrams:

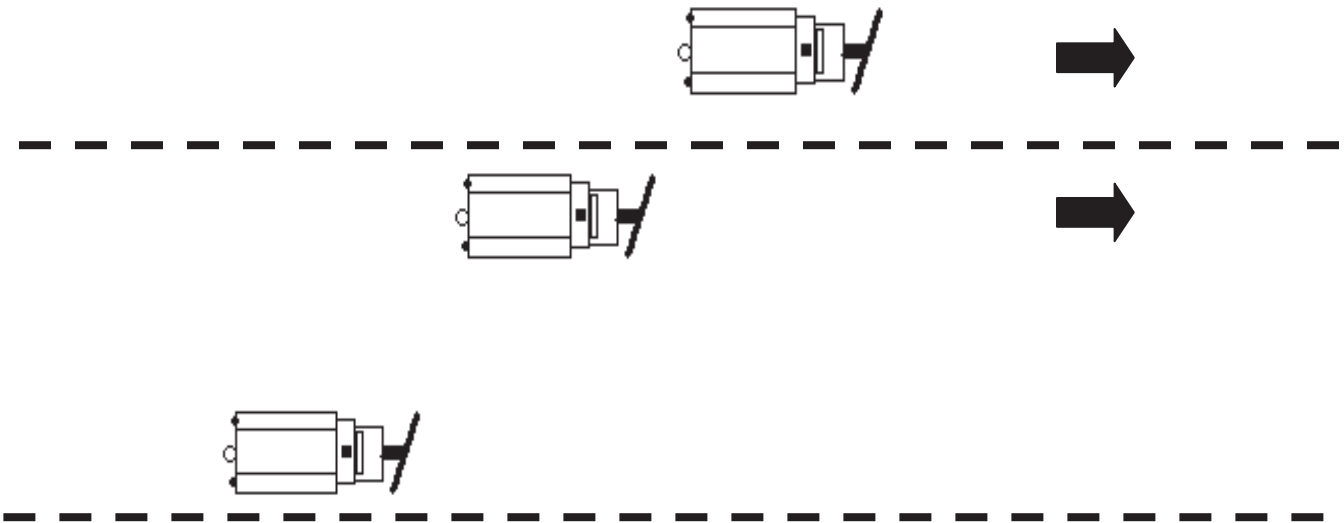
A. TWO LANE, TWO WAY TRAFFIC



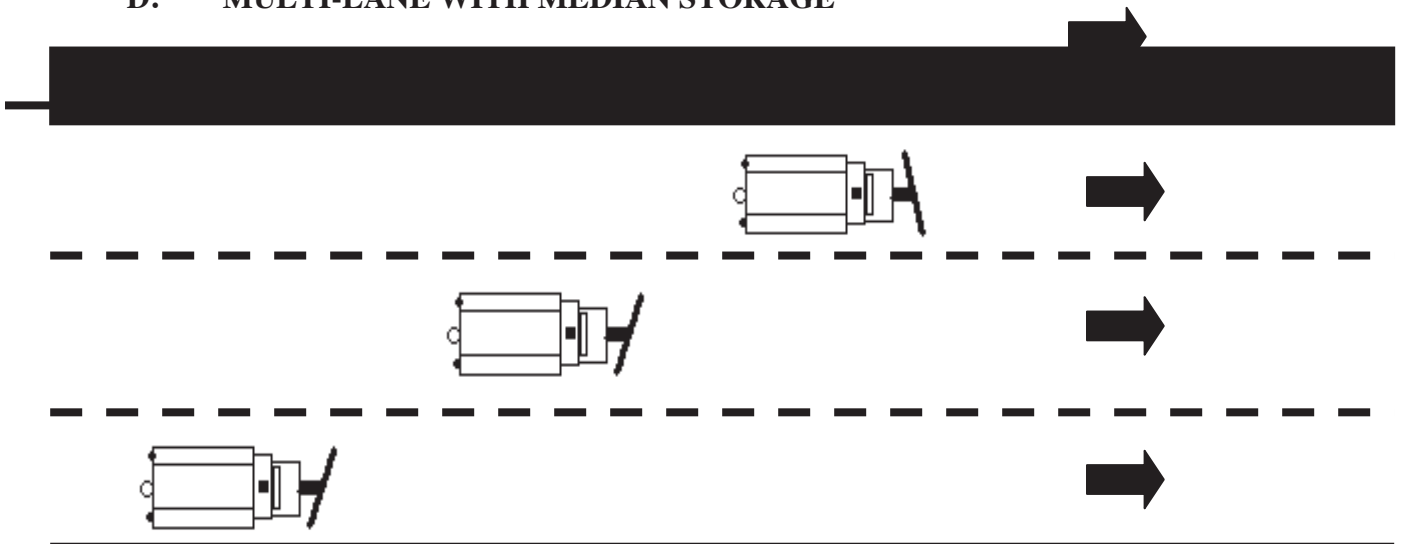
B. TYPICAL DIVIDED HIGHWAY WITH MEDIAN STORAGE



C. MULTI-LANE, NO MEDIAN STORAGE



D. MULTI-LANE WITH MEDIAN STORAGE



Other Storm Considerations

Coordinating Plowing and Spreading Activities

The first activity for most storms is to anti-ice if the conditions are warranted. Next practice would be to plow the 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

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

Super-elevated Curves

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

Disabled or Abandoned Vehicles

Vehicles are often disabled or abandoned in storm events. Typically, snowplow drivers notify the Subdistrict of the vehicle's location and the status of occupants, if any. Occupants may be transported to the nearest phone to call for assistance. The State Police are often called to arrange for towing of abandoned vehicles.

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 28°F 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 32°F 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 32°F and to be aware of the potential for “quick or surprise” freeze-ups.

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

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

Ice Control

The formation of ice on the pavement presents a far greater traffic hazard than snow, especially during its early stages. Treatment for hazardous ice conditions must begin immediately. Patrols and watchmen 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. The process of “thermal mapping” has been used by a number of agencies to predict where problem areas will arise. These critical areas can be monitored more closely and treated as needed. Anti-icing is an effective strategy for frost and scheduled treatments during the week throughout the season can be used to reduce slippery conditions. If ice has already formed, an effective tool to break it up is the underbody plow.

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

Post-Storm Activities

Post-storm activities are almost as important as the primary operations of plowing and spreading. Support activities minimize hazards, as well as identify needs for subsequent storms. Such activities include melt water control, clean up of special roadway features,

handling & disposal of snow/ice/abrasives, material management, personnel management, equipment repair & cleaning, and facility clean-up.

Melt Water Control

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

Shoulder Clearing

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.

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. Priority removal should be assigned to Class I locations – i.e. those locations with the highest traffic volume.

Restoring Highway Safety Features

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

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

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

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

Clearing of Special Areas

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

Personnel Management

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

Material Management

Material inventories should be evaluated immediately after a storm to assess the need for re-supply. Keep in mind those businesses, cities, counties, adjacent states, and other INDOT 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.

To see the list of Frequently Asked Questions reference Appendix A8.4.

Chapter 9 – Special Considerations

AVL

Automated vehicle location (AVL) technology utilizes sensors and drivers to collect weather and road condition data in real time which is automatically transferred to MDSS. Collected data includes: road temperature, plow position, location, chemical distribution rate, road condition, and weather condition. In-truck equipment includes the Muncie box, a GPS receiver, and data collection device with a modem. The data is transferred to the MDSS server via a wireless data connection. Currently two AVL vendors are being used by INDOT.

Some AVL systems have a truck camera that provides live images of road conditions. Most AVL systems have feedback capabilities that allow messages to the truck providing driver instructions.

During the winter 2008-2009, approximately 170 trucks were equipped with an AVL system. The equipment came from two vendors and the below image shows the IWAPI system.



Figure 9.1 – IWAPI AVL Equipment

Snow Fence

Snow fences are commonly used to address the problem of blowing and drifting snow on roadways. NCHRP report for project 20-7 (147) identifies several problems associated with blowing snow and notes the effectiveness of snow fences to control blowing snow.

- Blowing snow adds significantly to snow removal costs in that the quantity of snow that blows on to the road can be hundreds of times greater than the quantity of snow that falls directly on the pavement.
- Drifting snow can cause drivers to lose control of vehicles, limit sight distances, among other safety hazards.
- Ice and slush can form on the roadway as a result of blowing snow.
- Snow fences can help address the problems associated with blowing snow. Properly designed snow fences can eliminate snow drifts, improve visibility, and reduce ice formation.

How Snow Fences Work

Snow fences work by disturbing the wind flow that carries the snow particles. The fences reduce the wind speeds and change the wind profile. These disturbances cause the snow particles to deposit on the leeward side of the fence. If properly designed, this deposition will drastically reduce the amount of snow that drifts or blows across the road. The following figure illustrates how snow fences affect wind flow.

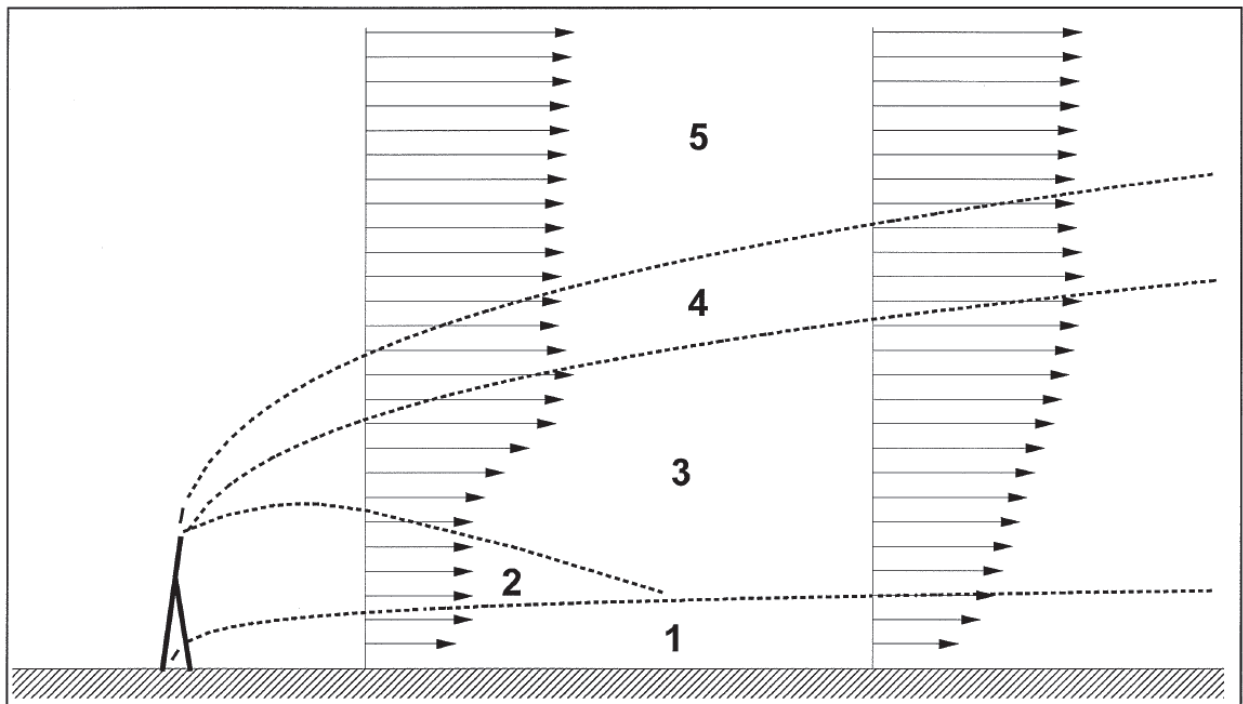


Figure 9.2 Disturbance of Wind Flow at Snow Fence (Source: NCHRP 20-7 (147))

Snow Fence Types

Snow fences can be broken into three broad categories: structural permanent, seasonal, or living. Each type has pros and cons and selection of which type to be used should be based on site specific needs.

Structural fences, such as the Wyoming snow fence, typically are based on heavy wooden frames anchored with reinforcing bars. The Wyoming snow fence can be 10 to 12 feet tall and uses equally spaced 1 x 6 boards fastened to the frame, however other synthetic options are also available. The frames are anchored to the ground using 5 foot long reinforcing bars. If anchored properly, these fences can withstand strong winds and snow burial. They are most effective during large snow events or in areas in which snow accumulation is common. These fences are more costly to construct than seasonal fences. Structural snow fences also require a larger crew as well as additional equipment to place them. Further, structural snow fences require considerable maintenance. If properly maintained they can last for more than 25 years. Examples of structural snow fences are shown in Figure 9.3.



Figure 9.3 Structural Snow Fences at Wolcott Evaluation Site (Left Tensar – Right Wyoming)

Seasonal snow fence is the type that most people are familiar with. These fences are typically 4 feet tall and are affixed to steel posts. They are available in rolls and can be made from either wood slats or more commonly these days, plastic. Because these fences are temporary in nature, they are not as durable as the structural fences. Performance is

based on proper installation. If installed properly, the fences will perform as intended throughout the season. Proper installation of plastic fence requires that the fence be stretched about 1 percent once the slack has been removed. The plastic should be attached to the posts securely so that abrasion does not occur. This can be accomplished by sandwiching the plastic between the post and a wood slat or 2 by 2. Additional protection can be provided by placing a length of foam pipe insulation over the metal post. A 6 inch gap should be left at the bottom of the fence. This will increase the storage capacity by 25 percent and reduce the tendency for the fence to be buried by the drift.

Seasonal fences have a lower cost than the structural snow fence and can perform equally as well. However, they are not as effective once the snow has accumulated to a 4 foot depth (i.e. the height of the fence). Seasonal snow fence is easier to install and can be done with a small crew and minimal equipment. However, as they are not permanent, an additional operation is needed to remove the snow fence in the spring. A seasonal snow fence is illustrated in Figure 9.4.



Figure 9.4 Seasonal Snow Fence at Wolcott Evaluation Site

Living snow fences are also an effective means of controlling blowing and drifting snow and have been shown to be as effective as structural fences. Properly designed living snow fences take into account adequate storage capacity, absence of gaps, and sufficient set-back from the road. Consideration must also be given to the selection of appropriate trees and shrubs. One main requirement is that the plants be tolerant to salt spray and soil

salt. Living snow fences can cost less than structural fences. Installation is the same as any other planting operation. Once planted, living snow fences require little maintenance. One drawback with living snow fence is that depending on the size and type of plants selected, it may take a few years for the barrier to reach its maximum size and, therefore, achieve its intended maximum effect. Another type of living snow fence that avoids this problem is standing corn rows. Living snow fence options in Minnesota are shown in Figures 9.5 and 9.6.



Figure 9.5



Figure 9.6

(Sources: (a) <http://www.newsline.dot.state.mn.us/archive/07/feb/14.html> (b) <http://www.dot.state.mn.us/environment/livingsnowfence/scr.html>)

Recommendations for Living Snow Fence

Warm season prairie grasses and forbs can be used to help control light drifting. These plants will hold light snow back and reduce the scatter slick spots that occur after a snow

event of 1 inch or less. Figure 9.7 shows the effectiveness of this type of planting on I-65 between the Wolcott Rest Area and SR 43.



Figure 9.7 Grasses planted to control snow drifting on I-65

Larger plants can also be used to control drifting. The recommended types for use in Indiana are viburnum or cypress and are illustrated in Figures 9.8 and 9.9. These types of plants take a longer time to establish. However, when fully grown they are taller and have a greater effectiveness at controlling drifting snow.



Figure 9.8 - Viburnum



Figure 9.9 - Cyprus

Viburnum or cyprus plants can be grown by the Department of Corrections and provided to INDOT at no cost. They are available bare-root or in containers, however containers must be provided.

Snow Fence Design

The following is a list of general snow fence design parameters.

- Set back of the fence should be 35 times the height of the fence from road shoulder.
- The fence should extend beyond protection limits on either side at 30 degree angle.
- Placement should be perpendicular to wind, but can be up to 10 degrees in departure.
- The fence should have a gap of 10-12% the fence height under the fence.
- If placing on rolling terrain, the fence should be placed on crests of hills or ridges, or sites upwind of other depressions

Steps in Snow Fence Design

NCHRP report 20-7(147) notes the following steps in design of snow fences.

- 1) Prepare for Site Visit
 - a. Evaluate maps and/or aerial photos of the site.
- 2) Site Visit:
 - a. Talk with maintenance personnel to determine the nature of the problem.
 - i. Locate the exact location (milepost, station, etc.).
 - ii. Identify the type of problem (blowing/drifted/road ice).
 - iii. Discuss weather information associated with the problem.
 - iv. Gauge the severity of the problem.
 - v. Look for possible solutions.
 - b. Note road geometry and other features (barriers, bridges, structures, trees) that may affect or influence the problem.
 - c. Determine if problem is isolated to right-of-way or if problems are upwind.
 - d. Evaluate possibility of living snow fences.
 - e. Identify adjacent property owners.
- 3) Collect Additional Data
 - a. Historical wind data
 - b. Historical snowfall data
 - c. Crash history
 - d. Plans for reconstruction
- 4) Determine wind direction associated with problem
 - a. Based on the site visit and the historical data, the most critical wind direction should be accurately identified.
- 5) Determine measures to minimize blowing snow within right-of-way
 - a. Efforts to reduce blowing snow within the right-of-way should focus on leaving as much vegetation in place as possible to hold the snow in place.

- b. This could be accomplished by reduced mowing or planting of living snow fences.
- 6) Estimate blowing snow from beyond the right-of-way
 - a. Refer to NCHRP report 20-7 (147) for details.
- 7) Mitigation Measures
 - a. Other mitigation measures can include cross-section modification and/or evaluation of safety barriers (which can also act as a snow fence and deposit snow on the roadway).
 - b. Evaluate snow fence options (structural, seasonal, or living).
- 8) Determine required height of snow fence
 - a. 4-foot seasonal fence is adequate for most applications in Indiana.
 - b. Refer to NCHRP report 20-7 (147) for details in determining other heights.
- 9) Determine Fence Alignment
 - a. Ideally, fences should be placed parallel to roadways for winds attack angles between 55 and 90 degrees. If the wind attack angle is outside this range the fence can be placed at a 10 degree angle from the perpendicular.
- 10) Determine required setback
 - a. Typically the setback should be 35 times the height of the fence. For a 4-foot snow fence the setback should be 140 feet.
 - b. A single tall fence is more effective than multiple rows. However, if multiple rows are needed, these should be spaced at a distance of 30 times the height of the fence. This distance should be decreased on upward slopes and decreased on downward slopes.
- 11) Determine the preliminary layout
 - a. The length of the fence should be determined by the length of the desired area protected. The ends of the fence should extend beyond the length of either side of the protected area at an angle of 30 degrees from the prevailing wind direction. This is to account for variations in wind direction.
 - b. Consideration should also be given to any required openings.
- 12) Finalize the fence locations
 - a. Verify the preliminary layout in the field.
 - b. Assess the design in regards to creating abrupt transitions in visibility or ice conditions.
 - i. Evaluate gaps between the fence and existing features.
 - ii. Tie the fence in with natural features such as bushes or trees
 - iii. Fill-in gaps between fencing systems
 - iv. Taper our the fence by reducing height
- 13) Select final fence option
 - a. Determine if structural, seasonal, or living fence is the best option for the site.
 - b. Refer to NCHRP report 20-7 (147) for details on the specific designs for each of these options.

Snow Fence Placement Operations

Snow fence should be erected during October and November and taken down and properly stored during March and April. A log of snow fence locations, showing the beginning of each run, the number of feet of fence in each run and the distance left or right of the highway, should be kept on file in the Subdistrict office and revised as required. All snow fence will be placed as designed and approved by the District Highway Maintenance Office. Good public relations with property owners, on whose land snow fence is placed, are mandatory. Obtain prior approval from the property owner for all installations on private property. Instruct crews to be careful of crops, fence, etc., in this operation. All seasonal snow fence should be removed and properly stored as the weather permits.

Department of Homeland Security (DHS)

During severe winter storms the DHS Emergency Operations Center (EOC) may be activated to coordinate the activities of various State Agencies. The Agencies normally involved are the Indiana Department of Transportation (INDOT), the Indiana State Police (ISP), the Indiana Department of Natural Resources (DNR) and the Indiana National Guard. Each agency has a representative present in the EOC to facilitate communication and decision-making. It is in the EOC that decides to close Interstate Highways, activate the National Guard, etc. are made.

Training Aids & Affiliations

INDOT works with a number of groups to keep abreast of the latest trends, technology and training available in snow and ice removal. The following is a list of affiliations and a brief description of the benefit to INDOT.

Indiana Local Technical Assistance Program (LTAP)

LTAP was established by FHWA to translate the latest, state-of-the art road, highway and bridge technologies into systems usable by local highway agencies. Purdue University oversees this agency and FHWA and the Motor Vehicle Highway Account fund it. LTAP sponsors various training sessions throughout the year. Although geared mainly toward counties and cities, the basics are common to most snow fighters. In addition LTAP has various publications that may benefit us. For more information on LTAP, contact them at (765) 496-6584.

Salt Institute

The Salt Institute has a major interest in successful snow and ice control since salt is currently our most frequently used material. Years ago INDOT supported the “Sensible Salting” approach to snow and ice control. As times have changed, so have the materials provided by the Institute. A number of updated training manuals, slides, and videos are available through them. They also maintain an Internet site that has much useful

information and links to other sources. It may be accessed at:
<http://www.saltinstitute.org>.

Snow and Ice List-Serve

Maintained by Professor Wilfred Nixon and the University of Iowa, the Snow and Ice List-Serve allows members to join a worldwide network of winter enthusiasts that communicate through the internet. A member can pose a question to the group, and typically there are several to many responses from those that have experience in that area. Although this is not a training tool geared toward the masses, it is very useful in gaining practical knowledge first hand from those that have succeeded or failed. Members may actively participate or just sit back and learn from the various conversations. A considerable number of messages occur during the winter season.

To join, send an e-mail message to: *Snow-ice-request@list.uiowa.edu*
In the body of the message, type the word *subscribe*. You are now on the list. To “unsubscribe,” send a message with the word *unsubscribe* typed.

Federal Highway Administration (FHWA)

Their “Manual of Practice for an Effective Anti-icing Program” as well as other training resources are available at: <http://ops.fhwa.dot.gov/Weather/index.asp>.

Miscellaneous Training Aids

There are a number of consultants that can provide training although typically for a fee. Various vendors have at times sponsored training seminars and brought in experts to present material associated with their products. This is a good way to learn about the latest changes in the industry.

There are several state highway experts from surrounding states that are available to use for training. They are usually happy to come and basically charge only for their immediate travel expenses. They bring lots of practical technology based on their experiences.

Affiliations – APWA, Midwest Snow & Ice Group

Purdue University

INDOT has a long history of working with Purdue University. Purdue has performed research projects in various areas of snow and ice removal. Their assistance includes compiling this manual. Purdue also hosts the annual Road School program that often includes an INDOT maintenance session including snow and ice removal topics.

American Association of State Transportation Officials (AASHTO)

AASHTO has several subcommittees addressing snow and ice removal concerns. The outcomes from these subcommittees are made available to INDOT and other states. AASHTO contributions include the salt specification used by INDOT, training (including computer based training), development and research. The Snow and Ice Pooled Fund Cooperative Program (SICOP) is a subcommittee devoted to researching snow and ice removal issues. SICOP has a Web page containing helpful information (<http://www.sicop.net/>).

American Public Works Association (APWA)

APWA is a national organization. They have an annual North American Snow & Ice Conference that provides an excellent forum for the exchange of ideas with other states and local agencies, sessions on current issues and a vendor display of the latest materials and equipment available. Their website is www.apwa.net.

Mid-West States Snow and Ice Workshop

The Mid-West States Workshop is an informal gathering of eleven states. The annual meeting provides an excellent forum to discuss snow and ice issues.

Reports

The respective Appendix references for the following reports are:

- Work Management System- Procedure A9.1
- Taper Log – A6.6
- Salt/Materials Report – A9.2
- Truck Report – A5.6
- Fall Snow Removal Equipment VIP Inspection Report – A5.7

Chapter 10 - Winter Operations Research

Research

Research is a systematic inquiry involving analytical and experimental activities which primarily seek to increase the understanding of underlying phenomena. Research can be basic (scientific research) or applied (engineering research). Research in the winter operations area is typically applied research, which involves solving specific problems that directly benefit the DOT and the transportation industry at large. Furthermore, technology transfer and the implementation of viable research findings into field practice is a priority.

There are several different organizations which support research in the area of winter operations. The following sections describe some of these organizations, specifically those in which INDOT has been actively involved. The information included has been taken from the cited websites.

INDOT/JTRP Research Program

The mission of the INDOT/JTRP Research Program is to conduct, oversee, and partner in cost-effective transportation research that benefits our customers; perform specialized testing on behalf of INDOT; assist in technology development, identification, and transfer; and provide expertise and technical assistance in solving INDOT's transportation problems. The research program is a mandated part of the federal aid program of Indiana highway infrastructure and is a match program (80% federal: 20% state).

Some winter operations related research projects funded through the INDOT/JTRP research program include the projects entitled "Development of Snow and Ice Removal Performance Standard" and "Snow and Ice Removal and Anti-Icing Synthesis Study"

For more information on the INDOT/JTRP Research Program you can visit the JTRP website at the following link: <http://rebar.ecn.purdue.edu/jtrp>.

Transportation Research Board

The mission of the Transportation Research Board (TRB) is to provide leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal.

TRB is one of six major divisions of the National Research Council— a private, nonprofit institution that is the principal operating agency of the National Academies in providing services to the government, the public, and the scientific and engineering communities. The National Research Council is jointly administered by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. TRB's varied activities annually engage more than 7,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest by participating on TRB committees, panels, and task forces. The program is supported by state transportation departments, federal agencies including the component administrations of

the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation.

TRB has a standing committee that addresses winter operations issues: AHD65 Winter Maintenance. This committee is concerned with providing winter maintenance professionals with up to date information on materials, equipment, technologies, techniques, and measures through research, technology transfer and education. This includes fundamental aspects of ice adhesion, heat transfer and fog control, as they influence roadway operations and the safety, mobility and control of traffic under adverse winter conditions; management of snow and ice removal; performance measures to determine and evaluate levels of service; snow and ice removal equipment; training needs of snow-fighting personnel, including worker safety; materials for preventing or breaking the bond of snow and ice to pavements; materials storage and use; environmental impacts of winter maintenance operations; road weather forecasting; snow accumulation and drift prevention; drainage of melting snow and ice; and, pavement and bridge heating and automated anti-icing systems.

TRB also administers the National Cooperative Highway Research Program (NCHRP). The NCHRP was created in 1962 as a means to conduct research in acute problem areas that affect highway planning, design, construction, operation, and maintenance nationwide. NCHRP is sponsored by the member departments (i.e., individual state departments of transportation) of the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration (FHWA). The state departments of transportation are the sole sponsors of the NCHRP. Support is voluntary and funds are drawn from the states' Federal-Aid Highway apportionment of State Planning and Research (SPR) funds. Furthermore, the funds can be spent only for the administration of problems approved by at least two-thirds of the states. Each state's allocation amounts to 5 and 1/2 percent of its SPR apportionment. Some recent winter operations related research projects undertaken by NCHRP include: "Guidelines for Snow and Ice Control Materials and Methods," "Feasibility of Using Friction Indicators to Improve Winter Maintenance Operations," and "Testing and Calibration Methods for RWIS Sensors."

More information about TRB and NCHRP can be found at the TRB website:
<http://www.trb.org/default.asp>.

FHWA Road Weather Research Initiatives

In August 2005, the President signed the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). Section 5308 of SAFETEA-LU authorizes the establishment of a Road Weather Research and Development Program to (1) maximize use of available road weather information and technologies, (2) expand road weather research and development efforts to enhance roadway safety, capacity, and efficiency while minimizing environmental impacts, and (3) promote technology transfer of effective road weather scientific and technological advances. The legislation directs the Road Weather Research and Development Program to carry out research and development called for in the National Research Council report entitled *Where the Weather Meets the Road: A Research Agenda for Improving*

Road Weather Services. The FHWA leads this program in partnership with NOAA, AASHTO, nonprofit organizations, and the private sector.

One initiative from the FHWA related to winter operations is the Clarus initiative. Clarus (which is Latin for "clear") is an initiative to develop and demonstrate an integrated surface transportation weather observing, forecasting and data management system, and to establish a partnership to create a Nationwide Surface Transportation Weather Observing and Forecasting System. The objective of Clarus is to provide information to all transportation managers and users to alleviate the effects of adverse weather (e.g., fatalities, injuries and delays).

More information on the FHWA's Road Weather research can be found at:

<http://ops.fhwa.dot.gov/weather/resources/resdev.htm>.

FHWA Pooled Fund Projects

When significant or widespread interest is shown in solving transportation-related problems, research, planning, and technology transfer activities may be jointly funded by several federal, state, regional, and local transportation agencies, academic institutions, foundations, or private firms as a pooled fund study.

To qualify as a pooled fund study, more than one state transportation agency, federal agency, other agency such as a municipality or metropolitan planning organization, college/university or a private company must find the subject important enough to commit funds or other resources to conduct the research, planning, and technology transfer activity. If a subject has been studied previously, the new study should provide new information that will complement or advance previous investigations of the subject matter.

A federal, state, regional, or local transportation agency may initiate pooled fund studies. Private companies, foundations, and colleges/universities may partner with any or all of the sponsoring agencies to conduct pooled fund projects.

More information on the FHWA's pooled fund program can be found at:

<http://www.pooledfund.org/>

Development of Maintenance Decision Support System

INDOT participated in the pooled fund project to develop the Maintenance Decision Support System (MDSS). The following section describes the motivation that led to this project.

To provide safe transportation to motorists, state transportation agencies in northern states must apply effective highway maintenance treatments appropriate to a wide range of winter and year-round conditions. Maintenance personnel must decide what treatments to apply, and when to apply them, based on their knowledge of current pavement conditions, current and forecast weather conditions, and available maintenance techniques and resources. In large part, the decisions are based upon prior experience of maintenance personnel and supervisors.

Agencies could provide more effective maintenance, and provide it more efficiently, with the help of an automated Maintenance Decision Support System (MDSS) that could: assess current road and weather conditions using observations and reasonable inferences based upon observations; provide time- and location-specific weather forecasts along transportation routes; predict how road conditions would change due to forecast weather and the application of several candidate road maintenance treatments; notify state agencies of approaching conditions and suggest optimal maintenance treatments that can be achieved with resources available to the transportation agencies; and evaluate the reliability of predictions and the effectiveness of applied maintenance treatments for specific road and weather conditions so decision support can be improved.

The primary goal of this Pooled Fund Study was to provide integrated weather, road condition, treatment and resource information to the appropriate maintenance personnel so they can make proactive decisions to better manage the transportation system before, during, and after adverse weather conditions. The anticipated benefits of this project include reduced operating expenses and a higher level of service, which will result in safer and smoother highway operations and traffic flow. This effort will also make more efficient use of chemicals, which reduces impacts on the environment. INDOT implemented MDSS in the winter of 2008-2009.

Clear Roads

Clear Roads is an ongoing pooled fund research project aimed at rigorous testing of winter maintenance materials, equipment and methods for use by highway maintenance crews. Launched in 2004 by experienced winter maintenance professionals, Clear Roads responds to a need for research based on practical experience.

By conducting structured field testing and evaluation across a range of winter conditions and highway maintenance organizational structures, Clear Roads projects will deliver immediately useful data and recommendations on the effectiveness, ease of use, optimum application rates, durability, and more, of many advanced winter operations technologies.

Example research projects funded through Clear Roads include: “Development of Standardized Test Procedures for Carbide Insert Snowplow Blade Wear,” “Development of Standardized Test Procedures for Evaluating Deicing Chemicals,” and “Development of a Toolkit for Cost-benefit Analysis of Specific Winter Maintenance Practices, Equipment and Operations.”

More information on the Clear Roads project can be found at: <http://www.clearroads.org/>.

Aurora

Aurora is an international program of collaborative research, development and deployment in the field of road and weather information systems (RWIS), serving the interests and needs of public agencies. The program, launched in 1996, brings together a number of U.S., Canadian, and European agencies.

The Aurora vision is to deploy RWIS to integrate state of the art road and weather forecasting technologies with coordinated multi-agency weather monitoring infrastructures. It is hoped this will facilitate advanced road condition and weather monitoring and forecasting capabilities for efficient highway maintenance, and the provision of real-time information to travelers.

Projects funded through the Aurora program include: “Benchmarking the Performance of RWIS Forecasts,” “Development of a National Road Weather Testing Program,” and “Development of an RWIS Quality Assurance Monitor System.”

More information on the Aurora program can be found at: <http://www.aurora-program.org/> .

APPENDIX

A2.1 Operations Memorandum No. 08-01 (pages 83-89)

Field Operations Manual, Operating Procedure, December 12, 2008

SNOW AND ICE CONTROL

Department Objective

The Indiana Department of Transportation (INDOT) will utilize available resources to keep all INDOT roads and bridges open and passable during winter storm events.

Three classifications of INDOT roads are identified to prioritize allocation of INDOT resources and to outline INDOT's snow and ice control service objectives.

Classifications

The three classes of INDOT roadways are identified as follows:

CLASS I

Interstate routes and roadways with Average Daily Traffic (ADT) volumes over 10,000 vehicles per day, as well as other high priority roadways, including but not limited to those serving hospital facilities and other emergency providers.

CLASS II

Routes with traffic volumes between 5,000 and 10,000 ADT.

CLASS III

Routes with traffic volumes of less than 5,000 ADT.

Service Objectives

The following snow and ice control service objectives are identified for each of the three roadway classifications:

CLASS I

INDOT shall provide service to mainline pavements, ramps, and turn lanes to remove snow and ice from pavement surfaces by plowing and chemical applications to achieve bare pavement conditions. Once bare pavement conditions are achieved, minimal plowing of shoulders should

commence. All other cleanup will be deferred to normal working hours. Class I routes should be serviced approximately every 2 hours.

CLASS II

INDOT shall provide service to mainline pavements, ramps, and turn lanes to remove snow and ice from pavement surfaces by plowing and chemical applications to achieve bare pavement conditions. All other cleanup will be deferred to normal working hours. Class II routes should be serviced approximately every 2.5 hours.

CLASS III

INDOT shall provide service to remove snow and ice from mainline pavements to provide partial bare pavement. Final cleanup will generally be deferred to normal working hours. Class III routes should be serviced approximately every 3 hours.

General Notes

Winter Storm Event cleanup activities begin after the storm ends and after the identified service objectives have been achieved. Normally, cleanup activities should be performed during normal working hours; however, under some circumstances, such as when another winter storm is approaching or sudden drop in temperature is anticipated, cleanup activities may occur during overtime hours.

Cleanup activities include plowing and spot use of materials to remove snow and ice from the driving surface. This work also includes plowing back shoulders, crossovers and approaches, cleaning and opening of frozen drains, and equipment cleanup.

It is impractical to develop specific rules for every winter storm event situation due to the numerous variables involved in winter storms. The judgment of the District Highway Maintenance Director, Sub-District Managers, and the Unit Foremen will govern the type, quantities and application schedules used for INDOT's snow and ice control services.

It is the intent of INDOT to use the appropriate amount of deicing and anti-icing chemicals needed to maintain and/or restore bare pavement conditions before, during and after winter storm events.

For the purposes of this document, bare pavement is defined as a condition under which the roadway's driving surface is cleared of loose snow and ice. The driving surface may have isolated patches of snow, ice, or slush.

For the purposes of this document, partial bare pavement is defined as a condition under which the roadway's driving surface is partially cleared of loose snow and ice. The driving surface

may have some bare pavement, but the bare pavement may be limited to that portion of the pavement in the vehicular wheel paths.

Preparation for Winter

1. Equipment Inspection

Each fall, as directed by the District Operations Engineer, an inspection by District and Subdistrict personnel shall be made of all snow and ice equipment to ensure it is properly repaired and ready for snow and ice removal. This shall include, but is not limited to: plows, trucks, spreaders, loaders, graders, conveyors, ground speed control units, liquid distribution systems, liquid storage systems, temperature sensors, weather data systems (RWIS), and weather warning systems.

Each vehicle shall be inspected against a predetermined checklist. Equipment not ready for snow and ice operations shall be red tagged. A timely follow-up inspection shall be completed to ensure that all red tagged equipment has been repaired. Unsafe equipment shall not be used.

2. Calibration

a) Spreader

All materials spreading equipment, including ground speed equipped vehicles, must be calibrated prior to the winter season with assistance by District personnel, as needed. Each spreading unit shall be calibrated to provide an accurate rate of application. For units without ground speed control, a chart listing the various driving speeds and spreader setting combinations for the designed application rates should be prepared for each spreading unit/truck.

b) Sprayer

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

2. Routing

District Operations shall develop and coordinate route designs and changes. Routes shall be designed in accordance with the INDOT Total Storm Management Manual. All changes to routes should be made and finalized by October 15 of each year. Routes are to be well documented with copies sent to Operations Support for their concurrence.

3. Material Acquisition

Prior to the winter season, sufficient quantities of chemicals and abrasives shall be stockpiled or available. Chemicals and abrasives shall be stored in accordance with Operating Procedure No. 22, "SNOW AND ICE CHEMICALS – POLLUTION CONTROL GUIDELINES".

4. Training

Each management level of the Operations organization has responsibilities for training in snow and ice removal. All employees involved in snow and ice operations shall attend annual snow and ice training coordinated by the District and conducted by the Subdistrict. Training shall include actual demonstrations with equipment, review of the Department Objectives and Procedures, Total Storm Management, and safety.

TOTAL STORM MANAGEMENT

1. General

A safe driving surface is of primary importance. The aim of snow and ice removal operations is to return the surface to normal conditions as soon as possible within the limitations of the Departmental Goals and Objectives.

The desired results can be obtained by proper use of storm forecasts, personnel, equipment, and materials. A coordinated effort must be made by all Districts and Subdistricts to provide the public with a uniform driving surface.

2. Storm Forecasts

INDOT utilizes many resources to predict and track winter storms; these include the National Weather Service, RWIS, satellite weather, 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.

3. Personnel

The District shall coordinate winter personnel assignments. It is the Subdistrict Managers' responsibility to call out the right number of people at the right time. The Subdistrict Manager may delegate authority to call out people to the Operations Foreman, Unit Foremen, or another designee.

5. Equipment

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

- a) Inspection - each time before a piece of snow and ice removal equipment is used, a routine inspection should be made to see that the piece of equipment is operating properly. Optimum times for inspections are at loading time and at shift change. Special attention should be given to all safety equipment and to the hydraulic system. Inspection should also be made after the storm and any problems reported and scheduled for early repair.
- b) Assignment of equipment - if possible each piece of equipment should be assigned to one person. This person would be responsible for reporting all maintenance needs and for keeping the equipment clean. Inspection should be completed before use by any person operating that piece of equipment. The Unit Foreman is responsible for making sure that reported maintenance needs are performed and equipment is in good working order.
- c) Repair of equipment - the shop is responsible for equipment repairs. The Shop Foreman shall be responsible for deeming a piece of equipment as “temporarily out of service”.
- d) Cleanup - snow and ice removal equipment needs to be cleaned as soon as possible after each storm to remove deposits of winter materials. All cleanup shall be performed in accordance with Operating Procedure #22, “Snow and Ice Chemicals, Pollution Control”.
- e) Truck and weather report - is required daily between November 1 and April 1 to track equipment being used and equipment that is down. The report shall originate at each Subdistrict, be compiled by the District, and posted to Operations Support via the Internet.

6. Snow and Ice Control Materials

A variety of materials are available for use during snow and ice operations. Selection of materials to be used can vary considerably depending on location, temperature, precipitation, forecast, traffic, etc. Several types of abrasives are available – naturally occurring sand being the most prevalent. Various chemicals are also available, as well as the same chemicals in different forms, including dry solids, pre-wetted solids, and liquids. New materials will be evaluated and recommended for use by the Winter Operations Team.

Materials are to be used to produce the desired pavement conditions within a reasonable period of time. Excessive applications of materials must be avoided at all times. Every effort must be made to hold the use of materials at the minimum level, which will produce the desired results in the time required.

6. Snow & Ice Strategies

Several strategies may be used to accomplish Department Objectives. They include anti-icing, de-icing, plowing, and spreading. The appropriate timing of any strategy requires the use of sound judgment, interpretation of available weather data, and prompt action.

a) Anti-icing: an effort to prevent bonding of snow and ice to the pavement by placing chemical prior to the storm or frost condition. Typically, liquids are used for this operation; anti-icing requires about 1/5 the amount of chemicals that is required to destroy the bond in de-icing operations.

b) De-icing: an effort to break bonding of snow and ice to the pavement after it has formed, usually after an inch of accumulation. Because de-icing is reactive, it cannot always provide reasonably safe road conditions during winter storms. Although there are various materials available for de-icing, pre-wet solids tend to be more effective; the pre-wetting liquid enhances the melting capacity of salt and results in as much as a 40% increase in retention of material on the pavement.

(i) Plowing: an effort to remove as much snow or loose ice prior to applying chemicals in an anti-icing or de-icing operation. Plowing is all that will be necessary if the pavement and snow are both cold and dry, and the snow is not adhering to the pavement.

(ii) Spreading: an effort to melt accumulated snow and ice by means of mechanical application of chemicals. INDOT shall use straight chemical, at its lowest effective rate, as its prevalent application. The amount of material utilized is dependent on a number of conditions; application rates will generally vary from 100-400#/lane mile or more. It must be noted that abrasives are not ice control chemicals and, as such, will not support the fundamental objective of either anti-icing or de-icing operations.

POST WINTER OPERATIONS

1. Equipment

All snow and ice removal equipment shall be thoroughly inspected and cleaned after winter operations are complete. This inspection should identify required cleaning and maintenance; required work shall be completed in a timely manner prior to storage. All material handling equipment, including liquid pumps, storage tanks, spreader chains and boxes, conveyors, beds, and plows shall be periodically maintained during the off-season as recommended.

2. Materials

All storage facilities shall be cleaned of excess materials in accordance with Operating Procedure #22, "Snow and Ice Chemicals, Pollution Control".

APPROVED: James M. Poturalski 3-5-01
Chief of Operations Support Date

A2.2 Planning Snow Routes and Instructions for Completing Form MM355 (pages 93-97)

Development of Snow and Ice Routes

These criteria shall be used in the development of snow & ice routes. Although these factors are discussed individually, many of them are interdependent.

1. **Facility Location** – Locations of Subdistricts, Units, and stockpiles must be considered to develop efficient routes, with particular emphasis on the following:
 - Deadhead mileage should be minimized
 - Only one snowplow shall be assigned to each snow route
2. **Boundaries** – Existing District, Subdistrict, and Unit boundaries may be crossed if necessary for more efficient routing. Coordination will be required between the affected management units.
3. **Levels of Service** – INDOT specifies three classes of roads with a different level of service for each. Class I roads have $ADT > 5000$, Class II roads have $ADT \leq 5000$, and Class III roads have $ADT < 5000$. Special conditions may warrant a Class II road to be serviced as a Class I; for example, this may include the presence of a hospital or school. Each snow route should be limited to one class of road to provide uniform level of service and avoid operator confusion when possible.

CLASS I

Interstate routes and roadways with Average Daily Traffic (ADT) volumes over 10,000 vehicles per day, as well as other high priority roadways, including but not limited to those serving hospital facilities and other emergency providers.

CLASS II

Routes with traffic volumes between 5,000 and 10,000 ADT.

CLASS III

Routes with traffic volumes of less than 5,000 ADT.

4. **Frequency of Service** – Routes must be serviced (plowed or treated) to obtain the desired level of service according to classification. Routes should be planned so that a Class I is serviced approximately every 2 hours (generally between 1 ½ and 2 ½ hours) and a Class II is serviced approximately every 2.5 hours (generally between 2 and 3 hours). Class III should be serviced every 3 hours (generally between 2 ½ and 3 ½ hours). Routes that must combine roads of different classes should combine the frequencies of service. For example,

combining two roads of the same length, one being Class I and the other Class II, should have a target service frequency of 2 ½ hours.

5. **Length of Routes** – Factors that affect the length of routes include driving speed, deadhead miles, truck capacity, and material application rate. Routes must have a length that under average conditions can be serviced within the specified service frequency.
6. **Speed** – For the purposes of route design, average deadhead speed should be 40mph and average service speed should be 20mph. However, the physical characteristics of a road must be considered - hills, curves, urban areas, ramps or other special conditions may affect these average speeds. If variances are used they should be documented.

Instructions for Completing Form MM 355: Snow and Ice Removal Route Documentation



Form MM 355 will be used to document snow and ice routes. One form will be completed for each route. In addition to the narrative, either a freehand or computer generated drawing of the route shall be provided with the MM355. This may be either on the back of the MM355 or on a separate attached sheet. Each route should be reviewed by District Operations staff and approved by the District Director. After District approval, a copy of the route will be sent to Central Office, Division of Operations Support, for review and final approval. Major discrepancies from approved routing procedures will be noted and discussed with the District Operations Engineer.

To complete the MM 355 the following information needs to be filled in (see attached example).

1. **Subdistrict Name** – Fill out the name of the Subdistrict where the route originates.
2. **Route Number** – A unique number should be assigned to each route. The number should be in the form A-BCD-E where:
 - A = Priority of route within the Subdistrict
 - BC = Subdistrict Number (first two digits of the maintenance management number)
 - D = Unit Number
 - E = Route Classification
3. **Estimated Time** – An estimate of how long it will take to service the route in hours. This time is the sum of deadhead time, service time, and loading time. Loading time shall be 15 minutes.
4. **Action** – Action performed on the route - Load, Deadhead, or Service
5. **On Route** – Road action is performed on; for loading put Unit or stockpile number.
6. **From/To** – Description of starting and ending points of listed action.
7. **LN. MI. Service** – Record the lane miles serviced for each line service is listed as action.
8. **D.H. Miles** – Record the deadhead miles traveled for each line deadhead is listed as action.
9. **Lane Miles Serviced** – Total of all lane miles serviced for the route.
10. **Deadhead Miles** – Total of all deadhead miles traveled for the route.
11. **Travel Miles** – Total of Lane Miles Serviced and Deadhead Miles.

12. **Notes** – Special considerations or conditions associated with the route.
13. **Approved By** – Signature of District Director
14. **Effective Date** – Date approved.

Use either the following or some other easily recognized symbols for the map:

	Unit Location Number
	Stockpile Location Number
+++++	Deadhead
→ → → →	Service

Direction of travel on ramps, turn around locations and special problem areas should be noted on the map.

MM355 8/01

INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF OPERATIONS SUPPORT
SNOW & ICE REMOVAL ROUTE DOCUMENTATION



SUBDISTRICT: 1

ROUTE NUMBER: 2 ESTIMATED TIME: 3

ACTION	ON ROUTE	FROM	TO	LN. MI. SERVICE	D.H. MILES
4	5	6		7	8
NOTES: 12			LANE MILES SERVICED	9	10
			DEADHEAD MILES	11	
			TRAVEL MILES		

APPROVED BY: 13

EFFECTIVE DATE: 14

DISTRICT DIRECTOR
1137

State Form

A2.3 Tort Claim Form (pages 98-99)



NOTICE OF TORT CLAIM FORM for PROPERTY DAMAGE & PERSONAL INJURY Provided by the State of Indiana - Office of the Attorney General

Anyone who has a claim for personal injury or property damage against the State of Indiana must either use the following form to file a claim or make the claim in writing as prescribed in Indiana Code 34-13-3 and these rules:

--DO NOT DELAY MAKING YOUR CLAIM. INDIANA LAW GIVES YOU ONLY 270 (TWO HUNDRED SEVENTY) DAYS AFTER THE LOSS TO MAKE A CLAIM, AND IT MUST COMPLY WITH Indiana Code 34-13-3.

--EACH PERSON WHO HAD A LOSS SHOULD FILE A SEPARATE FORM.

--KEEP A COPY OF YOUR CLAIM FORM, YOUR RECEIPTS FOR YOUR BILLS AND YOUR CERTIFIED OR REGISTERED MAIL RECEIPT.

--if your claim is properly filed, the Office of the Attorney General will investigate it and will notify you in writing within 90 days of receipt if your claim is approved. A claim is denied if not approved within 90 days.

--The filing of this claim is part of a legal process. If you have any questions about the right way to file a claim, you should contact an attorney of your choice. The state's attorneys are not authorized by law to assist you with filing this claim; however, for your information, the following is a list of actions or conditions resulting in nonliability pursuant to Indiana Code 34-13-3:

See 3. A governmental entity or an employee acting within the scope of the employee's employment is not liable if a loss results from:

- (1) the natural condition of unimproved property;
- (2) the condition of a reservoir, dam, canal, conduit, drain, or similar structure when used by a person for a purpose which is not foreseeable;
- (3) the temporary condition of a public thoroughfare which results from weather;
- (4) the condition of an unpaved road, trail, or footpath, the purpose of which is to provide access to a recreation or scenic area;
- (5) the initiation of a judicial or an administrative proceeding;
- (6) the performance of a discretionary function;
- (7) the adoption and enforcement of or failure to adopt or enforce a law (including rules and regulations), unless the act of enforcement constitutes false arrest or false imprisonment;
- (8) an act or omission performed in good faith and without malice under the apparent authority of a statute which is invalid, if the employee would not have been liable had the statute been valid;
- (9) the act or omission of anyone other than the governmental entity or the governmental entity's employee;
- (10) the issuance, denial, suspension, or revocation of, or failure or refusal to issue, deny, suspend, or revoke, any permit, license, certificate, approval, order, or similar authorization, where the authority is discretionary under the law;
- (11) failure to make an inspection, or making an inadequate or negligent inspection, of any property, other than the property of a governmental entity, to determine whether the property complied with or violates any law or contains a hazard to health or safety;
- (12) entry upon any property where the entry is expressly or impliedly authorized by law;
- (13) misrepresentation if unintentional;
- (14) theft by another person of money in the employee's official custody, unless the loss was sustained because of the employee's own negligent or wrongful act or omission;
- (15) INJURY TO THE PERSON OR PROPERTY OF A PERSON UNDER SUPERVISION OF A GOVERNMENTAL ENTITY and who is:
 - (A) on probation; or
 - (B) assigned to an alcohol and drug services program under IC 12-23, a minimum security release program under IC 11-10-8, or a community corrections program under IC 11-12;
- (16) design of a highway (as defined in IC 9-13-2-73), if the claimed loss occurs at least twenty (20) years after the public highway was designed or substantially redesigned; except that this subdivision shall not be construed to relieve the responsible governmental entity from the continuing duty to provide and maintain public highways in a reasonably safe condition; or
- (17) development, adoption, or implementation, operation, maintenance, or use of an enhanced emergency communication system.

**STATE OF INDIANA
CLAIM FOR PERSONAL INJURY OR PROPERTY DAMAGE
"PLEASE PRINT"**

1. Name of Claimant: _____ Drivers Lic. # _____
2. Date & Time of Loss: _____
3. EXACT Location of Loss (include COUNTY, nearest crossroad, & town): _____

4. Dollar Amount of Loss: _____
5. State Agency &/or State Vehicle Commission # Involved (if known): _____

6. Names & Addresses (if known) of ALL persons involved: _____

7. Address of Claimant at Time of Loss: _____
8. Claimant's Current Address (if different from above), & Current Phone #'s: _____

() _____ Home () _____ Work
9. How was the State negligent: _____
10. Explanation of what happened (use additional sheets if necessary): _____

PLEASE READ: I swear & affirm under the penalties of perjury, that the foregoing information is true and correct to the best of my knowledge & belief.

CLAIMANT'S SIGNATURE

DATE

ATTACH PHOTOGRAPHS, COPIES OF MEDICAL BILLS, ACCIDENT REPORTS, VEHICLE REGISTRATION, RECEIPT(S) FOR REPAIR TO YOUR PROPERTY OR TWO ESTIMATES OF REPAIR, & ANY ADDITIONAL DOCUMENTATION IN REFERENCE TO THIS MATTER.

Mail this claim form & any attachments by **CERTIFIED** or **REGISTERED** mail to:

Office of the Attorney General
ATTN: Tort Claim Investigations
IGCS 5th Floor
402 W. Washington Street
Indianapolis, IN 46204-2770

A2.4 Waiver of All Claims and Agreement to Assume Any and All Risks

**WAIVER OF ALL CLAIMS
AND
AGREEMENT TO ASSUME ANY AND ALL RISKS**

I, _____,

representing, _____,

hereby request permission to accompany and /or observe Indiana Department of Transportation

(INDOT) personnel on _____ (specify type) operations.

I fully understand that such operations are often inherently hazardous and agree to assume any and all risks, known and unknown associated therewith. I further certify, by my signature below, that I am over the age of 18 years, and agree as consideration for receiving the opportunity herein requested, to waive any and all claims against INDOT, which might arise during the requested observation of INDOT operations.

SIGNATURE _____

PRINTED NAME _____

DATE _____

A2.5 INJURY REPORTING

1. REPORT EVERY OCCURRENCE no matter how minor
2. NOTIFY YOUR SUPERVISOR
 - A. Complete the Indiana Worker's Compensation Report
 - B. Your Supervisor must fill out the Supervisor's Investigation Report
 - C. You should receive a Attending Physician's Report from the hospital (if you get medical attention)
 - D. Send all of the above to your Department so it can be input into the Injury Reporting System within 7 days.

In the event of a **SERIOUS ACCIDENT/INJURY** the department person in charge at the job site will be responsible for calling in to get emergency care sent. The person receiving the call notifies the Department Head, the District Finance/HR Manager and the District Safety Director.

If you have any questions please contact your supervisor.

Appendix 4.1 - District Call-Out Procedures (pages 99-104)

DATE: January 23, 2009

MEMORANDUM:

TO: District Deputy Commissioners
District Highway Maintenance Directors

OPERATIONS
MEMORANDUM NO, 08-02
Maintenance

FROM: James Poturalski, Deputy Commissioner
Highway Management

Michael B. Cline, Deputy Commissioner
District Operations & Traffic Management

INDOT
District Call—Out Procedures

The INDOT District Call-Out Procedures apply to all INDOT District employees performing Snow and Ice Control activities and to District Highway Maintenance Subdistrict and Unit employees for all other activities. The intent of these procedures is to offer a fair opportunity for voluntary overtime and a fair distribution of mandatory overtime to all overtime eligible INDOT employees.

Definitions:

District Driver:

An INDOT employee assigned on an on-call basis to the INDOT Subdistricts or Units for Snow and Ice Removal.

Unit Driver:

An INDOT employee permanently assigned or reassigned to an INDOT Unit for the winter.

Full Call—Out:

A Call-Out of INDOT employees that requires staffing for every route and all supporting functions.

Partial Call-Out:

A Call-Out of INDOT employees that does not require every route or support activity to be staffed.

Distance Drivers:

INDOT District Drivers assigned to an IN DOT facility located a distance from their home that is in excess of their normal commute distance.

Part 1: Volunteer lists

A list of Unit Drivers and District Drivers volunteering for Snow and Ice Control activities will be compiled by the District Highway Maintenance Director and maintained in each INDOT Unit. This list of volunteers, by shift, will be posted at all INDOT Units by the Unit Foreman. The list will be posted and updated bi-weekly. Employees are only eligible to volunteer for the shift they are assigned.

For all other overtime opportunities, a current list of INDOT Unit volunteers will be posted at the INDOT Unit.

Employees desiring to work any available overtime may indicate their availability by signing their name to the volunteer list. Employees are encouraged to volunteer for overtime at the Unit location they are assigned to where the employee meets the minimum position qualifications.

Employees refusing two volunteer assignments will have their name removed from the volunteer list and be ineligible for signing the volunteer list for thirty (30) days.

The Subdistrict Manager has the discretion to reinstate an employee's eligibility to sign the volunteer list prior to the end of thirty (30) days. It is the employee's responsibility to keep their volunteer status up-to-date.

Part 2: Mandatory Lists

A current list of employees will be posted, by shift, at each INDOT Unit facility.

In the event that the District Highway Maintenance Director determines overtime staffing needs are not met by volunteers the District Highway Maintenance Director (or his/her designated manager/supervisor) will call-out employees from the mandatory list.

Part 3: Overtime

3A: Distribution of Overtime:

It is anticipated that INDOT overtime work will be distributed among INDOT employees with first consideration being given to volunteers. During winter operations, overtime will be distributed alphabetically according to employees' assigned shift.

The supervisor conducting the employee call-out will start at the top of the volunteer list on the first call-out. Subsequent call-outs will begin where the previous call-out ended. When the end of the list is reached, supervisors will return to the beginning of the list. Exceptions will be made at the discretion of the manager/supervisor to ensure adequate snow removal experience or supervision will be available on each shift.

INDOT managers and supervisors are accountable for proper administration of overtime.

For Districts that use a set twelve (12) hour shift, employees will be offered overtime for their shift.

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District Call-Out Procedure

January 23, 2009

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3B: Excessive Overtime:

Except in unusual circumstances, employees will neither be required nor allowed to work more than a sixteen (16) hour day. After working a sixteen (16) hour shift, an employee must be off for a minimum of eight (8) hours prior to returning to work.

Use of 16-hour shifts is discouraged and should be used only where sufficient personnel are not available or when transitioning into twenty-four (24) hour operations.

Part 4: Absences

4A: Employee's Responsibilities

Employees requesting to be excused for a specific time period should submit their request to their supervisor as far in advance as possible.

Employees should not expect to have every request approved.

Approval of an INDOT employee's request to be excused from a mandatory overtime assignment is the responsibility of the INDOT Subdistrict Manager. An INDOT employee is allowed to refuse one mandatory overtime assignment once every six months.

4B. Supervisor's Responsibilities

Subdistrict Managers are authorized to approve or deny requests for absences in accordance with the appropriate leave policy.

4C.: Unexcused Absences

Any INDOT employee absence for overtime work that is not excused under Part 4A and 4B of the INDOT District Call-Out Procedures is considered an unexcused absence. INDOT employees are considered in violation of these procedures and subject to disciplinary action for any absence subsequent to one (1) excused mandatory overtime assignment within a 6-month period. Each subsequent unexcused absence within a six-month period is considered a further violation and subject to further progressive discipline described in the State's Discipline Policy.

Part 5: Commute Pay

A distance driver who has gone home after completing his/her regular work day and is subsequently called out to travel a substantial distance (defined as travel 30 miles in excess of normal commute

distance) to perform a Snow and Ice Control assignment shall have all time spent on such travel counted as working time.

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District Call-Out Procedure
January 23, 2009
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Distance Drivers without state assigned vehicles are also eligible for mileage reimbursement as described in Financial Management Circular 2003-1 including mileage based in excess of their normal commute distance, or between their normal work station and the temporary assignment, or between the employee's home and the temporary assignment, whichever is least. Standard procedures for mileage reimbursement will apply; therefore, normal commute miles should be subtracted from reimbursement request.

Distance Drivers may be assigned a state owned vehicle in-lieu of mileage compensation.

Part 6: Call-Back Pay

INDOT employees called back to work by their INDOT supervisor will be paid no less than two (2) hours work.

If the employee chooses, they need only work the time it takes to perform the required duties, in which case the employee will only be paid for the time worked.

INDOT employees are eligible to work their normally scheduled hours at the end of a winter snow call-out that are not in excess of a total of twelve (12) hour worked.

INDOT employees choosing to stay after the time needed to complete their snow call-out assignments will be provided job assignments by the supervisor.

Part 7: Winter Reassignment

By September 1st of each year, a list of INDOT District employees eligible for overtime, and in a job classification required to have a Commercial Drivers License (CDL) will be compiled by the District Highway Maintenance Director.

The District Highway Maintenance Director will assign each listed District employee to a Maintenance Unit or Subdistrict to which they are to report for snow and ice control operations.

By November 1st of each year, the Highway Maintenance Director will compile a list of INDOT employees in CDL required classifications to identify their current winter assignment location and eligibility for full-time winter re-assignment. Permanent winter re-assignments will be made by the District Highway Maintenance Director to optimize use of INDOT staff during winter.

By November 1 of each year, the District Highway Maintenance Director will distribute the list of eligible District staff indicating:

1. Driving assignments

2. Permanent winter reassignments
3. List of employees designated as Distance Drivers
4. List of employees eligible for Commute Pay.

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District Call-Out Procedure
January 23, 2009
Page 5 of 5

An effort will be made by the Highway Maintenance Director to assign all INDOT Drivers to the INDOT Unit nearest their home; however, it is anticipated that this will not be possible for every assignment.

Part 8: 12-hour Shift Procedures (Where sufficient personnel is available)

Twelve Hour Shifts will be implemented as follows:

1. Where District Drivers are required, approximately half of the Unit driver positions will be assigned to each shift.
2. District Drivers will choose their shift by permitting the employee with the highest seniority, as of November 1 of the current calendar year, to make the first selection, and so on.
3. Unit assigned personnel will choose their shift by permitting the employee with the highest seniority, as of November 1 of the current calendar year, to make the first selection, and so on. The Subdistrict Manager has the authority to modify shift assignments.
4. The Subdistrict Manager may assign a supervisor to each shift for each Unit.
5. Set shift times will be established Noon-to-Midnight and Midnight-to-Noon.
6. Each Unit Foreman will post a volunteer list for each shift. Employees may only volunteer for their assigned shift.
7. Designated callout times-
 - a. Shifts:
 - i. Shift A is from Noon to Midnight
 - ii. Shift B is from Midnight to Noon
 - b. Events that start during the normal hours of operation: the employees at the Unit will work snow removal until the end of their normally scheduled day. The needed Shift A District Drivers will be called in to report to the Unit for duty until Midnight and the Shift B Unit Drivers will be sent home.
 - c. For events that start outside of normal hours of operation, events that start from 8 am - 8 pm, Shift A will be called in to work until Midnight or the cod of the event Events that start from 8pm - 8 am, Shift A will be called in to work until Noon or the end of the event.
8. The Subdistrict Manager (or his/her designated manager/supervisor) has the authority to alter shift times.

Part 9: Exceptions

The District Highway Maintenance Director, Subdistrict Managers, and Unit Foremen may deviate from the procedures, set forth herein, in the event conditions exist that threaten the security or operation of INDOT or the public safety.

A 4.2 DRIVER CERTIFICATION

Mark an “S” for Satisfactory or “U” for Unsatisfactory for each item. If “U” is marked, make comments below.

ITEM	TRUCK	LOADER
Perform Required Daily Inspection		
Engine Warm-up		
Buckle up & Takeoff		
Use of Control and Emergency Equipment		
Truck Operation in Traffic/ Loader with Yard Traffic		
Turning of Vehicle		
Braking		
Backing and Parking		
Use of Snow Removal Equipment		
Muncie System Operation		
Performs Mid-Shift “Walk Around” Before Leaving Unit to Resume Snow Removal Efforts		
Drives at Night Speed		
Knowledge of Roadside Landmarks for Pavement Location		

TRUCK

Truck /Tanker		
Miles Driven		
Certifier's Last Name		

LOADER

Time Spent		
Certifier's Last Name		

DRIVER EXPERIENCE

ITEM	DATE
Step 1: Employee rides/drives with experienced driver	
Step 2: Employee drives with experienced driver and acquires route familiarization	
Step 3: Employee drives with unit foreman for driver qualification	
Step 4: Employee operates loader while experienced operator observes	

It is my opinion that this driver possesses sufficient skill to operate snow and ice removal equipment:

Supervisor Signature

Date

Comments: _____

A5.1 Snow and Ice Equipment Fleet Sizes

Snow and Ice for 6/01/2009			
	Class	Replace	
Name of Equipment	Code	Cost Each	Fleet Size
Front End Loader	2150	\$113,200	1 PER LOADING SITE
Hydraulic Reversing Snow Plow	6319	\$3,400	THIS IS FOR ALL TYPES OF SNOW PLOW INCLUDING "V" & WING PLOWS FT. WAYNE/LAPORTE 1 PER TRUCK + 2 PER UNIT ANY COMBINATION CRAWF./GREENFIELD 1 PER TRUCK + 1.5 PER UNIT ANY COMBINATION SEYMOUR/VINCENNES 1 PER TRUCK + 1 PER UNIT ANY COMBINATION
Manual Reversing Snow Plow	6320	\$2,600	SEE HYDRAULIC REVERSING SNOW PLOW CRITERIA
10 Ft. Spreader	6324	\$11,000	NUMBER OF SA TRUCKS + 1 PER SUB AND 2 ADDITIONAL FOR INDY SUB
13 Ft. Spreader	6325	\$12,000	NUMBER OF TA TRUCKS + 1 PER SUB AND 2 ADDITIONAL FOR INDY SUB
"V" Plow	6330	\$6,000	SEE HYDRAULIC REVERSING SNOW PLOW CRITERIA
One Way Wing Plow	6336	\$12,000	SEE HYDRAULIC REVERSING SNOW PLOW CRITERIA
Anti-icing Sprayer	6400	\$12,550	1 PER SUB EXCEPT + 4 FOR INDY SUB, +3 GREENFIELD DISTRICT AND LAPORTE 2/5000 GALLON TANKERS, 1/1200 GALLON TANKS, AND 13/2000 GALLON TANKS , SEYMOUR 2/5000 GALLON TANKERS
Anti-icing Tanker	6406	\$65,000	
Tow Plow	6319	\$82,850	FT. WAYNE DISTRICT

A5.2 Dump Truck Fleet Sizes

Dump Trucks 6/01/2009			
	Class	Replace	
Name of Equipment	Code	Cost Each	Fleet Size
Dump Truck Single Cab Single Axle	1580	\$121,000	THIS BASED ON THE NUMBER OF SNOW ROUTES PLUS 2 PER SUBDISTRICT
Dump Truck Double Cab Single Axle	1587		. THE MIX OF TANDEM, DOALLS, AND SINGLE AXLES WILL BE
Dump Truck Single Cab Tandem Axle	1590	\$130,100	AT THE DISCRETION OF THE DISTRICTS. NO TANDEM OR DOALL
Doall Single Cab Single Single Axle	1604	\$127,300	INCREASE IS ANTICIPATED AND WOULD BE MONITORED BY THE
Multi-Purpose Dump Single Axle	1605	\$140,000	EQUIPMENT SECTION . THE
Multi-Purpose Dump Tandem Axle	1606	\$150,300	COST OF A DUMP TRUCK FOR BUDGET/REPLACEMENT PURPOSES WILL
			BE THE AVERAGE PRICE OF A TANDEM AND SINGLE AXLE, WHICH IS
			ROUGHLY THE (50% TANDEM/50% SINGLE) CURRENT PERCENTAGE.
			THIS PERCENTAGE WILL REMAIN THE SAME EACH YEAR AS
			REPLACEMENT COSTS ARE CALCULATED.

A5.3 Preventive Maintenance Schedules

Preventive Maintenance (PM) “A” Requirements		
Equipment Type	Service Time	Tasks
Dump Trucks (Single Axle, Tandem Axle, and Doalls)	4000 miles, 300 hours or 182 days	Drain and change the oil.
		Change oil and fuel filters on all Level A PM’s
		Check all fluids
		Check tire pressure
		Check lights
		Check the U-joints
Check the Muncie System		
Loaders	200 hours or 182days	Check the auto lube system if the loader has one
		Drain and change the oil
		Change the oil and fuel filters
		Check lights
		Check the bucket blade
		Check the radiator
		Check swivel bushings
		Grease the driveline
		Check the brakes
Preventive Maintenance (PM) “B” Requirements		
Equipment Type	Service Time	Tasks
Dump Trucks (Single Axle, Tandem Axle, and Doalls)	12000miles, 900 hours or 365 days	Drain and change the oil if needed
		Change the water, transmission, fuel, and hydraulic filters
		Adjust the brakes and pull the wheels if necessary
		Check and change anti-freeze, if needed
		Check tire pressure
		Check lights
		Inspect Muncie System
		Check all fluids
		General inspection of the truck from front to back
Loaders	600 hours or 365 days	Drain and change the oil
		Change the oil, transmission, and hydraulic filters
		Inspect the external brakes if applicable
		General inspection over the entire piece of equipment

Spreaders	365days	Check of fittings
	(Between 1st and 3rd of	General inspection over the entire
	August each year)	piece of equipment
Plows	365 days	General inspection over the entire
	(Between 1st and 3rd of	piece of equipment
	August each year)	

A5.4 Operator's Daily Checklist

**INDIANA DEPARTMENT
OF TRANSPORTATION**
State Form 9396 (R3 / 11-95)
OPERATOR'S DAILY CHECK LIST

DATE		
MO.	DAY	YR

SHIFT 1 2 3

EQUIPMENT I.D. No.

TYPE OF EQUIPMENT

BEFORE STARTING:

	✓ IF OK — X IF NOT						
	SU	MO	TU	WE	TH	FR	SA
ENGINE OIL LEVEL							
FUEL LINES, CONNECTIONS & LEVEL							
COOLANT LEVEL							
BATTERY (CONDITION WATER LEVEL-TERMINALS)							
BELTS, HOSES & WIRING							
TIRES/TRACKS							
HYDRAULIC COMPONENTS & ATTACHMENTS (LEAKS-DAMAGES-ETC.)							
WHEELS-LUGS-RIMS							
SUSPENSION COMPONENTS							
EXHAUST SYSTEM							
LUBE-HEAVY EQUIPMENT							
LUBE-SEASONAL EQUIPMENT							

AFTER STARTING:

ENGINE (OIL PRESSURE UNUSUAL NOISE)							
AIR PRESSURE (AIR BRAKE EQUIPPED VEHICLES) BLEED AIR TANKS							
ALL INSTRUMENTS							
ALL LIGHTS							
CAB & BODY CONDITION (GLASS & DOORS)							
WINDSHIELD WIPERS & WASHERS							
HORN							
CLUTCH (PEDAL TRAVEL-SMOOTHNESS)							
TRANSMISSION WHEN WARM (ATF LEVEL-NOISES)							
BRAKES/EMERGENCY PARKING BRAKE (PEDAL TRAVEL-STOPPING ABILITY)							
SAFETY EQUIPMENT							
STEERING							
RADIO							
OTHER (DETAILS BELOW)							

REMARKS _____

OPERATOR SIGNATURE: _____

A5.5 Equipment Repair List



EQUIPMENT REPAIR LIST

State Form 9397 (R3 /3-05)

Indiana Department of Transportation

EQUIPMENT I.D. No.					DATE		
					MO.	DAY	YR
MILEAGE READING					TYPE OF EQUIPMENT		
HOUR READINGS							
SHOP NOTIFIED							
MONTH	DAY	YEAR	TIME				
LOCATION WHERE EQUIPMENT IS PARKED OR OPERATING							
√ SHOP ATTENTION REQUIRED							
<input type="checkbox"/> FUEL SYSTEM				<input type="checkbox"/> STEERING/FRONT SUSPENSION			
<input type="checkbox"/> COOLING SYSTEM				<input type="checkbox"/> BRAKE SYSTEM			
<input type="checkbox"/> ENGINE ELECTRICAL				<input type="checkbox"/> HYDRAULIC SYSTEM			
<input type="checkbox"/> EXHAUST SYSTEM				<input type="checkbox"/> BODY/CAB/FRAME			
<input type="checkbox"/> ENGINE BLOCK HEAD				<input type="checkbox"/> INSTRUMENTS & ACCESSORIES			
<input type="checkbox"/> POWER TRANSMISSION GROUP				<input type="checkbox"/> TIRES			
<input type="checkbox"/> DRIVE SHAFT AXLE(S)				<input type="checkbox"/> MUNCIE SYSTEM			
<input type="checkbox"/> RADIO				<input type="checkbox"/> SAFETY			
<input type="checkbox"/> REAR SUSPENSION				<input type="checkbox"/> BACK UP ALARM			
DETAIL/REMARKS _____							
UNIT FOREMAN'S SIGNATURE							
				√ EQUIPMENT CONDITION			
				USEABLE SAFE		UNUSEABLE	
OPERATOR'S SIGNATURE							

A5.6 Truck Report

Friday

03/28/2008

Vincennes District

Truck and Weather

Linton Sub-District as of 3/28/2008 6:46:45 AM

<u>Snow Accum.</u>	<u>Road Conditions</u>		<u># Routes</u>	<u>Trucks Out</u>	<u>Fleet Size</u>	<u>Down</u>	<u>Available</u>
0	Wet		21	0	23	1	22
Down	Comm#	Axles	Down	Problem		Est. Return	
	066613	TA	2/22/2008	Fire			

Evansville Sub-District as of 3/28/2008 6:57:52 AM

<u>Snow Accum.</u>	<u>Road Conditions</u>		<u># Routes</u>	<u>Trucks Out</u>	<u>Fleet Size</u>	<u>Down</u>	<u>Available</u>
0	Dry		37	0	41	2	39
Down	Comm#	Axles	Down	Problem		Est. Return	
	066829	MPS	3/11/2008	Truck Frame		4/4/2008	
	066609	SA	3/24/2008	Radiator		4/4/2008	

Paoli Sub-District as of 3/28/2008 7:40:42 AM

<u>Snow Accum.</u>	<u>Road Conditions</u>		<u># Routes</u>	<u>Trucks Out</u>	<u>Fleet Size</u>	<u>Down</u>	<u>Available</u>
0	Wet		30	0	33	0	33

Tell City Sub-District as of 3/28/2008 8:05:05 AM

<u>Snow Accum.</u>	<u>Road Conditions</u>		<u># Routes</u>	<u>Trucks Out</u>	<u>Fleet Size</u>	<u>Down</u>	<u>Available</u>
0	Wet		32	0	38	1	37
Down	Comm#	Axles	Down	Problem		Est. Return	
	066852	TA	2/27/2008	Oil Leak		2/27/2008	

Vincennes Sub-District as of 3/28/2008 7:30:37 AM

<u>Snow Accum.</u>	<u>Road Conditions</u>		<u># Routes</u>	<u>Trucks Out</u>	<u>Fleet Size</u>	<u>Down</u>	<u>Available</u>
0	Dry		30	0	33	1	32
Down	Comm#	Axles	Down	Problem		Est. Return	
	066787	DA	3/17/2008			3/24/2008	

Comments Temp is 35

Friday, March 28, 2008

Truck and Weather Report
Main Page

Page 1 of 1

A5.7 Fall Snow Removal Equipment VIP Inspection Report (pages 116-120)

State Form 48208 (9-2009)

**Fall Snow Removal Equipment
VIP Inspection Report**

DATE: _____

COMMISSION # _____ YEAR _____ MAKE _____ MODEL _____

MILEAGE _____ HOUR METER _____

DRIVER _____ UNIT _____

RADIO COMMISSION # _____ OR RADIO SERIAL # _____

STATION 1

1A-LIGHTING SYSTEM (25 POINTS)

- DOME LIGHT – DEDUCT (1) POINT
- CLEARANCE LIGHTS – DEDUCT (1) POINTS
- HEAD LAMPS – DEDUCT (3) POINTS
- PARKING LIGHTS - DEDUCT (1) POINT
- STROBE LIGHTS – DEDUCT (3) POINTS
- TAIL LIGHTS – DEDUCT (3) POINTS
- POINTS
- TURN LIGHTS – DEDUCT (3) POINTS
- BACKUP LIGHTS – DEDUCT (3) POINTS
- BRAKE LIGHTS – DEDUCT (3) POINTS
- PLOW LIGHTS – DEDUCT (3) POINTS
- PATTERN LIGHTS – DEDUCT (1) POINTS

6A-MISCELLANEOUS (100 POINTS)

- INDOT DECALS – DEDUCT (20) POINTS
- LICENSE PLATE – DEDUCT (20) POINTS
- OSHA DECALS – DEDUCT (20) POINTS
- REQUIRED DOCUMENTATION – DEDUCT (20) POINTS
- REGISTRATION – DEDUCT (20) POINTS

8A-OUTSIDE APPEARANCE (50 POINTS)

CONSIDERING THE AGE OF THE VEHICLE
LOOK AT: OVERALL APPEARANCE, INCLUDING

- PAINT, BODY & CAB CONDITION
AND CLEANLINESS
- 1 to 3 YEARS OLD MAXIMUM (30) POINTS
- OVER 3 YEARS MAXIMUM (50) POINTS

9A-INSIDE APPEARANCE (50 POINTS)

CONSIDERING THE AGE OF THE VEHICLE
LOOK INSIDE VEHICLE FOR : OVERALL

1C-ACCESSORIES (25 POINTS)

- BACKUP ALARM – DEDUCT (5) POINTS
- HEATER/DEFROSTER – DEDUCT (4) POINTS
- HORNS – DEDUCT (4) POINTS
- HOUR METER – DEDUCT (4) POINTS
- TACHOMETER – DEDUCT (4) POINTS
- WIPERS/WASHERS/SOLVENT – DEDUCT (4)

2A-CAB (30 POINTS)

- CAB MOUNTS – DEDUCT (2) POINTS
- CAB RAILS – DEDUCT (2) POINTS
- GLASS – DEDUCT (2) POINTS
- HITCH – DEDUCT (2) POINTS
- UNDERCARRIAGE – DEDUCT (2) POINTS
- CAB CONDITION – DEDUCT (2) POINTS
- CAB CLEANLINESS – DEDUCT (2) POINTS
- MIRRORS – DEDUCT (2) POINTS
- RUST/ACCIDENT DAMAGE – DEDUCT (2) POINTS
- SAFETY EQUIPMENT – DEDUCT (2) POINTS
- SEATS – DEDUCT (2) POINTS
- SEAT BELTS – DEDUCT (3) POINTS

FLOOR MATS – DEDUCT (1) POINTS

CONDITION, INCLUDING DASH, MATS,
SEATS, ETC.
1 TO 3 YEARS OLD MAXIMUM (30) POINTS
OVER 3 YEARS OLD MAXIMUM (50) POINTS

COMMENTS: _____

STATION 2

2B-BODY (30 POINTS)

FRAME – DEDUCT (5) POINTS
POINTS
PLOW HITCH ASSEMBLY – DEDUCT (10) POINTS
POINTS
RUST/ACCIDENT DAMAGE – DEDUCT (8) POINTS

BODY CLEANLINESS – DEDUCT (5) POINTS
MUD CLEANLINESS – DEDUCT (2) POINTS

10A-PLOW (100 POINTS)

COMMISSION # _____
TANKS – DEDUCT (10) POINTS
LIFT SYSTEM – DEDUCT (10) POINTS
CYLINDERS – DEDUCT (20) POINTS
HOSES – DEDUCT (10) POINTS
BLADES– DEDUCT (10) POINTS
MOLDBOARD – DEDUCT (20) POINTS
FRAME/BREKOVER ASSEMBLY– DEDUCT (10) POINTS
CONDITION – DEDUCT (5) POINTS
HOOKUP – DEDUCT (5) POINTS
PAINT – DEDUCT (5) POINTS
PLOW MARKERS – DEDUCT (5) POINTS

11A-SPREADER (100 POINTS)

COMMISSION # _____
POINTS
PAINT – DEDUCT (5) POINTS
CHAIN/BELT – DEDUCT (20) POINTS
HOSES – DEDUCT (10) POINTS
BEARINGS – DEDUCT (15) POINTS
MOTOR – DEDUCT (20) POINTS
CONDITION – DEDUCT (5) POINTS
SPINNER ASSEMBLY – DEDUCT (15) POINTS
GRATES – DEDUCT (5) POINTS
TIE DOWNS/HOLD DOWNS – DEDUCT (5) POINTS

2C-HYDRAULICS (40 POINTS)

HYDRAULIC SYSTEM – DEDUCT (20)

PLOW LIFT CYLINDER – DEDUCT (10)

HYDRAULIC FLUID LEVEL/COND –
DEDUCT (10) POINTS

12A-PRE WETTING SYSTEM (60 POINTS)

HOSES – DEDUCT (10) POINTS
NOZZLES – DEDUCT (10) POINTS
ELECTRICAL – DEDUCT (10) POINTS
SENSORS – DEDUCT (10) POINTS
PUMP/FILTERS – DEDUCT (10) POINTS

12B-MUNCIESYSTEM (40POINTS)

CONTROLLER CLR/RESET – DEDUCT (10)

SENSOR – DEDUCT (10) POINTS
CALIBRATION – DEDUCT (10) POINTS
ELECTRIAL– DEDUCT (10) POINTS

13A- PRE SEASON AVL (0 POINTS)

POWER UP SYSTEM AND MONITOR

CHECK MOUNTING LOCATION OF MONITOR
TO ENSURE ABILITY TO VIEW AND INPUT
INFO.

WEB PAGE CHECK

DATA ENTRY CHECK

ENSURE PAVEMENT TEMPERATURE READING
FROM SENSOR IS TRANSFERRING TO IWAPI

COMMENTS: _____

STATION 3

1B-CHARGING SYSTEM (50 POINTS)

ALTERNATOR – DEDUCT (20) POINTS
BATTERY – DEDUCT (10) POINTS
POINTS
BATTERY CABLE ENDS – DEDUCT (5) POINTS
POINTS
BATTERY BOX – DEDUCT – (10) POINTS
BATTERY CABLES – DEDUCT (5) POINTS

3B-ENGINE (30 POINTS)

BELTS – DEDUCT (2) POINTS
ENGINE CONDITION– DEDUCT (15) POINTS
STARTER – DEDUCT (2) POINTS
FUEL SYSTEM LEAKS/FILTERS – DEDUCT (3) POINTS
ENGINE CLEANLINESS – DEDUCT (2) POINTS
ENGINE OIL LEVEL – DEDUCT (3) POINTS
POINTS
FUEL WATER SEPARATOR – DEDUCT (3) POINTS
POINTS

4A-STEERING (60 POINTS)
POINTS)

STEERING LINKAGE – DEDUCT (30) POINTS
POWER STEERING PUMP – DEDUCT (10) POINTS
STEERING GEAR BOXES & LINES – DEDUCT (20) POINTS

3A-COOLING SYSTEM (20 POINTS)

RADIATOR – DEDUCT (7) POINTS
RADIATOR/HEATER HOSES – DEDUCT (2)

COOLANT CONDITION/LEVEL – DEDUCT (2)

FAN CLUTCH – DEDUCT (2) POINTS
HEATER CORE – DEDUCT (7) POINTS

3C-EXHAUST (20 POINTS)

EMISSION SYSTEM – DEDUCT (5) POINTS
EXHAUST SYSTEM – DEDUCT (10) POINTS
RAIN CAP – DEDUCT (5) POINTS

3D-DRIVELINE (30 POINTS)

TRANSM. OIL PAN & LEAKS – DEDUCT (10)

TRANSMISSION OIL LEVEL – DEDUCT (2)

U-JOINTS – DEDUCT (10) POINTS
HUB OIL (LEVEL/SEALS/CAP COND.) –
DEDUCT (3) POINTS

TRANSMISSION/DIFFERENTIAL VENTS –
DEDUCT (5) POINTS

4B-SUSPENSION SYSTEM (40

SHOCKS – DEDUCT (2) POINTS
SPRINGS/PINS & BUSHINGS – DEDUCT (30)
TIRES – DEDUCT (8) POINTS

5A-BRAKE SYSTEM (100 POINTS)

7A-OVERALL CONDITION (100)

- BRAKE LINES & VALVES – DEDUCT (5) POINTS
- AIR COMPRESSOR – DEDUCT (10) POINTS
- SHOES/DRUMS/BACKING PLATES – DEDUCT (25) POINTS
- BRAKE CHAMBERS – DEDUCT (25) POINTS
- SLACK ADJUSTERS – DEDUCT (25) POINTS
- SUPPLY TANKS – DEDUCT (5) POINTS
- AIR DRYER – DEDUCT (5) POINTS

- 80 – 100 EXCELLENT
- 60 – 79 GOOD
- 40 – 59 AVERAGE
- 0 – 39 POOR

COMMENTS: _____

INSPECTION CATEGORY TOTALS

COMMISSION # LOCATION/UNIT

CATEGORY 1 (A+B+C) TOTAL SCORE

CATEGORY 8 TOTAL SCORE (NON-RADS POINTS)

CATEGORY 9 TOTAL SCORE (NON-RADS POINTS)

CATEGORY 10 TOTAL SCORE

CATEGORY 11 TOTAL SCORE

CATEGORY 12 (A+B) TOTAL SCORE

CATEGORY 13 **NO POINTS*******

TOTAL SCORE

A5.8 Pre-Trip Walk-Around Checklist

Created: 11/29/2007

Indiana Department of Transportation		
DRIVERS DAILY MAINTENANCE LOG		
Employee Name: _____		Date: _____
Truck # _____	Start Mileage: _____	Start Material: _____
<p>The following inspection must be completed prior to vehicle operation.</p> <p style="text-align: center;"><u>Outside of Vehicle</u></p> <p><u>Fluid Levels:</u></p> <p><input type="checkbox"/> Engine Oil Level</p> <p><input type="checkbox"/> Coolant Level</p> <p><input type="checkbox"/> Power Steering fluid level</p> <p><input type="checkbox"/> Hydraulic Fluid level</p> <p><input type="checkbox"/> Auto transmission fluid level</p> <p><input type="checkbox"/> Front wheel bearing lube</p> <p><input type="checkbox"/> Windshield washer fluid level</p> <p><u>Equipment:</u></p> <p>The following items have been inspected on all equipment :</p> <p><input type="checkbox"/> Headlights</p> <p><input type="checkbox"/> Tail lights</p> <p><input type="checkbox"/> Stop lights</p> <p><input type="checkbox"/> Turn lights</p> <p><input type="checkbox"/> Rotary Lights</p> <p><input type="checkbox"/> Flashing lights</p> <p><input type="checkbox"/> Side view mirrors</p> <p><input type="checkbox"/> Wiper blades</p> <p><input type="checkbox"/> Tires</p> <p><input type="checkbox"/> Belts</p> <p><input type="checkbox"/> Exhaust system</p> <p><input type="checkbox"/> Springs</p> <p><input type="checkbox"/> PTO shaft</p>	<p>The following items have been inspected and tested:</p> <p><input type="checkbox"/> Spinner</p> <p><input type="checkbox"/> Auger</p> <p><u>Hydraulic system:</u></p> <p><input type="checkbox"/> Motor, hose and fittings</p> <p><u>Snow Plow:</u></p> <p><input type="checkbox"/> Blade edge checked and replaced if necessary</p> <p><input type="checkbox"/> Plows have been placed on truck and latches are secure</p> <p><input type="checkbox"/> All hoses, cylinders and fittings have been inspected</p> <p><input type="checkbox"/> Reversible plow works properly and freely</p> <p><input type="checkbox"/> Plow ends are marked with reflective sticks</p> <p><input type="checkbox"/> Front flap is in place—not damaged</p> <p style="text-align: center;"><u>Inside of Vehicle</u></p> <p><u>Safety Devices:</u></p> <p>Truck is equipped with:</p> <p><input type="checkbox"/> Flares</p> <p><input type="checkbox"/> Flashlights</p> <p><input type="checkbox"/> Safety vest and hat</p> <p><input type="checkbox"/> First aid kit</p> <p><input type="checkbox"/> Fire extinguisher</p> <p><input type="checkbox"/> Two flags</p> <p>The following were inspected and are in working order:</p> <p><input type="checkbox"/> Instrument lights</p>	<p><input type="checkbox"/> Dome lights</p> <p><input type="checkbox"/> Horn</p> <p><input type="checkbox"/> Back-up alarm</p> <p><input type="checkbox"/> Windshield wipers</p> <p><input type="checkbox"/> Defroster</p> <p><input type="checkbox"/> Heater</p> <p><input type="checkbox"/> Fuel gauge</p> <p><u>Spreader - Muncie System:</u></p> <p><input type="checkbox"/> Spreading rates posted in cab</p> <p><input type="checkbox"/> Spinners checked for width of spread</p> <p style="text-align: center;">The following is conducted after vehicle operation.</p> <p><u>Shut Down:</u></p> <p>End Material: _____</p> <p>End Mileage: _____ Hrs: _____</p> <p><input type="checkbox"/> Fill with fuel</p> <p><input type="checkbox"/> Unload truck</p> <p><input type="checkbox"/> Turn off all lights and radio</p> <p><input type="checkbox"/> PTO off</p> <p><input type="checkbox"/> Clean trash out of cab</p> <p><input type="checkbox"/> Roll up all windows</p> <p><input type="checkbox"/> Plug in truck</p> <p><input type="checkbox"/> Lock truck and equipment</p> <p><input type="checkbox"/> Hang keys in office</p> <p style="text-align: center;">If any repairs are needed, complete a work order and turn it in to the supervisor.</p>
Employee signature: _____		Date: _____
Supervisor signature: _____		Date: _____



A6.1 Procedure No. 22 (pages 119-129)

Field Operations Manual, Operating Procedure December 1988, Revised July 1998

Snow And Ice Chemicals -Pollution Control Guidelines

Statement of Problem

The Indiana Department of Transportation (INDOT) has experienced an increasing number of incidents involving salt pollution. In varying degrees, private properties and ground waters located adjacent to salt storage facilities and salt/abrasive mix locations have undergone pollution damage from the runoff of our brine solution. Environmental concerns and media coverage has increased public awareness of the problems which salt run-off has created and mandated that we take appropriate action at each and every location to create a clean environment. The extent of cleanup operations required at isolated locations may have influenced public opinion to the feeling that the problem is much more severe than actual. In this regard, it is imperative that we take every reasonable precaution to insure that we have established a course of responsible salt management and instilled a level of conscious awareness within the work force that "an ounce of prevention is worth a pound of cure".

Priority

It is our intent to establish, as one of our primary goals, that INDOT is making a sincere effort to minimize and control any and all undesirable situations, which might arise from the storage and/or handling of snow and ice chemicals. Our plan is to control runoff to the extent that we will reduce our influence on the pollution of the environment to below allowable levels. The purpose of this guideline is to establish and maintain pollution control as a top priority.

IT SHALL BE THE RESPONSIBILITY OF EACH SUPERVISOR INVOLVED WITH THE ICE AND SNOW REMOVAL OPERATION TO INSURE THAT EACH EMPLOYEE IS AWARE OF THE INSTRUCTIONS CONTAINED- WITHIN THIS GUIDELINE AND THAT THEY ARE MADE KNOWLEDGEABLE OF THE RESULTS OF SLOPPY HOUSEKEEPING.

Guidelines concerning chloride levels are established in another section, but should not exceed local standards. Acceptable contamination levels established by governing agencies will normally take priority over levels established within these guidelines if they are more stringent. We are responsible and accountable for our activities in the areas of salt storage and handling and will make a concentrated effort to promote a policy of sensible salting operations. We will promote an image of concern and make every conscious effort to address the inherent problems of each facility on an individual basis. The subsequent suggestions and instructions will attempt to highlight many of the areas, which need to be addressed, but in no way are they intended to be all-inclusive. **THE WRITTEN WORD MUST BE TEMPERED AND APPLIED WITH REASON IN EACH INSTANCE.**

Administration and Supervision

Exercising good practice and administering sound judgment in salt storage/handling requires some expertise and technical knowledge in the field. Although all administrators are not expected to be experts in the field, they should be knowledgeable of the sensible salting practices. Each district should identify individual(s), possibly the district maintenance operations engineer, who has the clear responsibility to represent the District/Subdistrict in all issues regarding pollution and the environment. This individual should be informed in this field, having the ability and expertise to address problems and also know where to seek assistance when it is required. In order to accomplish this, this person should participate in training courses, seminars and other informational sources to expand their resources and keep abreast of new techniques and technology.

The following is a list of responsibilities that this person should have knowledge about, but not be limited to:

1. The identification and assessment of the needs of salt storage facilities in regard to environmental engineering aspects.
2. The gathering of information such as groundwater sodium and chloride levels, initiation of testing procedure, and assembling of pertinent data in order to submit recommendations regarding existing or planned practices which may affect the environmental aspects of our operations.
3. Assist in design, preparation of plans, specifications, and provisions of new construction or reconstruction of existing facilities.
4. Assist in coordination of efforts between INDOT and other agencies at the local level regarding environmental or public health hazards for storage/handling.
5. Ensure proper maintenance of pollution control devices and maintain the integrity of both the structure and the ecology.
6. Assist in the instruction and training of maintenance workers in sensible salting procedures including the protection of the environment during salt delivery, handling, loading, and clean up of equipment and staging areas. (Mixing and loading sites should be generally cleaned after each storm).
7. Perform spot inspections during winter storms to observe actual practice and take appropriate action to correct deficiencies that will promote sensible salting.
8. Spot-check reporting procedures on usage of de-icing chemicals to prevent excess usage of salt. Studies by various states indicate that a considerable savings could be realized if more stringent guidelines were applied to current application rates.
9. Last, but most important, is the leadership factor. Efficient, safe storage and handling of salt depends on the attitude and cooperation of the maintenance workers to achieve results. Their outlook on sensible salting and preservation of the environment will depend largely upon the attitude of their supervisors. If they receive a strong endorsement of good housekeeping practices, their efforts will be directed towards achieving the goals outlined within this guideline. In this regard, top management has taken a strong and determined stand to support a policy of safe and proper salt storage and handling. It is critical, however, to retain the Operations Support Division's environmental control capability at the Subdistrict level where the problems exist.

Site Analysis

Although neither federal, state, nor local authorities are requiring environmental impact statements for site selection at the present time, it is only sound management practice that would dictate the consideration of the side effects of salt storage facilities upon the environment. These considerations should be given to the construction of new sites, the enlargement of existing facilities, and our operational activities at established locations.

Many problems can either be averted or created when a decision is being made regarding the location of buildings and work areas. We must, therefore, address these needs at an early stage in the development and planning of field functional maintenance operations units. Although the plan development of all facilities will continue to originate at the district level, final review and approval will be coordinated with the appropriate central office authority.

Management will continue to be involved and will provide additional expertise as may be necessary to ensure that proper coordination will occur at an early stage in order to effect a well organized, safe, functional, and environmentally acceptable operational unit. All phases of planning, design, and construction must be coordinated with the environmental aspects of salt storage and will require the review and approval of the designated individual responsible for representing the district in these matters.

Drainage

The drainage of the area, on which the building is to be located and upon which loading and mixing operations are to occur, is as important to the environment as it is to providing a suitable working area. The paving of the floor inside the building should be impenetrable and slop towards the door so as to prevent the intrusion of rainwater and to prevent contamination of the underlying soil and groundwater. A seal coat is recommended to extend life and additionally protect the pad from water intrusion. The exterior pad should be sloped away from the building to its outer limits and the water retained by means of curb or slope reversal of the pad itself in order that the runoff may be directed into a collection system. It is important to note at this juncture that collection facilities are a last resort and that "time, effort, and money, in most cases, can be better spent on avoiding or minimizing the formation of salt brine". However, it is our plan that all brine runoff is retained in some form of impervious storage and/or evaporation facility and from that point, safely released into the environment. This is especially critical where maintenance units are located adjacent to ground water wells or near fresh water lakes or reservoirs.

The drainage systems should be designed so that brine runoff, if any, is directed into the storage/evaporation facility, or so that unpolluted rainwater which falls on the pad after spring clean up is diverted away from the facility and allowed to resume its natural drainage course. The main objective at this point is to minimize the quantity of water collected and to not collect unpolluted runoff.

Design of Brine Storage/Evaporation Facilities

The most economical design and construction principles should be used in determining what brine runoff facilities are needed. The proper design type and size can be predicated from knowing the local site conditions, available space, and the capacity of the local treatment facilities. In retrospect, however, it cannot be overemphasized that THE TOP PRIORITY IN BRINE CONTROL IS ITS MINIMIZATION and efforts in this direction will certainly alleviate the task of dealing with it once it has been formed.

Numerous brine control methods are available, and at this point, there is insufficient evidence available to determine which is the best overall solution to the problem. There is, however, some application, which is most suited for each specific situation being addressed. The alternatives must be investigated and analyzed to determine the best solution available.

The most desirable situation would be the usage of a sanitary sewer line, if available. The owner must give permission and some questions may arise as to the salt concentration of the brine. This should not present any problem as sewage treatment plants are generally capable of handling chloride concentrations in sludge of 50,000 parts per million before digestion is retarded or inhibited. In comparison seawater contains an average of 3.5% or 35,000 parts per million of salt. Sampling of the effluent at the point source of pollution may be necessary to determine that the plant will be able to successfully ingest the brine concentration.

It may be noted at this point in this guideline, that the topic of salt concentrations of brine solutions in the water and the soil has arisen. Acceptable chloride levels are easily addressed but difficult to reasonably define. What may be within reason to one agency may be unacceptable to another. In this regard INDOT has established guidelines of the most widely acceptable levels, in an effort to meet most contingencies. These levels may be set at unattainable levels, in some instances. As a target, we may use approximately 1000 parts per million (ppm) or 1000 milligrams per liter (mgil) for saltwater (brine) solution, in free form, being released from INDOT properties into the environment. There are however, exceptions to most rules. Heavier concentrations may be emitted only into sanitary sewer lines or flowing streams when the dilution level prior to leaving INDOT property would exceed 1000 ppm. In the event that the stream did not occupy state right of way but is near enough to be economically practical and large enough to be environmentally acceptable, we should investigate the possibilities of piping runoff into it. A small reservoir for temporary retention of runoff waters to allow the metering of runoff into the environment within allowable levels may be an alternate and should be considered if space is available.

If space is not available, a large buried storage tank, series of buried storage tanks, or series of buried cement block and concrete brine storage basins may be constructed. In any case, storage facilities must be constructed that do not leak into the ground water.

Capacity shall be designed so that even during periods of heavy precipitation, overflow should not occur. Figure 1 illustrates typical brine storage basins construction in series.

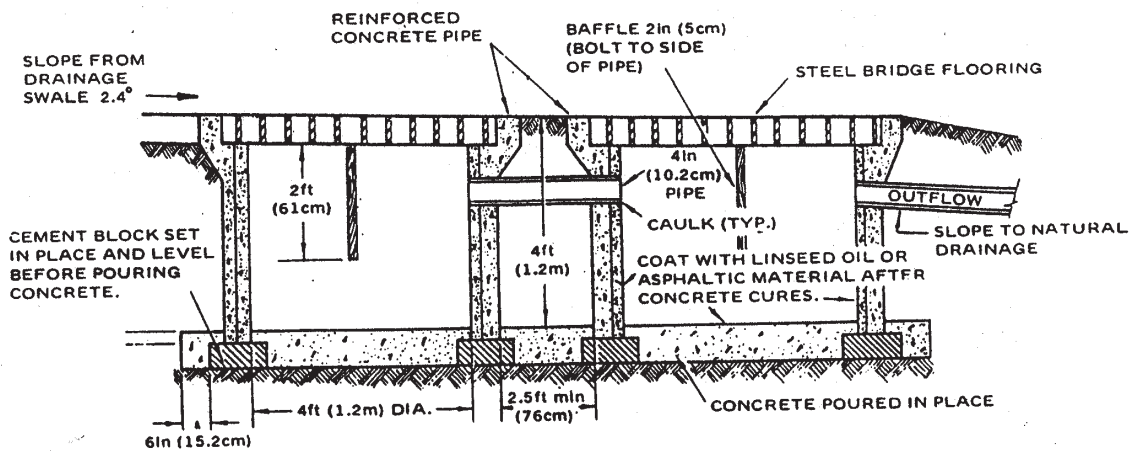


Figure 1

Figure 1. Salt brine storage basin
 Courtesy of Pennsylvania Department
 of Transportation

Brine may be used or disposed of as conditions warrant. Some uses may include stabilization of compacted aggregate shoulders or recycling by pumping onto abrasive stockpiles or back into the salt bins. The shoulder stabilization activity should be included in the maintenance work program. The additional equipment and crew size needed to include this application in the reconditioning or spot repair of unpaved shoulders should be identified early on and so noted in the work control category of the performance standard. Disposal operations may also include hauling to an approved dumpsite (an expensive alternative with no benefits) or spraying or spreading further diluted brine on unpaved shoulders. In this instance, application rates should be monitored to prevent excessive amounts from being spread on any particular section so that runoff and leeching do not cause vegetation kill. As mentioned previously, it may simply be metered off into the environment at approved levels.

Another viable alternative is the construction of a brine retention lagoon. Information such as average monthly rainfall, average monthly evaporation rates, soil conditions (percolation etc.) size of storage and mixing pad, number of snow/ice routes, and location and size of the equipment cleanup area are primary factors in the design of such a facility. Other, less obvious, factors must also be considered. Central Office Highways Operations will direct the plan development of such facilities with input from the district.

Collection facilities such as brine retention lagoons must be constructed with impervious liners, which may be composed dense graded bituminous mixes, geomembrane fabrics or a combination of these. They must retain their imperviousness and durability when subjected to repeated cleanup and maintenance operations. Steel and/or concrete tanks should be

bituminous coated. This may be accomplished by hand application or by filling with liquid bitumen and subsequent emptying by pumping.

As additional information is assembled and becomes available, it will, from time to time, be distributed, as it is not the intent of these guidelines to be all-inclusive. New and innovative ideas are continuously being developed, as the state of the art is refined. We are, therefore, attempting to maintain the instructions up to current standards and encourage the submittal of new and applicable material to be shared and reviewed for inclusion into the guidelines.

Mixing/Handling of De-icing Chemicals

In most cases and at most locations, the mixing and handling of de-icing chemicals has become a routine and familiar process. This situation has both its good and bad aspects. It is highly desirable in the fact that the "fire drill" approach certainly minimizes reaction time to the approach of a storm. In the other hand, familiarity may lead to the standardization of storm preparation, allowing the omission of detail, which may be required by a combination of varying factors. These particulars need to be addressed in individual situations and assessed so that the best approach is tailored to fit the available storm information.

Although pre-mixed piles are utilized for timely reactions to storm conditions, they are a luxury that may be causing unnecessary salt brine runoff. The department can no longer afford this luxury, in most cases. The "one round of mix" rule of thumb may no longer be appropriate, especially at locations where brine runoff is not yet under control. It is therefore recommended that pre-mixing not be performed unless where special conditions or facilities exist, or cover is provided where brine control is not yet available. Although this approach may somewhat delay reaction time to the approach of a storm, it is a positive step forward in the control of brine runoff. In the absence of pre-mixed materials, straight salt may be applied and may well be more appropriate for the particular storm conditions than mix. Pre-mix piles may be established for one round when the warning of a severe storm dictates. The re-establishment of the practice of pre-mixing of one round of mix should be considered only after an adequate brine control has been established at the location and a determination is made that the facility is capable of handling the increased concentrations of chemicals in the operation of that facility.

The snow/ice operations area should include the installation of a permanent "equipment clean and wash area" which is drained into the brine treatment facility. This area should preferably be constructed near, or adjacent to, the brine treatment area. In some instances, where existing conditions would not allow such a convenience, the drain from the wash area would be directed into the brine treatment area during the months that ice/snow chemicals are in use. Later, it would be directed away from the brine treatment facility after the final winter cleanup and during the months that chemicals are not in use. Commercial equipment washing sites, when locally available, should be considered for equipment cleanup. Under no circumstances will equipment (spreaders) be placed in permanent summer storage locations prior to final cleanup, unless the storage area has been constructed on the ice/snow removal operations pad and the cleanup is completed before the pad drainage is diverted away from the brine treatment facility for the summer months.

Sensible Salting

Maintenance Operations is charged with the responsibility of minimizing the harmful effects of chemical de-icers on the environment by addressing the manner in which plants, soils, and waters are affected by de-icing applications. Although chlorides are not reported to have harmful effects on soil characteristics, they have been found to exert a toxic (harmful) effect on plants. There is also an indication that the sodium ion is toxic to trees while calcium is an element commonly found in oils, and is essential to plant growth. The Public Health service has indicated an upper limiting chloride concentration in public water supplies of 250 ppm. In extreme cases, waters with 2000 ppm have been used for domestic purposes without adverse effects once the human system has adjusted to these waters. It is extreme negligence to disregard the cause and effects of our contributing any pollution to sources of drinking water and our legal responsibilities could reach catastrophic proportions.

It makes little sense to spread salt where salt is not needed, and although some studies indicate that the application of de-icing salts in rural areas is unlikely to cause water quality problems, it is within the realm of responsible management to maintain minimum applications rates for economic as well as ecology reasons. Determining the precise spreading rates necessary to attain bare pavement and to keep from causing environmental damage to the vegetation is the crux of the problem. The "bare pavement" snow and ice removal policy has led INDOT, as well as the user, into the situation in which we find ourselves. The concept of public pressure for bare pavement may have evolved simply because the public was unaware of its contribution to environmental damage, thinking that a bare pavement policy resulted only in a small increase in the cost of snow and ice removal.

Some salt may travel more than 100 feet laterally from the roadway, even when the ground is very gently sloped. Concentration levels along the roadside are on the increase. Studies have determined that sodium levels from 0-18 years of salting at distances from 0 to 45 feet from the edge of pavement vary from 30 ppm to 488 ppm. Chloride concentrations in the same time frame and at the same distances have varied from a trace to 217 ppm. To respond to these conditions the goals of our operations must focus on the need to discontinue practices, which continue to create a pollution invasion of the environment. We must gear our operations to keep abreast of the state of the art of sensible snow and ice control management and use our current practices and equipment to elevate potentials of sensibility. Continuing education to train Operations personnel in the operation and application of these guidelines has now become a priority, which must be assessed by management. There should be greater emphasis on training drivers in the skills and usage of snow and ice removal equipment.

In the interim, the operations manager when addressing conditions and options available in dealing with winter storms must observe attention to detail. The increase in calcium chloride as an additive to pure salt or salt/abrasive applications should be considered when conditions warrant. These conditions or characteristics may be identified by, but not limited to, the following criteria:

1. Reduction in salt usage because of a quicker, more effective use of material. (Prewetting of salt with calcium chloride may reduce the amount of salt required by 40%). About 4% of prewetted salts leave the roadway while about 40% of dry spread

salt leaves the roadway. Salt brine from a brine treatment facility is an excellent procedure at this time.

2. A quicker melt is effective because the 30-45 minute time period required to form a brine is nearly eliminated.
3. There is less salt waste and therefore less adverse environmental effect because prewetted salt does not bounce and immediately begins to penetrate through the frozen layer.

Recommendations for use of calcium chloride from a Pennsylvania study include the following list of calcium chloride levels:

Temperature	Recommended Application Rate
25° F+	use straight salt
15° – 25° F	¼ CaCl ₂ -- ¾ salt
5° – 15° F	1/3 CaCl ₂ – 2/3 salt
below 5° F	½ CaCl ₂ -- ½ salt

Although the above chart may indicate an extensive and therefore expensive usage of CaCl₂, the conditions warranting the use of such a treatment are infrequent and the appropriate treatment is certainly the correct treatment from an economic, ecology, and management standpoint.

There are many other treatment combinations of materials and equipment that are available to the responsible manager and it would be both impossible and inappropriate to address the infinite number of possible combinations or conditions under which their usage is appropriate. Good judgment and sound management practices are essential and must preclude standardization of the snow and ice removal operations. The public expects and deserves the best effort and application of men, equipment, and materials to maintain our roadways in a safe, comfortable, and environmentally acceptable condition.

Cleanup of Existing Facilities

It is a principle of physics that matter cannot be created or destroyed. Since sodium, calcium, and chlorine are all elements and are governed by the laws of nature, they can neither be created nor destroyed and must eventually be accounted for. When salt is allowed to be released from point sources in particular, it is free to inhabit the environment along pathways of least resistance, and becomes involved in many processes, which in many cases possess the potential of creating significant ecological alterations.

The cleanup of existing salt storage facilities begins with the evaluation and assessment of existing conditions at salt storage locations where point source pollution has adversely affected adjacent property. Salt affected soils may be classified as saline, sodic, or saline-sodic depending on the kinds and amounts of soluble salts present. The difference in these soil classifications determines, to a great extent, the measures that may be undertaken to

reclaim these soils to their former productivity. Saline soils contain soluble salt in sufficient quantities to impair seed germination and plant growth. Sodic soils contain a relatively low amount of soluble salts but are high in levels of sodium. Saline-sodic soils contain large amounts of both sodium and salt. Concentrations of these classifications in varying amounts affect different crops to a greater or lesser degree.

The chemical exchange, as it occurs within the various soil groupings, becomes a very complicated process, and any discussion regarding this topic is beyond the scope and intent of this guideline. It is, however, important to understand that the differences in classifications as they exist in a specific soil type, determines to a great extent the factors that need to be identified and considered in the effective and economic reclamation of affected soils. Some salt affected soils cannot be economically reclaimed due to the very small soil particle-size to a depth in excess of two feet, the lack of high quality water for leaching out of salts, and the absence of good drainage.

The concept of reclaiming soils is a new and complex issue, and several workable options and/or combination of options are available. Saline affected soils cannot be reclaimed by chemical alteration (i.e. treated with another chemical, conditioner, or fertilizer). However, some possible physical alterations are as follows. It is necessary to point out, however, that no solution would be effective without first removing the source of the pollutant.

1. Leaching out of the soil either by rainfall over a period of time or by repeated application of high quality irrigation water.
2. Construction of French drains surrounding and through affected clayey soils or highly compacted dense soils to allow the flushing process to be accelerated.
3. Tillage speeds up desalting by mixing the easily soluble salts deeper into the soil and loosing the dense subsoil. Subsoil tillage operations such as chiseling or moldboard or disk-plowing land with compacted, cemented, or hardpan layers will improve filtration and uniformity of water and root penetration.
4. Planting to avoid salt build-up in the immediate zone of seed placement. Salt accumulation can be avoided by planting seeds on the shoulders of the beds.
5. Germinating seeds and seedlings are usually most sensitive to salt.
6. Establishment of salt tolerant crops that add fresh organic matter, and the addition of organic matter whether from manure, compost, or sludge. If the relative salinity were determined to not be excessively high, perhaps dilution of the affected area by one or more of the above methods would bring it to within tolerable limits for medium or even low salt tolerance crops(See Table 9-4).
7. Complete removal of the affected soil to a depth of approximately two feet and replacement with acceptable material.

The determination of the degree of soil salinity is the preliminary step to the evaluation and assessment of existing conditions of salt polluted property that was discussed at the beginning of this section. This may be achieved by the testing of these soils. If the testing and analysis are to be true indicators of the magnitude of the problem, they must be representative of the entire soil profile that has been affected. It is generally best to sample both surface soil and subsoil to a depth of three feet. However, dense or impervious layers of soil at depths of seven (7) to ten (10) feet below the surface may cause salt accumulation in

Table 9-1. Summary of Salt-Affected Soil Classification

Classification	Conductivity (mmhos/cm)	Soil pH	Exchangeable Sodium Percentage	Soil Physical Condition
Saline	> 4.0	< 8.5	< 15	Normal
Sodic	< 4.0	> 8.5	> 15	Poor
Saline-sodic	> 4.0	< 8.5	> 15	Normal

Table 9-4 provides a summary of tolerance of some common crops to salt.

Table 9-4. General Salt Tolerance Ratings of Various Crops

Sensitive (0-4 mmhos/cm)	Moderately Tolerant (4-6 mmhos/cm)	Tolerant (6-8 mmhos/cm)	Highly Tolerant (8-12 mmhos/cm)
<i>Field Crops</i>			
Field bean	Soybean Castorbean Sesbania Rice Flax Guar Sorghum (grain) Corn (field)	Wheat (grain) Oats (grain) Safflower Cotton Sunflower Triticale	Barley (grain) Rye (grain) Sugar beet
<i>Forage Crops</i>			
White clover Dutch clover Alsike clover Red clover Ladino clover Crimson clover Meadow foxtail	Reed canarygrass Oats (hay) Orchardgrass Bromegrass Big trefoil Gramagrasses Sour clover Milkvetch Timothy Sudan-sorghum hybrids Sorghum (forage) Corn (forage)	Hardinggrass Kleingrass Alfalfa Birdsfoot trefoil Hubam clover Dallisgrass Tall fescue grass White sweetclover Yellow sweetclover Perennial ryegrass Wheat (hay) Johnsongrass	Bermudagrass Crested wheatgrass Barley (hay) Rye (hay) Panicgrass Alkali sacaton Rhodesgrass Saltgrass

root zones as water containing dissolved salts can be caused to move upward through the soil through capillary action.

A relatively new method for measuring soil salinity in the field is the Four-Electrode Technique that has the potential of eliminating soil sampling and laboratory analysis. This method employs a direct measure of the soil properties and provides a measure of electrical conductivity measured in millimhos/centimeter. The ability of a soil to carry a current is called electrical conductivity and the higher the conductivity, the higher is the salt concentration. Generally a value of four plus (4+) millimhos/cm indicates a saline condition. Table 9-1 provides a summary of salt-affected soil classifications.

It becomes obvious that a general guideline cannot be issued to cover the innumerable combinations of conditions, as they exist in the field. However, it is possible to analyze and assess the existing conditions at each site when provided with the pertinent information that can be made available through a reasonable and thorough program of investigation and testing. The analysis of the findings of such a program would allow engineers and

Approved By: Timothy D. Bertram 8-24-98
 Timothy D. Bertram, Chief Date
 Operations Support Division

supervisors to evaluate the problems inherent at the individual locations and make recommendations to management regarding a proposed plan of action.

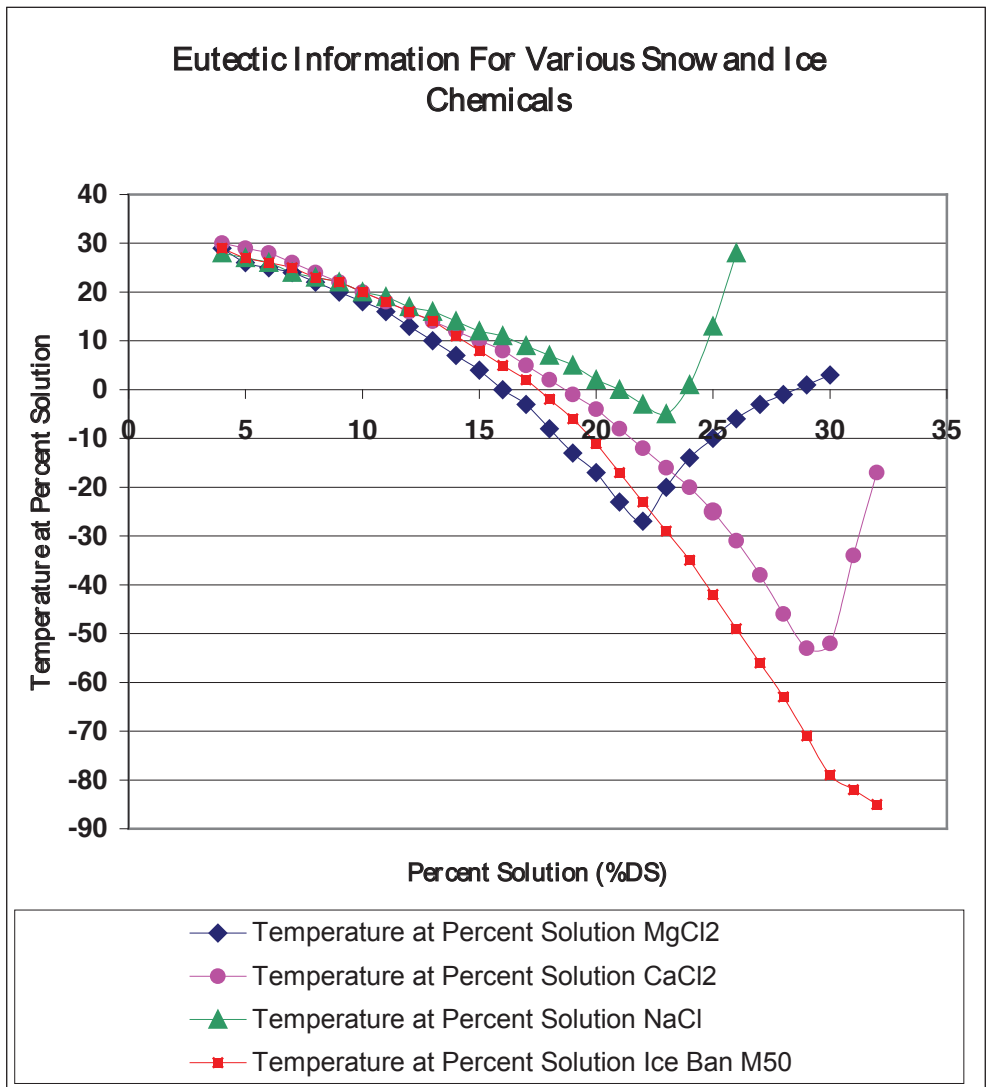
Testing procedures are currently being investigated regarding available methods and equipment, sampling, personnel and/or vendor availability etc. A directive will be issued at a later date as an addendum to this guideline instructing the districts as to the direction to be taken in gathering the needed data to provide sufficient information to formulate a sound decision and expedite the resulting recommendation.

A6.2 A Sample That Documents Test Results

Salt Brine

Date Made	Quantity	Hydrometer Reading(23.3%)	Signature

A6.3 Graphical Representation of the Lowest Effective Working Temperature



A6.4 Tabular Representation of the Lowest Effective Working Temperature

Percent Solution	Temperature At Percent Solution				
	% DS	MgCl ₂	CaCl ₂	NaCl	Ice Ban M50
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	

A6.6 Taper Log (pages 133-134)



Road(s): _____ **Name:** _____
From / To / Route #: _____
Start Date: _____ **End Date:** _____

Event	Method	Air Temp	Sky Cond.	Snow-fall Inches	Time am / pm	Road Temp.	Road Cond.	Product	Rate	Result	Notes

Column Codes	
Event:	<p>A = Light Snow B = Moderate Snow C = Heavy Snow D = Drifting E = Ice F = Nothing</p>
Method:	<p>G = Plow and Spread Dry Salt H = Plow and Spread Pre-Wetted Salt I = Plow Only J = Spread Dry Salt (without plowing) K = Spread Pre-Wetted Salt (without plowing) L = Anti-Icing with Liquids M = De-Ice with Liquids N = Other (explain in remarks)</p>
Air Temp. = Air Temperature at Time of Event	Result = Use Same Notes as Road Cond.
Sky Cond.:	<p>O = Overcast P = Partly Cloudy / Partly Sunny S = Sunny</p>
Snowfall = In inches since last line	Time = Time of Application (am or pm)
Road Temp. = Road Temperature at Time of Event	Road Cond:
Road	<p>T = Bare or Bare and Wet Pavement U = Some T, Some V V = Wheel Tracks, Bare and Wet W = Some V, Some X X = Ice or Compacted Snow and Ice</p>
Product = Product used - Salt, Salt and MgCl, Calcium, etc.	Rate = Rate of Application - Gallons or Pounds per Lane Mile
Notes = Additional Notes as Needed	Notes = Additional Notes as Needed

A6.7 Hypothetical Application Rate Table for Various Conditions

<u>Application Rate Table for Brand 'x'</u>				
<u>Chemical</u>				
	Precipitation			
Temperat	Inches			
ure				
°F	2	3	4	5
30	40	45	50	55
28	45	50	55	60
25	50	55	60	65
20	55	60	65	70
18	60	65	70	75
16	65	70	75	80
14	70	75	80	85

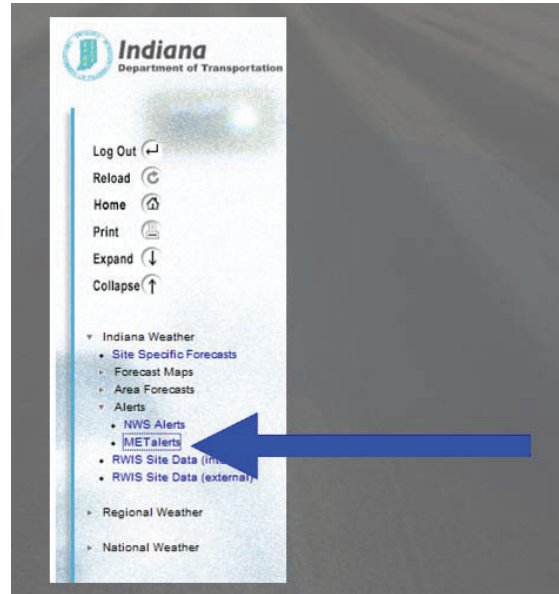
**Gallons per lane
mile**

A8.1 Meridian Storm Warning Notifications

At the Meridian Environmental Technology website (<http://indot.meridian-enviro.com>) a storm warning alert service can be activated. INDOT employees must use their individual usernames to establish this service. Available alert types are precipitation, road frost, and wind. There are two notification methods available, email and text messages.

Selecting this option will take you to the alert management webpage.

There are several steps to complete the alert service. Contact the Office of Maintenance Administration, Snow and Ice Section for detailed instructions.



Alert management page where subscriptions are available. Choose the method(s) and add.

The screenshot shows the alert management interface. At the top, there are buttons for 'Add a new notification method' and 'Edit an existing method'. A red arrow points to a table of subscriptions. A callout box states: 'By default, you already have one valid method – your official state email address'. Another callout box states: 'Additional methods can be set up if desired'. Below the table, there is a 'Validate' button and a section for 'Add a new alert subscription'. At the bottom, there is a footer with legal restrictions and the Meridian logo.

Destination	Description	Start	End	S	M	T	W	R	F	S
Test @ Email sgaddy@meridian-enviro.com	—description—	12:00	12:00	●	●	●	●	●	●	●

Enter method validation codes here:

Add a new alert subscription

No subscriptions are provided by default (you must sign up for these)

View the [legal restrictions and terms of use](#) applicable to this site. Use of this site signifies your agreement to the terms of use. Technical problems or site related con

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Meridian Environmental Technology Inc.

A8.2 Operations Guide For Maintenance Field Personnel (pages 137-145)

The following tables are based on information gathered by 15 State highway agencies and supported by SHRP and FHWA. These are recommendations that have worked in other locations around the country and parts of the world. They are intended to complement existing decision-making and management practices currently in effect. It is important to realize that some weather conditions may require other treatments. Past experiences to success will always supercede these tables. It is also important to remember that most of the values listed call for pre-wetted salt. These numbers appear lower than our current recommended amounts but reflect the importance and value of pre-wetting. As much as 30 percent and more salt may be ineffective if spread in the dry state. Pre-wetting also provides the bonus of “jump starting” the chemical reaction required to melt the snow and ice.

The tables presented cover six various weather events that are typically found in Indiana. These are:

Table 1	Light Snow Storm
Table 2	Light Snow Storm with Periods of Moderate or Heavy Snow
Table 3	Moderate or Heavy Snow Storm
Table 4	Frost or Black Ice
Table 5	Freezing Rain Storm
Table 6	Sleet Storm

There are several thoughts to keep in mind when using the tables.

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

CHEMICAL APPLICATIONS: Time initial and subsequent applications to prevent deteriorating conditions or development of packed and bonded snow. Try to apply materials ahead of rush periods occurring during a storm.

Anticipate increases in snowfall intensity. Apply higher rate treatments prior to or at the beginning of heavier snowfall periods to prevent the development of packed and bonded snow.

Liquid applications have been successful in preventing icing when placed up to four days before freezing on higher volume roads and seven days on lower volume roads.

Table 1. Weather: Light Snow Storm

Pavement Temperature Range and Trend	Initial Operation			Subsequent Operations		Comments		
	Pavement surface at time of initial operation	Maintenance Action	Dry salt spread rate (100 lb/LM solid equals 60 gal/LM liquid)		Maintenance Action		Dry salt spread rate (100 lb/LM solid equals 60 gal/LM liquid)	
			Liquid (gal/LM)	Solid or prewetted salt (lb/LM)			Liquid (gal/LM)	Solid or prewetted salt (lb/LM)
Above 32° Steady or rising	Dry, Wet, Slush, or light snow cover	NONE, see comments			NONE, see comments			1) Monitor pavement closely for drops toward 32° and below 2) Treat icy patches if needed with salt at 100 lb/LM. Plow if needed
Above 32° 32° or below is imminent	Dry	Apply liquid or prewetted salt	60	100	Plow as needed; reapply liquid or salt when needed	60	100	1) Applications will need to be more frequent at lower temperatures and higher snowfall rates. 2) Do not apply liquid when the pavement temperature drops below 23° 3) Do not apply liquid onto heavy snow accumulation or packed snow
Also 20 to 32° remaining in range	Wet, slush, or light snow cover	Apply liquid or prewetted salt	60	100				
15 to 20° Remaining in range	Dry, wet, slush, or light snow cover	Apply prewetted salt		200	Plow as needed; reapply salt when needed		200	If sufficient moisture is present, salt without prewetting can be applied
Below 15° Steady or falling	Dry or light snow cover	Plow as needed			Plow as needed			1) Salt is not recommended in this temperature range 2) Abrasives may be applied

Table 2. Weather event: light snowstorm with period(s) of moderate or heavy snow

Pavement Temperature Range and Trend	Initial Operation		Maintenance Action	Subsequent Operation			Comments		
	Pavement surface at time of initial operation	Maintenance Action		Dry salt spread rate (100 lb/LM solid equals 60 gal/LM liquid)	Dry salt spread rate (100 lb/LM solid equals 60 gal/LM liquid)	Liquid (gal/LM)		Solid or prewetted salt (lb/LM)	
Above 32° , Steady or rising	Dry, Wet, Slush, or light snow cover	NONE, see comments	(gal/LM)	(lb/LM)	Light snow	Light snow	Heavier snow	1) Monitor pavement closely for drops toward 32° and below 2) Treat icy patches if needed with salt at 100 lb/LM. Plow if needed	
					Heavier snow	Heavier snow			
Above 32°F 32° or below is imminent Also 25 to 32° remaining in range	Dry Wet, slush, or light snow cover	Apply liquid or prewetted salt Apply liquid or prewetted salt	60	100	60	120	100	200	1) Applications will need to be more frequent at lower temperatures and higher snowfall rates. 2) Do not apply liquid onto heavy snow accumulation or packed snow 3) After heavier snow periods and during light snow fall, reduce salt rate to 100 lb/LM; continue to plow and apply chemicals as needed
			60	100	Plow as needed; reapply liquid or salt when needed				

15 to 25° Remaining in range	Dry, wet, slush, or light snow cover	Apply prewetted salt	200	Plow as needed; reapply salt when needed	200	250	<p>1) If sufficient moisture is present, salt without prewetting can be applied</p> <p>2) Reduce salt rate to 200 lb/LM after heavier snow periods and during light snow fall; continue to plow and apply salt as needed</p>
Below 15° Steady of falling	Dry or light snow cover	Plow as needed		Plow as needed			<p>1) Salt is not recommended in this temperature range</p> <p>2) Abrasives may be applied</p>

Table 3. Weather event: Moderate or Heavy Snow Storm

Pavement Temperature Range and Trend	Initial Operation		Subsequent Operation		Comments
	Pavement surface at time of initial operation	Maintenance Action	Dry salt spread rate (100 lb/LM solid equals 60 gal/LM liquid)	Maintenance Action	
Above 32° , Steady or rising	Dry, Wet, Slush, or light snow cover	None, see comments	Liquid	Liquid	1) Monitor pavement closely for drops toward 32° and below 2) Treat icy patches if needed with salt at 100 lb/LM. Plow if needed
			Solid or prewettted salt	Solid or prewettted salt	
Above 32° , 32° or below is imminent	Dry	Apply liquid or prewettted salt	60	60	1) If the desired plowing/treatment frequency cannot be maintained, the spread rate may be increased to 200 lb/LM to accommodate longer operational cycles 2) Do not apply liquid onto heavy snow accumulation or packed snow
		Apply liquid or prewettted salt	60	100	
Also 30 to 32° , remaining in range	Wet, slush, or light snow cover	Apply prewettted salt			1) If the desired plowing/treatment frequency cannot be maintained, the spread rate may be increased to 400 lb/LM to accommodate longer operational cycles 2) Do not apply liquid onto heavy snow accumulation or packed snow
		Apply prewettted salt	150-200	200	
25 to 30° , remaining in range	Dry	Apply prewettted salt			1) If the desired plowing/treatment frequency cannot be maintained, the spread rate may be increased to 400 lb/LM to accommodate longer operational cycles 2) Do not apply liquid onto heavy snow accumulation or packed snow
		Apply prewettted salt	150-200		
-10°C to -4C (15 to 25°F), Remaining in range	Dry, wet, slush, or light snow cover	Apply prewettted salt			1) If the desired plowing/treatment frequency cannot be maintained, the spread rate may be increased to 500 lb/LM to accommodate longer operational cycles 2) If sufficient moisture is present, salt without prewetting can be applied
		Apply prewettted salt	200	250	

Below -10°C (15°F) Steady of falling	Dry or light snow cover	Plow as needed			Plow as needed			1) Salt is not recommended in this temperature range 2) Abrasives may be applied
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Table 4. Weather event: Frost or Black Ice

Pavement Temperature Range, Trend and the Relation to Dew Point	Traffic Condition	Initial Operation		Subsequent Operation		Comments
		Maintenance Action	Dry salt spread rate (100 lb/LM solid equals 60 gal/LM liquid)	Maintenance Action	Dry salt spread rate (100 lb/LM solid equals 60 gal/LM liquid)	
Above 32°F , Steady or rising	Any Level	None, see comments	Liquid (gal/LM)	Liquid (gal/LM)	None, see comments	Monitor pavement closely; begin treatment if temperature falls to 32 or below and is at or below dew point
			Solid or prewetted salt (lb/LM)	Solid or prewetted salt (lb/LM)		
20 to 32°F , remaining in range or falling to 0°C (32°F) or below, and equal to or below dew point.	Traffic less than 100 Vph	Apply prewetted salt	25-65	Reapply prewetted salt as needed	25-65	1) Monitor pavement closely; if pavement becomes wet or if thin ice forms, reapply salt at higher indicated rate
	Traffic rate greater than 100 Vph	Apply liquid or prewetted salt	15-40	Reapply liquid or salt as needed	25-75	2) Do not apply liquids on ice so thick that the pavement cannot be seen
20 to 28°F , Remaining in range, and equal to or below dew point	Any level	Apply liquid or prewetted salt	40-80	Reapply liquid or salt as needed	40-80	1) Monitor pavement closely; if thin ice forms, reapply salt at higher indicated rate
			65-130	Apply liquid or prewetted salt	65-130	2) Applications need to be more frequent at higher levels of condensation
15 to 20°F , Remaining in range, and equal to or below dew point	Any level	Apply prewetted salt	130-200	Reapply prewetted salt as needed	130-200	3) It is not advisable to apply liquid when the temperature drops below 23
			130-200	Apply prewetted salt	130-200	1) Monitor pavement closely; if thin ice forms, reapply salt at higher indicated rate
Below 15°F Steady or falling	Any level	Apply abrasives as needed		Apply abrasives as needed		2) Applications need to be more frequent at higher levels of condensation Salt is not recommended in this range

Table 5. Weather event: Freezing rain storm

Pavement Temperature Range, Trend and the Relation to Dew Point	Traffic Condition	Initial Operation		Subsequent Operation		Comments
		Maintenance Action	Dry salt spread rate (100 lb/LM solid equals 60 gal/LM liquid)	Maintenance Action	Dry salt spread rate (100 lb/LM solid equals 60 gal/LM liquid)	
Above 32°F , Steady or rising	Any Level	None, see comments	Liquid (gal/LM)	None, see comments	Liquid (gal/LM)	Monitor pavement closely; begin treatment if temperature falls to 32 or below and is at or below dew point
			Solid or pretwett ed salt (lb/LM)		Solid or pretwett ed salt (lb/LM)	
20 to 32°F , remaining in range or falling to 0°C (32°F) or below, and equal to or below dew point.	Traffic less than 100 Vph	Apply pretwett ed salt	25-65	Reapply pretwett ed salt as needed	25-65	1) Monitor pavement closely; if pavement becomes wet or if thin ice forms, reapply salt at higher indicated rate 2) Do not apply liquids on ice so thick that the pavement cannot be seen
	Traffic rate greater than 100 Vph	Apply liquid or pretwett ed salt	15-40	Reapply liquid or salt as needed	25-75	
20 to 28°F , Remaining in range, and equal to or below dew point	Any level	Apply liquid or pretwett ed salt	40-80	Reapply liquid or salt as needed	40-80	1) Monitor pavement closely; if thin ice forms, reapply salt at higher indicated rate 2) Applications need to be more frequent at higher levels of condensation 3) It is not advisable to apply liquid when the temperature drops below 23
			65-130		65-130	
15 to 20°F , Remaining in range, and equal to or below dew point	Any level	Apply pretwett ed salt	130-200	Reapply pretwett ed salt as needed	130-200	1) Monitor pavement closely; if thin ice forms, reapply salt at higher indicated rate 2) Applications need to be more frequent at higher levels of condensation
Below 15°F Steady of falling	Any level	Apply abrasives as needed		Apply abrasives as needed		Salt is not recommended in this range

Table 6. Weather event: Sleet Storm

Pavement Temperature Range and Trend	Initial Operation		Subsequent Operation		Comments
	Maintenance Action	Dry salt spread Rate (lb/LM)	Maintenance Action	Dry salt spread Rate (lb/LM)	
Above 32°F, Steady or rising	None, see comments		None. See comments		1) Monitor pavement closely for drops toward 32 and below 2) Treat icy patches as needed with prewetted salt at 125 lb/LM
Above 32°F, 32°F or below is imminent	Apply prewetted salt	125	Plow as needed, reapply prewetted salt when needed	125	Monitor pavement and precipitation closely
28 to 32°F, remaining in range	Apply prewetted salt	125-325	Plow as needed, reapply prewetted salt when needed	125-325	1) Monitor pavement and precipitation closely 2) Increase spread rate with increase in sleet intensity 3) Decrease spread rate with decrease in sleet intensity
15 to 28°F, Remaining in range	Apply prewetted salt	250-400	Plow as needed, reapply prewetted salt when needed	250-400	1) Monitor precipitation closely 2) Increase spread rate with decrease in temperature or increase in sleet intensity 3) Decrease spread rate with increase in temperature or decrease in sleet intensity
Below 15°F Steady or falling	Plow as needed		Plow as needed		Salt is not recommended in this range Apply abrasives as needed

A8.3 Amount of Salt Needed To Melt Snow/Ice Pack at Different Temperatures

Ice Thickness (Inches)	Temp (°F)	Weight of Ice (lbs/lane-mile)	Salt for 100% Melt (lbs/lane-mile)	Salt for 10% Melt (lbs/lane-mile)	Salt for 20% Melt (lbs/lane-mile)
1/64	30	5148	111	11	22
	20	5148	599	60	120
	10	5148	1051	105	210
	0	5148	1391	139	278
1/32	30	10296	222	22	44
	20	10296	1197	120	239
	10	10296	2101	210	420
	0	10296	2783	278	557
1/16	30	20592	445	44	89
	20	20592	2394	239	479
	10	20592	4202	420	840
	0	20592	5565	557	1113
1/8	30	41184	890	89	178
	20	41184	4789	479	958
	10	41184	8405	840	1681
	0	41184	11131	1113	2226
1/4	30	82368	1779	178	356
	20	82368	9578	958	1916
	10	82368	16810	1681	3362
	0	82368	22262	2226	4452

A8.4 WINTER FREQUENTLY ASKED QUESTIONS (pages 147-149)

Winter operations often result in frequently asked questions from INDOT employees, the public, and other agencies. Listed below are many such questions and the appropriate answers:

- Q: When the public plows snow on our roadways, are we responsible if their actions contribute to an accident?
- A: Although the accident may have been caused by another party, INDOT is ultimately responsible for the condition of its roadways and would likely be named as a contributing party in the event of legal proceedings.
- Q: When a bad storm hits, what is the policy for getting some of our drivers to work? Do we have permission to take a State plows on County Roads to plow them out?
- A: There is no current policy providing guidance for this situation; although INDOT is not responsible for transporting employees, emergencies may arise prompting such activities to maintain INDOT's level of service. City and County roads are under the jurisdiction of city and county governments. State vehicles are not allowed to plow on local roads except when a formal arrangement is made between state and local officials following an emergency.
- Q: You are on an assigned snow route. A State Trooper stops your truck and wants you to treat a bridge deck on another route. What should you do?
- A: Inform the Trooper that you are on an assigned route, and that you will notify your Supervisor of his/her wishes so proper actions may be taken. Immediately notify your Supervisor.
- Q: If you sideswipe a car while plowing, what should you do?
- A: Notify the Subdistrict immediately. This should be treated as any other accident while in a State vehicle, which will require Indiana State Police for investigation and reporting.
- Q: The highways are clear, but why aren't you out here getting the county (city) roads plowed?
- A: INDOT is responsible for all Interstate, U.S., and State routes. City and County roads are under the jurisdiction of city and county governments. State vehicles are not allowed to plow on local roads except when a formal arrangement is made between state and local officials following an emergency.
- Q: Why are the roads closed?

- A: In extreme circumstances, roads are closed for public safety reasons. If a road is impassible and a vehicle gets stuck, hours may pass before help arrives. If the vehicle is disabled, such a long wait could have tragic results. INDOT will work to open these roads as soon as possible.
- Q: Why didn't I see a snow plow this morning while I was driving to work?
- A: Each snowplow is assigned a designated route for snow removal. This route takes two to three hours to cover. It is likely, especially during heavy snowfall, that roads will become slick again during that period or that a person may travel for quite a distance without seeing the truck assigned to that road.
- Q: Will the snowplows come back and plow out my driveway?
- A: State law does not permit INDOT snowplows to plow private property. Driveways are the responsibility of the property owners.
- Q: Will you buy me a new mailbox since your snowplow knocked mine down?
- A: Opening up roads is the primary responsibility of this agency. Unfortunately, mailboxes are often affected when snow is pushed to the side of the road by plows. According to State statute, property owners must replace mailboxes damaged in such fashion. If negligence is suspected, a property owner may file a tort claim with the Attorney General's office. Anyone may receive information on making such a claim by contacting the local Subdistrict or District.
- Q: What are the road conditions like in Indiana during storms?
- A: INDOT does not provide road condition reports because our primary duty is to clear the roads and work to keep them safe. Road conditions are reported through the INDOT 511 system. Call 511 or visit the 511 website at 511.in.gov.
- Q: What should I do if snow or de-icing chemicals from your truck hits my car?
- A: First, ask yourself if you are following the snowplow at a safe distance. If you can hear or feel material hitting your vehicle, you are too close. If you are on a multi-lane road and a snowplow is coming from behind, get to one side of it. If you can pull over, do so. If you believe that a driver acted improperly, you may contact INDOT's Office of Communications at 317-232-5115.
- Q: Will someone come out and uncover my buried car?
- A: No, unfortunately there is no way that roads can be plowed without pushing snow to the side of the road, so the resulting drifts may block vehicles along the highway. INDOT urges motorists to move their vehicles from the side of the highway to avoid getting "buried."

- Q: Is it safe to go to Chicago (or Cincinnati, or Louisville)?
- A: If a major storm is striking the area in which you want to travel, you may wish to delay your trip until clearer weather and clearer roads prevail. Remember, during winter storms, the availability of emergency cars and support systems, ambulances-shelters-tow trucks, is very limited. If you get stuck out in the country or are in an accident, several hours may pass before you receive help.
- Q: Why was a truck applying de-icing chemicals when there wasn't any snow?
- A: The application may have been an effort to keep a wet road from re-freezing, or an anti-icing application to prevent initial snow and ice bonds to the pavement.
- Q: Why haven't I seen a snow plow go by my house all day?
- A: If you live on a state road, INDOT is responsible for keeping it clear of snow and ice. Crews will continue to work toward this goal around the clock as long as snow continues to fall. During the most intense snowstorms, the removal effort concentrates on the interstate and high volume U.S. and state routes. Low volume routes will also receive service, but may be considered lower priority. This can have an effect on the number of times a snowplow might pass your house, and it may be only once outside regular working hours on a low volume route.
- Q: Why do bridge decks freeze before the roadway?
- A: Bridges decks freeze much more quickly than the roadway due to exposure to the elements from "all sides"; the roadway is only exposed on the surface and has an added element of heat from the underlying ground.
- Q: Why do concrete pavements freeze before asphalt pavements?
- A: Color variations are primarily responsible. Black asphalt pavements collect and maintain more heat - particularly from the daytime sun - than white concrete; therefore, they are generally warmer, causing a delayed freeze.

A9.1 Work Management System – Work Procedure (pages 150-153)

1. HEADER INFORMATION

<u>Activity Number:</u>	Select appropriate activity number from drop down menu, in the Day Cards window.
<u>Sub-Activity:</u>	Select appropriate sub-activity code, from drop down menu.
<u>Activity Name:</u>	The activity name will is displayed on the work order, from the activity number selection.
<u>Sub-Activity Name:</u>	Sub-activity name will display on the work order per sub-activity code selection.
<u>Work Order #:</u>	Work Order #'s are assigned by WMS, and will be displayed on the Daily Work Order Report.
<u>Management Unit Number</u>	Management Unit numbers will display on printed work orders.
<u>Management Unit Name:</u>	Management Unit names will print next to Management Unit codes.
<u>System/Class:</u>	IN for Interstate or OS for Other State Route is preprinted.
<u>Date:</u>	Actual date when the work is performed is handwritten here.
<u>Crew Size:</u>	Preprinted planned crew size for the activity at the Management Unit selected.
<u>Category:</u>	The work control category is preprinted: LI Limited, OV Overhead, PM Preventive Maintenance, SN Snow & Ice, UN Unlimited, VA Variable.

2. SPECIAL INFORMATION

<u>Asgnd. To:</u>	The Crew Leader or other individual given the assignment.
<u>Rqst.#:</u>	This Work Order may satisfy a complaint that was called in. The complaint number should be handwritten on the card prior to the assignment. Normally no number will appear here.

Location and Specific Instructions: Any information that is required to clarify the assignment

3. EQUIPMENT DETAIL

Comm.: Commission numbers are selected from equipment short lists, when creating the work order.

Description: The equipment description is included in the drop down menu, when selecting the commission number.

Begin/End: Beginning and ending mileage or hour meter reading for the piece of equipment.

Unit: How usage is measured: Hours or Mileage.

Hours on Job: The amount of time the piece of equipment was on the job, not actual usage time. Usually this will be a full day.

4. MATERIAL

Code: Material code for each material used, usually preprinted, but different codes may be handwritten as required.

Description: Material description for each material used, usually preprinted, but different descriptions may be handwritten as required.

Amount: Quantity of material used measured to the nearest 100th (.01) of a unit.

Unit: How the quantity of material used is measured; Gallons, Tons, Pounds, etc., will display on the work order, from the material day card.

5. ACCOMPLISHMENT

Unit of Measure: Determined by activity selection such as tons, miles, etc.

Quantity: Amount of work done at each location listed on the card in the Unit of Measure above, measured to the nearest 100th (.01) of a unit.

Location: The code used for area work performed; an asset such as a pipe or a maintenance location code for route.

Notes: Any notes that will help to explain situations on the card. Notes are required for activities 2190, 2290, 2390, 2490,

2590, 2610, 2690, 2790, and 2890, as more than one kind of work can be performed.

6. LABOR DETAIL

<u>Employee I.D.:</u>	The employee PeopleSoft ID number.
<u>Reg. Hours:</u>	The number of regular hours each individual worked.
<u>Employee Name:</u>	The full name of the employee.
<u>Borrowed:</u>	An X is placed here if this person is on loan to you.
<u>Other Time:</u>	All overtime is recorded as regular overtime, but other time can be recorded.

7. OTHER DETAILS

Type would indicate Labor, Equipment, or Materials.

Details indicates the actual use of the type; such as LABOR- DOC.

Amount would be the number of Labor, Equipment, or Materials used; such as 6 DOC laborers.

Cost is the associated cost to the details, so the cost would reflect the Amount times any applicable unit cost.

8. COMMENTS

A continuation of the notes on the front of the card, that will help to explain situations. The WMS system will accept approximately 80 characters, anything beyond that will not go into the system.

9. SIGNATURE

The person that the work order was assigned to should sign the card.

WORK ORDER SUMMARY

Management Unit: (5303) - COLUMBUS UNIT 3 (PS065496)	Start Date: 01/06/2009
Work Order #: 4028773	End Date: 01/06/2009
Activity: 2630 - SNOW & ICE REMOVAL (2009)	
Sub-Activity: 33 - PLOWING & SPREADING CHEMICALS	
Accomplishment: 7.5	Units: MHR
Comments:	

Inv. Element	Route	Starting MP	Ending MP	Accomplishment
53-03-03	z SNOW ROUTE	0.00	38.66	1.0

Labor:

Employee Name	Employee ID	Work Date	Wage Type	Hours	Total Cost
Carroll, Travis	10000249223	01/06/2009	REG	7.5	\$ 90

Equipment:

Comm No.	Equipment Name	Work Date	Total Hrs	Mileage	Total Cost
058155	HOPPER SPREADER	01/06/2009	7.5		\$ 33
065739	TANDEM AXLE DUMP TRUCK	01/06/2009	7.5	66	\$ 240

Material:

Material Stock	Work Date	Amount	Unit	Total Cost
4501 - SODIUM CHLORIDE / ROAD SALT	01/06/2009	16.5	STN	\$ 634

Accomplishments:

Work Date	Accomplishment	MHR	TOTAL COST
01/06/2009	7.5	MHR	0
<i>Total Accomplishment:</i>		7.5	<i>MHR</i> 0

LABOR TOTAL: \$ 89.61	MATERIAL TOTAL: \$ 634.10
EQUIPMENT TOTAL: \$ 272.40	OTHER COST: \$ 0.00
WORK ORDER TOTAL: \$ 996.11	

A9.2 Salt/Materials Report

(The following is a sample of a Salt Report)

Indiana Department of Transportation		WINTER MATERIALS REPORT						Page: 1 of 6		
FY 2009		(1000) - CRAWFORDSVILLE DISTRICT						Date:04/15/2009		
From: 04/05/2009								Time:1.09 PM		
To: 04/15/2009										
Sodium Chloride/Road Salt Usage History (STN)										
Unit #	Name	On Hand as of 04/15/2009	Rec'd 04/05/2009 04/15/2009	Rec'd to Date	Used 04/05/2009 04/15/2009	Used to Date	Trans. In 04/05/2009 04/15/2009	Trans. Out 04/05/2009 04/15/2009	Capacity	% Full
CRAWFORDSVILLE DISTRICT										
1000	CRAWFORDSVILLE DISTRICT (PS065120)	0	0	60,000	0	0	0	0	60,000	0.0 %
Subdistrict Totals		0	0	60,000	0	0	0	0		
TERRE HAUTE SUBDISTRICT										
1100	TERRE HAUTE SUBDISTRICT (PS065128)	0	0	0	0	0	0	0	0	0.0 %
1101	TERRE HAUTE UNIT 2 (PS065409)	1,229	0	512	4	2,685	0	0	3,400	36.1 %
1102	ASHBORO UNIT 3 (PS065407)	574	0	0	0	1,203	0	0	1,700	33.7 %
1103	FORT HARRISON UNIT (PS065408)	518	0	502	0	2,333	0	0	1,800	28.8 %
Subdistrict Totals		2,321	0	1,014	4	6,221	0	0		
CRAWFORDSVILLE SUBDISTRICT										
1200	CRAWFORDSVILLE SUBDISTRICT (PS065129)	0	0	0	0	0	0	0	0	0.0 %
1201	CRAWFORDSVILLE UNIT 1 (PS065390)	800	0	0	0	3,487	0	0	4,000	20.0 %
1202	BLOOMINGDALE UNIT 2 (PS065389)	502	0	8	1	1,951	0	0	2,700	18.6 %
1203	NEWPORT UNIT 3 (PS065391)	271	0	0	0	1,826	0	0	1,700	15.9 %
1204	VEEDERSBURG UNIT 4 (PS065392)	706	0	538	0	2,179	0	0	4,000	17.6 %
Subdistrict Totals		2,278	0	546	1	9,444	0	0		
FOWLER SUBDISTRICT										
1300	FOWLER SUBDISTRICT (PS065130)	0	0	0	0	0	0	0	0	0.0 %
1301	FOWLER UNIT 1 (PS065395)	1,107	0	0	29	2,200	0	0	3,400	32.6 %
1302	CARBONDALE UNIT 2 (PS065394)	1,230	0	0	9	2,133	0	0	1,700	72.3 %
1303	LAFAYETTE UNIT 3 (PS065396)	639	0	0	37	4,739	0	0	3,400	18.8 %
Subdistrict Totals		2,976	0	0	75	9,072	0	0		
FRANKFORT SUBDISTRICT										
1400	FRANKFORT SUBDISTRICT (PS065131)	0	0	0	0	0	0	0	0	0.0 %
1401	FRANKFORT UNIT 1 (PS065398)	1,611	0	4,543	0	4,089	0	0	5,300	30.4 %
1402	LEBANON UNIT 2 (PS065399)	819	0	2,609	0	2,528	0	0	2,300	35.6 %
1403	ROMNEY UNIT 3 (PS065400)	332	0	824	0	1,366	0	0	1,700	19.5 %
Subdistrict Totals		2,763	0	7,976	0	7,983	0	0		
CLOVERDALE SUBDISTRICT										
1500	CLOVERDALE SUBDISTRICT (PS065132)	0	0	0	0	0	0	0	0	0.0 %
1501	CLOVERDALE UNIT 1 (PS065403)	957	0	469	0	1,742	0	0	1,700	56.3 %
1502	BAINBRIDGE UNIT2 (PS065402)	2,666	0	0	0	2,094	0	0	5,300	50.1 %
1503	LIZTON UNIT 3 (PS065404)	492	0	510	0	2,340	0	0	1,700	28.9 %
1504	PLAINFIELD UNIT 4 (PS065405)	493	0	0	0	2,505	0	0	3,400	14.5 %
Subdistrict Totals		4,598	0	979	0	8,682	0	0		
District Totals		14,935	0	70,515	80	41,402	0	0		
PO #	PO Amount	Remaining	Minimum	AC Tons	AC Recvd	AC Remain.				