



STUDENT MANUAL

REV: July 2012

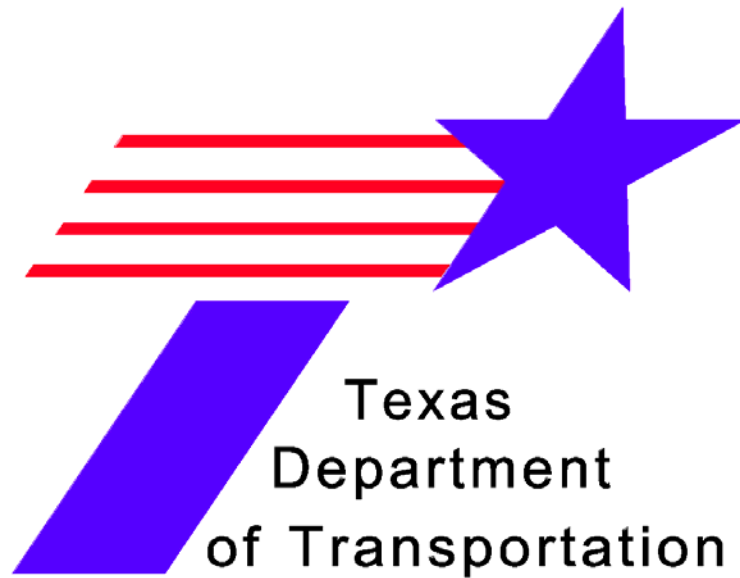
Winter Weather Operations Training MNT812

**12-hour
TRAINING COURSE**

Maintenance Division/
Workforce Development

WINTER WEATHER OPERATIONS TRAINING

MNT812



PREPARED FOR

Texas Department of Transportation
Maintenance Division/
Workforce Development

REV: July 2012

STUDENT MANUAL

WINTER WEATHER OPERATIONS TRAINING

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Workforce Development**

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INTRODUCTION

PRE-SEASON PREPARATION

MOUNT A V-BOX SPREADER

**MOUNT A REVERSIBLE
SNOW PLOW**

PRE-TRIP INSPECTION

**SNOW AND ICE CONTROL
MATERIALS**

**CALIBRATE A V-BOX
SPREADER**

**CALIBRATE A LIQUID SPRAY
APPLICATOR**

**PREPARING FOR SNOW/ICE
REMOVAL**

SNOW PLOWING TECHNIQUES

POST-STORM CLEANUP

**COURSE SUMMARY AND
ASSESSMENT**

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the assistance of TxDOT Project Advisors Mark Bradshaw, Gary Charlton, P.E., Gilbert Jordan, Darwin Lankford, P.E., Dennis Markwardt, Ted Moore, P.E., Wade Odell, P.E., and Nancy-Ellen Soteriou, Ph.D. We thank them for their support in developing this course. Special appreciation is extended to TxDOT Project Director, Mike Taylor, P.E., for his assistance and counsel.

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LEARNING OBJECTIVES

WINTER WEATHER OPERATIONS TRAINING MNT812

Course Description

Winter Weather Operations Training is a 12-hour roadway maintenance course designed to instruct operations personnel on how to more effectively respond to winter storms. Delivered through both classroom presentations and hands-on learning exercises, this practical, common-sense, implementation-type workshop is based on a recent research study of best practices for winter weather management and operations.

Target Audience

This course has been designed for operations personnel with one to three years of roadway maintenance experience. More experienced personnel including operators, crew chiefs, lead workers, assistant supervisors, and maintenance supervisors will also benefit from the instruction.

Learning Objectives

Upon completion of this course, the participant will be able to:

1. List safety considerations associated with winter weather conditions, equipment, materials, and operational tasks.
2. Describe winter maintenance activities associated with pre-season preparation.
3. Explain how available road maintenance equipment is used to fight snow and ice.
4. Mount winter maintenance equipment including material spreaders and snow plows.
5. Conduct a “pre-trip” inspection on winter maintenance equipment.
6. Comprehend the importance of calibrating equipment in order to “hit the target rate” when applying snow and ice chemicals.
7. Identify the basic snow and ice control chemicals used in TxDOT.
8. Compare and contrast traction improvement, de-icing, and anti-icing as snow and ice treatment strategies.
9. Demonstrate basic knowledge of snow and ice removal techniques.
10. Identify post-storm cleanup activities associated with winter weather operations.

ABOUT TxDOT

HISTORY

The Texas Legislature established the Texas Highway Department in 1917 to administer federal funds for highway construction and maintenance. Its responsibilities increased in 1975 when the Legislature merged the agency with the Texas Mass Transportation Commission to form the State Department of Highways and Public Transportation.

In 1991, the Legislature combined the State Department of Highways and Public Transportation, the Department of Aviation and the Texas Motor Vehicle Commission to create the Texas Department of Transportation (TxDOT).

TEXAS TRANSPORTATION COMMISSION

TxDOT is governed by the five-member Texas Transportation Commission and an executive director selected by the commission. Commission members, serving overlapping six-year terms, are appointed by the governor with the advice and consent of the Texas Senate.

TxDOT MISSION

Work with others to provide safe and reliable transportation solutions for Texas.

TxDOT VALUES

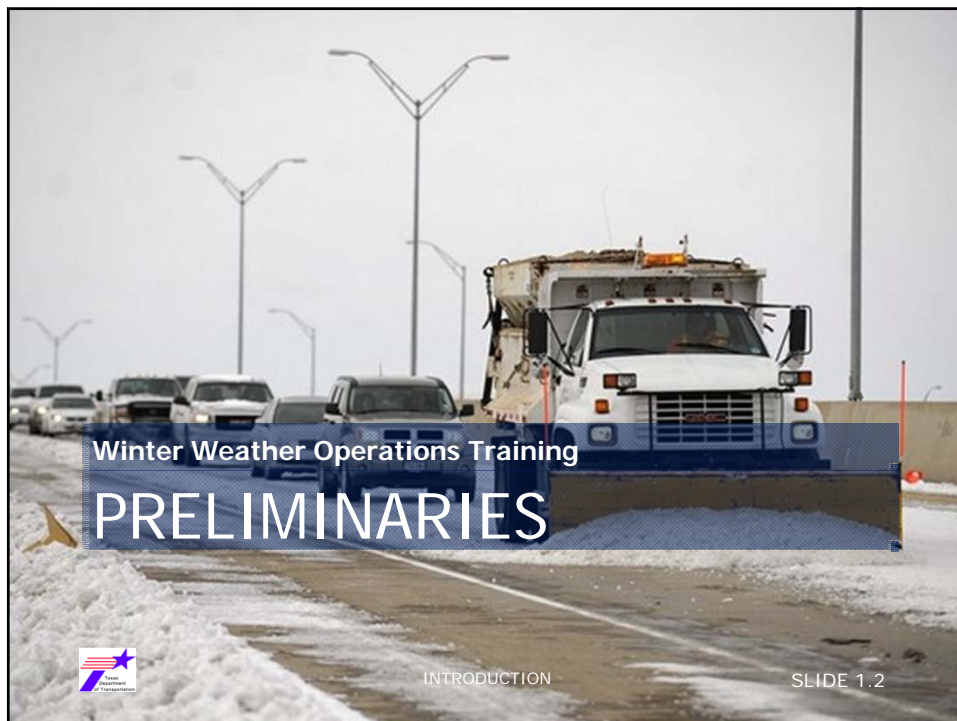
- Trust - We understand the importance of being trustworthy and credible, both as an agency and as individuals.
- Integrity - We honor our commitments and keep our word.
- Responsibility - We are reliable and dependable in carrying out our mission and roles.
- Excellence - We do our work at a high level of quality.
- Service - We do what we do for others with a spirit of humility and honor.

MODULE 1 INTRODUCTION



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012



About the Course

OVERVIEW

- 12.0 hours duration
- Part of a 2-course curriculum
 - Winter Weather Management Training (6.0 hrs)
 - Winter Weather Operations Training (12.0 hrs)
- Primary audience: “Operations personnel with one to three years of roadway maintenance experience”



INTRODUCTION

SLIDE 1.3

Course Outline

WINTER WEATHER OPERATIONS TRAINING

Twelve Learning Modules, approx 1 hour each

- | | |
|-----------------------------------|-----------------------------------|
| 1. Introduction | 7. Calibrate V-Box Spreader |
| 2. Pre-Season Preparation | 8. Liquid Spray Applicator |
| 3. Mount a V-Box Spreader | 9. Preparing for Snow/Ice Removal |
| 4. Mount a Snow Plow | 10. Snow Plowing Techniques |
| 5. Pre-Trip Inspection | 11. Post-Storm Cleanup |
| 6. Snow and Ice Control Chemicals | 12. Summary and Assessment |



INTRODUCTION

SLIDE 1.4

Instructional Materials

WINTER WEATHER OPERATIONS TRAINING

- Student Manual
 - Presentation slides
 - Learning exercises (green sheets)
 - Reference pages (white sheets)
 - Review (pink sheets)
- End-of-Course Exam
- Course Evaluation



INTRODUCTION

SLIDE 1.5

Learning Icons

WINTER WEATHER OPERATIONS TRAINING



...Digging Deeper/ Food for Thought



...Video Clip



...Reference Material



...Summary and Review



INTRODUCTION

SLIDE 1.6

Instructional Plan

WINTER WEATHER OPERATIONS TRAINING

- Instructor-led, face-to-face
 - Classroom... presentations, videos
 - Field... equipment, hands-on
- Student interaction
- 60 minutes for lunch
- 10-minute breaks, on the hour (+/-)



INTRODUCTION

SLIDE 1.7

Do's and Don'ts

WINTER WEATHER OPERATIONS TRAINING

DO's

- Be on time
- Participate in group discussion/exercises
- Ask questions!
- Respond to questions when prompted by Instructor
- Help your co-workers
- Be responsible for your learning

DON'Ts

- Forget to turn off pagers & cell phones or set to vibrate
- Talk among yourselves when the Instructor is talking
- Disrespect others



INTRODUCTION

SLIDE 1.8

Meet Your Neighbors

WINTER WEATHER OPERATIONS TRAINING

- Student introductions
 - Name
 - Maintenance office
 - Years experience
- Instructor introduction
 - Name
 - Training organization
 - Years experience



INTRODUCTION

SLIDE 1.9



INTRODUCTION

SLIDE 1.10

Learning Objectives

INTRODUCTION

Upon completion of this section, the learner will be able to:

1. Explain TxDOT Administration's perspective on winter storm maintenance
2. List key safety considerations associated with winter weather maintenance



INTRODUCTION

SLIDE 1.11

Learning Objectives, cont'd.

INTRODUCTION

3. Identify TxDOT's policy documents for snow and ice control
4. Define anti-icing, de-icing and traction improvement
5. Summarize your District's strategy for winter weather operations



INTRODUCTION

SLIDE 1.12

VIDEO 1.1 (02:00) TxDOT Winter Weather Maintenance



SPEAKER

John A. Barton, P.E.

Deputy Executive Director/
Chief Engineer
Texas Department of
Transportation



INTRODUCTION

SLIDE 1.13

Key Themes

TXDOT ADMINISTRATION PERSPECTIVE

- Safety
- Careful planning
- Preparation
- Communication
- Service expectations
- Winter weather plan
- Know your responsibilities
- Coordinate efforts
- Work together




INTRODUCTION

SLIDE 1.14



Exercise 1.1 Winter Weather Safety



1. Think about and jot down at least 3 safety considerations specific to TxDOT winter weather operations (individual assignment).
2. Meet with the people around you (3 to 4 persons) and discuss your ideas.

Be prepared to discuss your answers (5 minutes).

INTRODUCTION SLIDE 1.16

Working Safely in Cold Weather

WINTER WEATHER SAFETY

- Cold Weather Health Hazards
- Snow Plow Operations
 - Driver training
 - Truck/equipment readiness
 - Well-rested drivers
 - Drug and alcohol avoidance
- Defensive Driving
 - Working in traffic
 - Maintaining visibility
 - Driving on snow and ice
- Other Safety Items
 - Safe vehicle entry
 - Seat belts
 - Mirrors/lights
 - Equipment backing



INTRODUCTION

SLIDE 1.17



INTRODUCTION

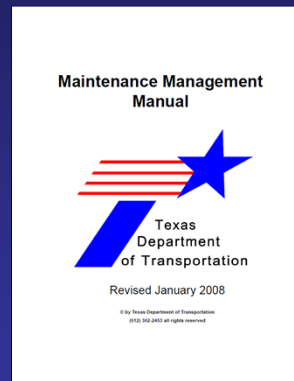
SLIDE 1.18



Maintenance Management Manual

TXDOT POLICY DOCUMENT

- Chapter 1, Section 2
 - Snow and ice control as routine maintenance
 - Part of Emergency Operations
- Chapter 5, Section 8
 - Highway Condition Reporting System
 - Weather related events

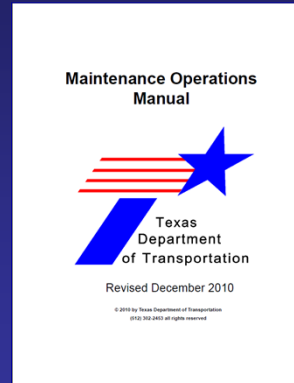


INTRODUCTION

SLIDE 1.20

Maintenance Operations Manual TXDOT POLICY DOCUMENT

- Chapter 5, Section 1
 - Overview
- Chapter 5, Section 2
 - Snow and Ice Control
 - Priority of Work
 - District Plan
 - Snow and Ice Control Methods
 - Road Closures
 - Highway Condition Report
 - Railroad Grade Crossing

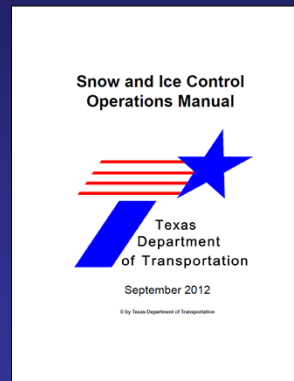


INTRODUCTION

SLIDE 1.21

Snow and Ice Control Operations Manual TXDOT GUIDANCE DOCUMENT

- UPDATED Sep. 2012
- Agency requirements for winter weather operations
- Based on best practices for snow and ice control



INTRODUCTION

SLIDE 1.22



WinterSafe

TXDOT PUBLIC SERVICE DOCUMENT

- Safety Guide for Winter Travel
- Expresses TxDOT's commitment to the traveling public

R_{1.2}
[1.33]



INTRODUCTION

SLIDE 1.23

Other Policy

TXDOT POLICY DOCUMENTS

- District Standard Operating Procedures
 - Emergency work guidelines and goals
 - Guide for District Approval on Miscellaneous Leave During Inclement Weather
 - Incident Clearance on State Highway System
- See your Supervisor for details



INTRODUCTION

SLIDE 1.24

District Snow and Ice Control Plan



Lubbock District Snow and Ice Control Plan FY 2011



INTRODUCTION

SLIDE 1.25

Some Key Elements

SNOW AND ICE CONTROL PLAN

1. Level of Service
 2. Communication
 3. Specific Treatment Guidelines
 4. Materials Spreading Procedures
 5. Post-Storm Cleanup and Safety Restoration Procedures
- Appended Materials
 - Route Maps
 - Equipment Lists
 - Materials Data
 - Treatment Rate Recommendations
 - Personnel Contact Lists



INTRODUCTION

SLIDE 1.26



Winter Weather Operations Training
MAINTENANCE STRATEGY

 INTRODUCTION SLIDE 1.27



Maintenance Terms
WINTER OPERATIONS STRATEGY


- Anti-Icing
- De-Icing
- Traction Improvement

 INTRODUCTION SLIDE 1.28

Winter Maintenance Challenge
PROACTIVE WINTER MAINTENANCE

FACT

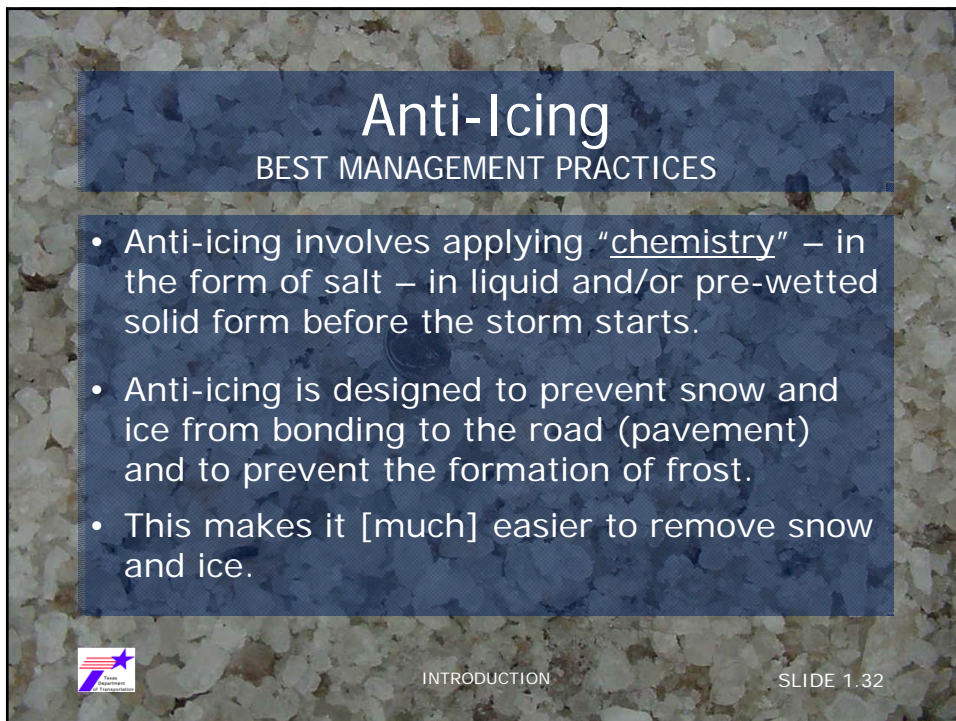
The time and effort required to plow and clear roadways dramatically increase once snow and ice are bonded to the roadway

 INTRODUCTION SLIDE 1.29



Winter Maintenance Strategy
PROACTIVE WINTER MAINTENANCE

 INTRODUCTION SLIDE 1.30

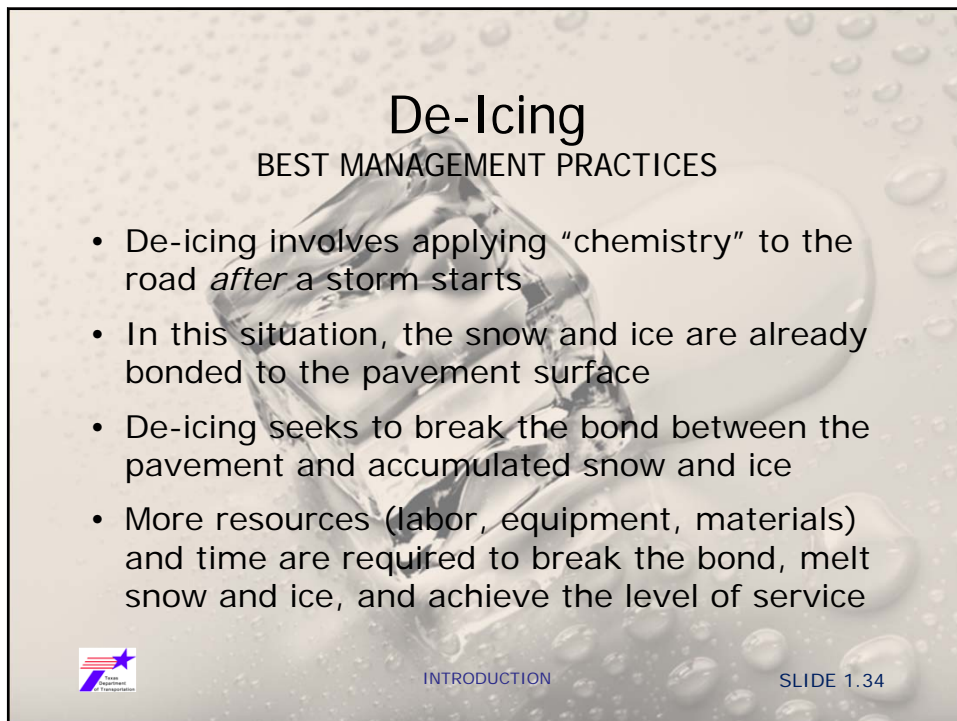


Anti-Icing

BEST MANAGEMENT PRACTICES

- Anti-icing involves applying “chemistry” – in the form of salt – in liquid and/or pre-wetted solid form before the storm starts.
- Anti-icing is designed to prevent snow and ice from bonding to the road (pavement) and to prevent the formation of frost.
- This makes it [much] easier to remove snow and ice.

INTRODUCTION SLIDE 1.32



De-Icing

BEST MANAGEMENT PRACTICES

- De-icing involves applying “chemistry” to the road *after* a storm starts
- In this situation, the snow and ice are already bonded to the pavement surface
- De-icing seeks to break the bond between the pavement and accumulated snow and ice
- More resources (labor, equipment, materials) and time are required to break the bond, melt snow and ice, and achieve the level of service

INTRODUCTION SLIDE 1.34



Traction Improvement with Abrasives

MATERIALS FOR SNOW AND ICE CONTROL

- Abrasives are often used to improve traction (frictional resistance) during winter weather operations
- The most commonly-used abrasives are sand, cinders, ash and crushed rock



INTRODUCTION

SLIDE 1.36

VIDEO 1.2 (01:58) Anti-Icing and De-Icing



CREDIT

“Winter Operations Training Series”

Iowa Department of Transportation

Used with permission.



INTRODUCTION

SLIDE 1.37

Winter Maintenance Strategy

BEST MANAGEMENT PRACTICES

- Anti-Icing is proactive... treating the roadway with “chemistry” *before* frost forms and before snow/ice bond to the pavement
 - GOAL: snow and ice separated from pavement by a layer of briny slush
- De-Icing is reactive... treating the roadway *after* the storm starts
 - GOAL: melt away snow and ice
- Traction Improvement... using abrasives to improve frictional resistance on snow and ice – no melting
 - GOAL: traction on snow and ice



INTRODUCTION

SLIDE 1.38

Let Chemicals Work for You

HOW ROAD CHEMICALS WORK



YOU DO THE WORK
←



→
CHEMICALS DO THE WORK



INTRODUCTION SLIDE 1.39



[Q.] Which method do you use?




INTRODUCTION SLIDE 1.40

[A.] It Depends on the Weather

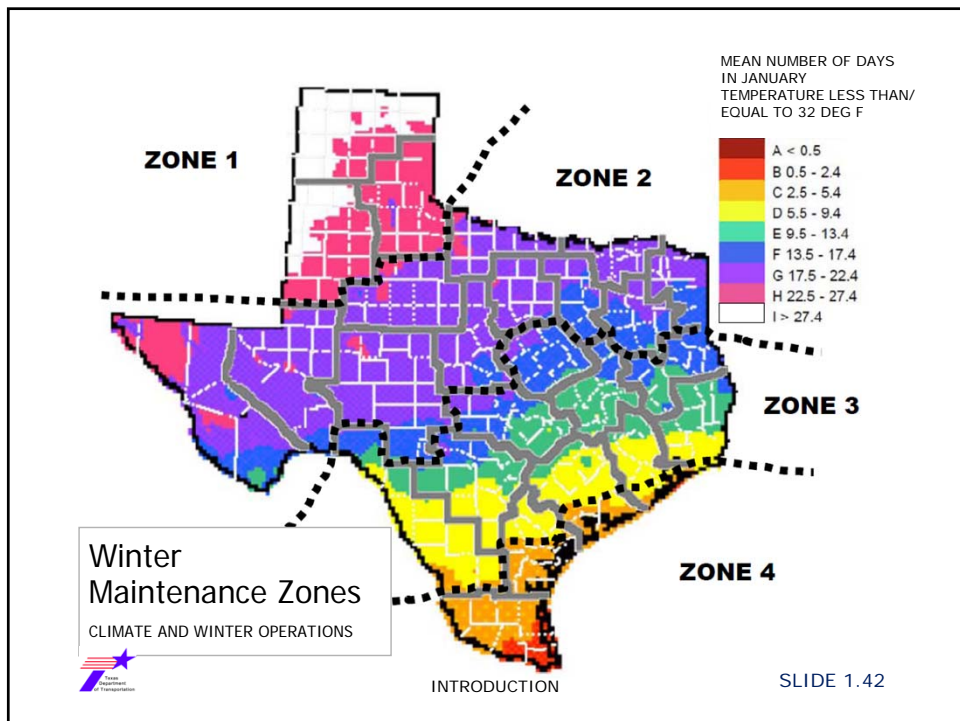
CLIMATE AND WINTER OPERATIONS

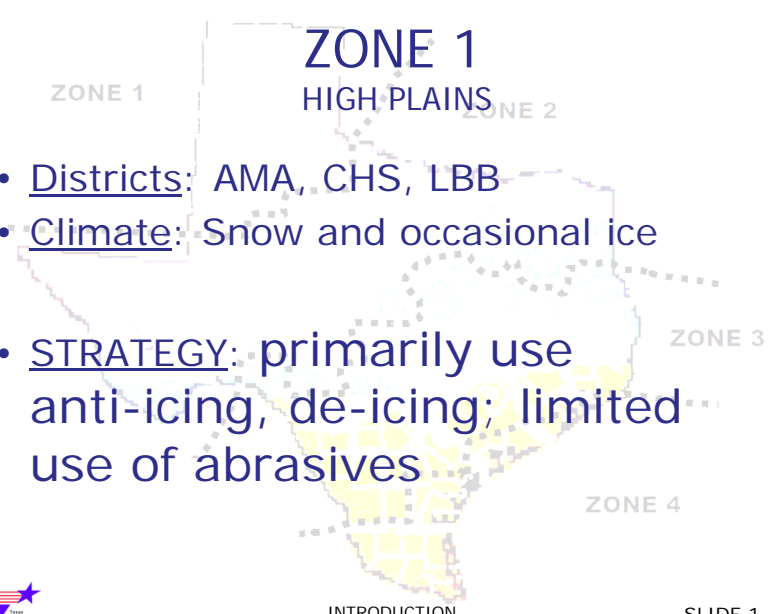
- The climate in Texas varies greatly from the panhandle to the coast
- TxDOT's maintenance strategy should not be "one size fits all"
- Geographic areas (zones) in Texas roughly correspond to climatic conditions where different maintenance approaches make sense



INTRODUCTION


SLIDE 1.41

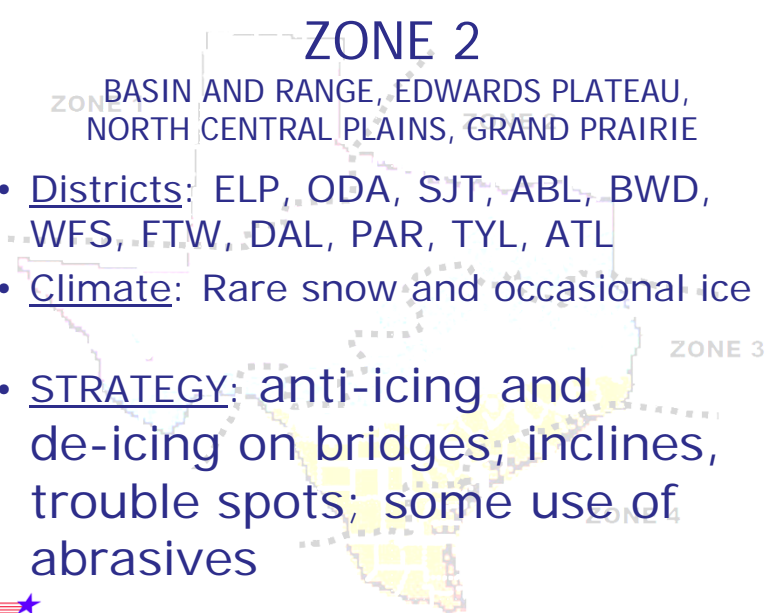




ZONE 1
HIGH PLAINS


- Districts: AMA, CHS, LBB
- Climate: Snow and occasional ice
- STRATEGY: primarily use anti-icing, de-icing; limited use of abrasives

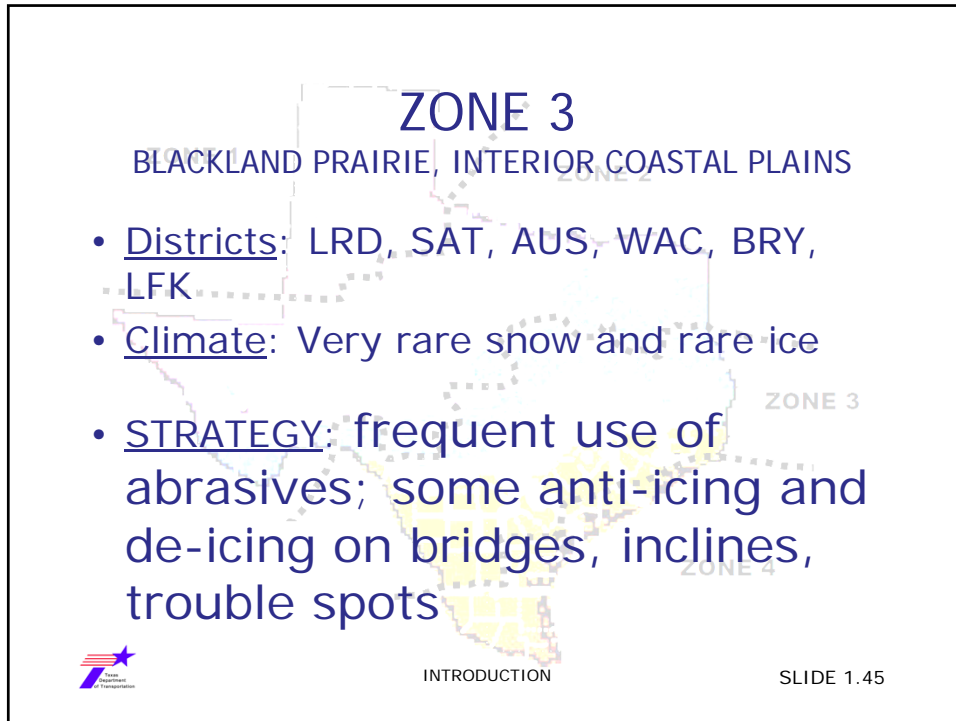
 INTRODUCTION SLIDE 1.43



ZONE 2
BASIN AND RANGE, EDWARDS PLATEAU,
NORTH CENTRAL PLAINS, GRAND PRAIRIE

- Districts: ELP, ODA, SJT, ABL, BWD, WFS, FTW, DAL, PAR, TYL, ATL
- Climate: Rare snow and occasional ice
- STRATEGY: anti-icing and de-icing on bridges, inclines, trouble spots; some use of abrasives


 INTRODUCTION SLIDE 1.44

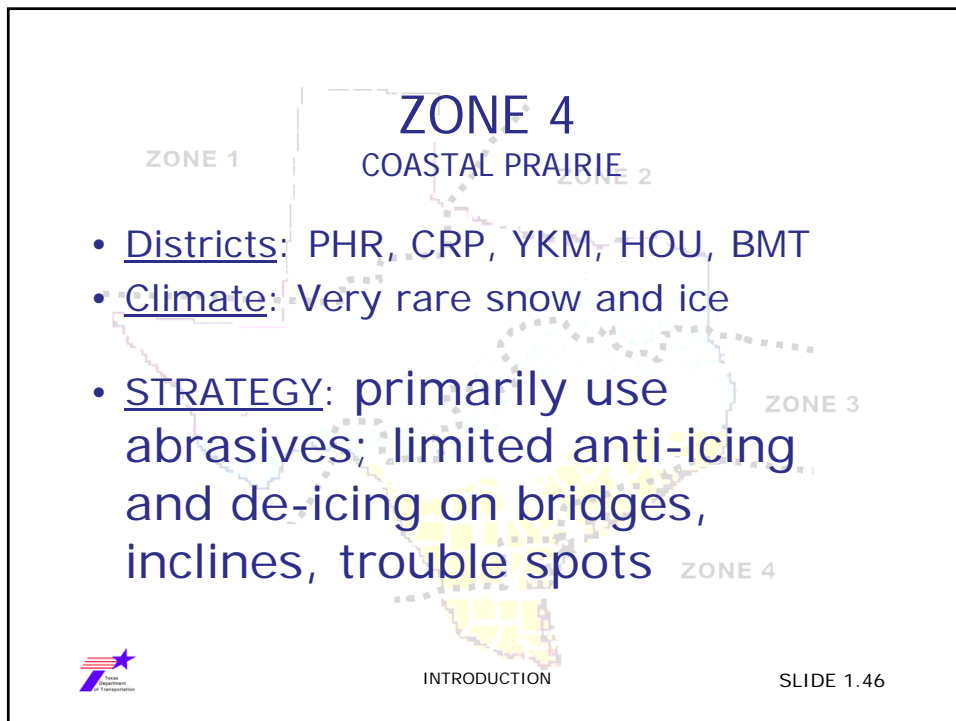


ZONE 3

BLACKLAND PRAIRIE, INTERIOR COASTAL PLAINS

- Districts: LRD, SAT, AUS, WAC, BRY, LFK
- Climate: Very rare snow and rare ice
- STRATEGY: frequent use of abrasives; some anti-icing and de-icing on bridges, inclines, trouble spots


 INTRODUCTION SLIDE 1.45



ZONE 4

COASTAL PRAIRIE

- Districts: PHR, CRP, YKM, HOU, BMT
- Climate: Very rare snow and ice
- STRATEGY: primarily use abrasives; limited anti-icing and de-icing on bridges, inclines, trouble spots

 INTRODUCTION SLIDE 1.46

Exercise 1.2

Winter Weather Operational Strategy



1. Think about the winter weather maintenance activities you have done in your Section. Jot down the strategy you think is most common in your section (individual assignment).
2. What is one topic about this strategy (or the others) you want to learn more about?
3. Meet with the people around you (3 to 4 persons) and discuss your ideas.

*Be prepared to discuss your views
(5 minutes).*



INTRODUCTION

SLIDE 1.47



Winter Weather Operations Training

GOALS AND OUTCOMES



INTRODUCTION

SLIDE 1.48

Winter Operations Training

INSTRUCTIONAL GOALS

- Provide positive encouragement
- Alleviate anxiety
- Show what is expected of you
- Develop confidence behind the wheel

“Not second-guessing yourself”



INTRODUCTION

SLIDE 1.49

Winter Operations Training

THE DESIRED OUTCOME

1. Safe... there is no substitute for safety
2. Confident... you know what to do and how to do it
3. Efficient... you perform winter operations tasks in a professional and competent manner



INTRODUCTION

SLIDE 1.50



Summary and Review

1. TxDOT perspective on winter maintenance
2. Winter weather safety
3. TxDOT policy for snow and ice control
4. Anti-icing, de-icing, traction improvement
5. Winter weather operational strategy



INTRODUCTION

SLIDE 1.51

Exercise 1.1 Winter Weather Safety



1. Think about and jot down at least 3 safety considerations specific to TxDOT winter weather operations (individual assignment).
2. Meet with the people around you (3 to 4 persons) and discuss your ideas.

*Be prepared to discuss your answers
(5 minutes).*



Exercise 1.2

Winter Weather Operational Strategy



1. Think about the winter weather maintenance activities you have done in your Section. Jot down the strategy you think is most common in your section (individual assignment).
2. What is one topic about this strategy (or the others) you want to learn more about?
3. Meet with the people around you (3 to 4 persons) and discuss your ideas.

*Be prepared to discuss your views
(5 minutes).*



INTRODUCTION

SLIDE 1.47

VIDEO 1.1. TXDOT WINTER WEATHER MAINTENANCE (02:00)

SCRIPT

The Citizens of Texas expect us to keep our highways safe and open to traffic during winter storm events. This is a responsibility we must meet. By clearly describing our expectations and policies, carefully planning and preparing, and effectively communicating this information to our employees, we can accomplish this goal.

We are fortunate that here in Texas, we don't normally experience harsh winter weather, like many states north of us do. However, the 2011 winter storm that slammed into Texas during Super Bowl XLV showed us the importance of being adequately prepared before snow and ice storms strike.

Proper planning and preparation are critical to successfully respond to storm events. We must clearly define for our employees what we expect of them and the roles that we will play should we be called into action.

In support of this objective, the Administration is working with the Districts and Divisions to take specific steps to ensure we have an effective statewide response to any winter storms.

You will be asked to understand and explain TxDOT's commitment to the traveling public in your District, to know and understand your own responsibilities when responding to winter weather, and to coordinate your efforts with others to achieve an effective response when faced with a winter weather event – whether that be in your district or in other areas of the state.

In all cases, communication – both internally within TxDOT and externally to the cities, counties, emergency responders, and other safety personnel in affected areas – is critical.

By diligently planning and preparing for winter weather events, we will ensure Texas has a safe and reliable transportation system, no matter what Mother Nature will bring our way. This is our mission, this is what the Citizens of Texas expect of us, and this is what we do every day.

Thank you.

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TXDOT PUBLIC SERVICE DOCUMENT (WINTERSAFE)



Source: TxDOT Internet Website, 2012.



WE'RE READY

Winter emergency road preparedness

Hazardous weather can unexpectedly change from freezing ice to snow and fog in some areas of the state. TxDOT works 24/7 to ensure our roads remain passable and safe year-round. RoadCrews throughout the state are especially prepared to improve road safety during severe winter weather conditions.

Particular attention is given to bridges, high traffic interchanges and roadways. TxDOT uses snowplows, salt spreaders and liquid de-icing rigs to assist with de-icing/anti-icing of the roadways and bridges.

TxDOT stockpiles various types of de-icers and anti-icing agents for winter storms as well as sand or small aggregate. Because each winter storm is unique, TxDOT will use a combination of materials and equipment depending on the severity of the storm.

 **TREATING THE ROADS**
Each area of Texas treats roads based on weather conditions.
The two most common materials used to include:

Liquid Anti-Icing solution to prevent roads from icing	Granular De-Icing materials to improve traction.
--------------------------------------------------------	--------------------------------------------------

 **USE CAUTION!**

Simple driving tips to practice on the roads

TxDOT's #1 priority is the safety of the traveling public, including using every resource available to keep the roads open and passable during winter storms. Motorists should always exercise caution and, if possible, allow extra time to reach destinations or delay travel until conditions improve.

-  Remove snow and ice from your vehicle before you drive
-  Maintain your vehicle in accordance with manufacturer's recommendations
-  Ensure headlights and tail lights are functioning properly
-  Accelerate slowly, drive slowly, and observe traffic signs and alerts
-  Approach bridges, shaded spots, and turns slowly



✓ PLAN FOR THE ROAD

Reduce your risks and avoid winter road hazards

You can reduce your risk by simply practicing a few road safety habits. Avoid getting caught by surprise, plan ahead, and be aware of alerts and advisories. Good road safety tips include:

- ▶▶▶ Stay tuned to local news and weather alerts
- ▶▶▶ Obtain information about road conditions online at www.TxDOT.gov keyword: ROAD CONDITIONS or by calling 1-800-452-9292

🔧 AUTO SAFETY CHECK ▶▶▶▶

Ensure your vehicle is maintained

Wiper blades

Heater/defroster

Ignition/battery

Anti-freeze level

Headlights
and tail lights



Fuel

Brakes

Tires

+ PREPARE A ROAD EMERGENCY KIT

- Booster cables
- Texas road map
- Chain/tow strap/shovel
- Abrasive materials (sand or cat litter)
- First-aid kit
- Flashlight
- Extra pair of socks and gloves
- Blanket
- Batteries
- Snacks and water
- Ice Scraper
- Flares and matches

TxDOT Road Conditions 24 Hour Hotline: 1-800-452-9292
www.TxDOT.gov Keyword: Winter Weather



ROAD SAFETY ALERT

TAKE EXTRA PRECAUTIONS 

while traveling through remote counties, primarily in North and West Texas during winter months.

Historically, North and West Texas experience the heaviest snowfalls, extreme white-outs, icy road and bridge conditions. These areas are generally where you could encounter major winter storms. If you plan to travel on roads leading towards El Paso or Amarillo be prepared. Rural areas of the state have very limited- to- no access to food, lodging, gas, or emergency medical services.

STAY INFORMED. BE WINTERSAFE.

The information contained in this safety guide is intended to help you be aware of potential hazardous conditions and contains tips to improve your road safety preparedness. Stay tuned to local news for road closures, changing conditions, and advisories.

For more information visit www.TxDOT.gov Keyword: Winter Weather

 Follow us on:   



Texas Road Conditions Hotline: 1-800-452-9292

If stranded, call the Texas Department of Public Safety's Stranded Motorist Hotline toll-free 1-800-525-5555.

VIDEO 1.2. ANTI-ICING AND DE-ICING (01:58)

SCRIPT

It wasn't many years ago that a 50/50 mixture of rock salt and sand was the primary formula used to combat snow covered icy highways.

Today, advance materials technologies and methods are providing many more options for effective and cost efficient application of de-icing chemicals and abrasives.

Both anti-icing and de-icing techniques are becoming highly refined. That is because of the greater selection of de-icing chemicals, improved application equipment, better trained personnel, improved weather forecasting, and roadway weather information systems data.

But before we go further, let's define anti-icing and de-icing.

As the term anti-icing implies, it is taking measures prior to a precipitation event to prevent formation of a bond between precipitation and the pavement by timely applications of deicing chemicals.

In other words, anti-icing is a proactive weather fighting measure.

On the other hand, de-icing is a reactive measure to break the bond that has formed between ice and pavement by chemical or mechanical means or a combination of the two.

With each approaching winter storm you may want to first consider an anti-icing strategy. It can pay off handsomely through savings and material equipment and labor.

Research has shown that it is 10 times more expensive deice than it is to take anti-icing measures and keep precipitation from bonding to the road surface.

Anti-icing may not be the best answer in all locations at all times. Check with your supervisor to determine if anti-icing is suitable for your area.

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Class Exercise – Review Questions
Module 1 – INTRODUCTION

MNT812 Winter Weather Operations Training

1. The primary reason TxDOT Administration has sponsored this winter weather operations training is:
 - A. Because some TxDOT maintenance personnel have not had snow and ice training
 - B. To help keep roadways safe and open for movement of people and goods
 - C. Because winter maintenance training is now required by legislative mandate
 - D. To avoid criticism and liability arising from winter road conditions

2. Which of the following safety topics apply to winter maintenance operations?
 - A. Cold weather health hazards
 - B. Snowplow operations
 - C. Defensive driving
 - D. All of the above

3. Which TxDOT guidance document would be most useful when you need information on winter weather operations in your District?
 - A. Snow and Ice Control Operations Manual
 - B. WinterSafe Safety Guide for Winter Travel
 - C. District Snow and Ice Control Plan
 - E. Maintenance Management Manual

4. When you apply chemical to the road to break the bond between the pavement and accumulated snow and ice, this is called:
 - A. De-icing
 - B. Traction improvement
 - C. Anti-icing
 - D. Post-storm cleanup

5. The main factor that determines your District's strategy for winter weather operations is:
 - A. Equipment
 - B. Labor
 - C. Climate
 - D. Public outcry

MODULE 2 Pre-Season Preparation



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012

Learning Objectives

Upon completion of this section, the learner will be able to:

1. Identify traditional maintenance equipment used to fight snow and ice
2. List the primary tasks involved in pre-season preparation for winter maintenance equipment



Learning Objectives, cont'd

3. Identify common snow and ice control materials used at TxDOT
4. List the primary tasks involved in pre-season preparation for snow and ice control materials



PRE-SEASON PREPARATION

SLIDE 2.3

SNOW AND ICE CONTROL

MAINTENANCE EQUIPMENT



PRE-SEASON PREPARATION

SLIDE 2.4

What Equipment is Used to Fight Snow and Ice?

PRE-SEASON EQUIPMENT CHECK

- Traditional maintenance equipment
- Attachments specifically intended to fight snow and ice
- Adapted equipment



PRE-SEASON PREPARATION

SLIDE 2.5



PRE-SEASON PREPARATION

SLIDE 2.6







Exercise 2.1

Pre-Season Preparation - Equipment



In groups of 3 to 4 persons:

1. Identify some of the tasks necessary to prepare your equipment for the winter maintenance season.
2. Jot down your ideas.

Be prepared to discuss your answers (5 minutes).



PRE-SEASON PREPARATION

SLIDE 2.13

Pre-Season Preparation
Picks Up from the
End of Last Season



PRE-SEASON PREPARATION

SLIDE 2.14

End-of-Season Checklist

PRE-SEASON EQUIPMENT CHECK

- Remove and properly store detachable winter-only tools/equipment
- Thoroughly wash vehicle and equipment; use chloride neutralizers
- Clean, apply silicon, and cover electrical connections
- Paint or treat any bare metal parts
- More... see Reference 2.1

R_{2.1}
[2.33]



PRE-SEASON PREPARATION

SLIDE 2.15



PRE-SEASON PREPARATION

SLIDE 2.16






Use Chloride Neutralizers
PRE-SEASON EQUIPMENT CHECK


PRE-SEASON PREPARATION

SLIDE 2.19


VIDEO 2.1 (00:27)
Equipment Cleaning



CREDIT
“Winter Operations Training Series”
Iowa Department of Transportation
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Winter Operations Training Series
Iowa Department of Transportation
DVD
"Intro to Winter Operations" 10:00
"Pre-Season Preparation" 29:55
"Equipment Operation" 10:29
"Plowing Techniques" 29:46



R
2.2
[2.35]

PRE-SEASON PREPARATION

SLIDE 2.20



Calibrate Solid/Granular Material Spreader

PRE-SEASON EQUIPMENT CHECK

- Calibrate solid/granular material spreaders in accordance with manufacturer's recommendations and guidelines
- All equipment should be calibrated on an annual basis (as a minimum)
- Calibration is critical to efficient and effective winter maintenance operations
- Details, Module 7

PRE-SEASON PREPARATION SLIDE 2.22

This slide has a dark blue background with white text. It contains a list of four bullet points regarding the calibration of solid/granular material spreaders. The Texas Department of Transportation logo is in the bottom left corner.



Calibrate Liquid Spray Application Equipment

PRE-SEASON EQUIPMENT CHECK

- Calibrate liquid spray application equipment in accordance with manufacturer's recommendations and guidelines
- Calibrate for anti-icing and de-icing applications
- Specific setups are required for each liquid de-icer material in terms of nozzle type, nozzle size, nozzle spacing and nozzle pattern
- Details, Module 8



PRE-SEASON PREPARATION

SLIDE 2.24



Dump Truck Checklist

PRE-SEASON EQUIPMENT CHECK

- Inspect...
 - Tires
 - Wheels
 - Hydraulic system
 - Lights
 - Cab
 - More... see Reference 2.3

PRE-SEASON PREPARATION SLIDE 2.26


R_{2.3}
[2.37]



V-Box Checklist

PRE-SEASON EQUIPMENT CHECK

- Inspect...
 - Drag chains
 - Hydraulics (gear box, hoses)
 - Spinner assembly
 - Conveyor assembly
 - PTO/Drive assembly
 - More... see Reference 2.4

 PRE-SEASON PREPARATION


R_{2.4}
[2.41]

SLIDE 2.28



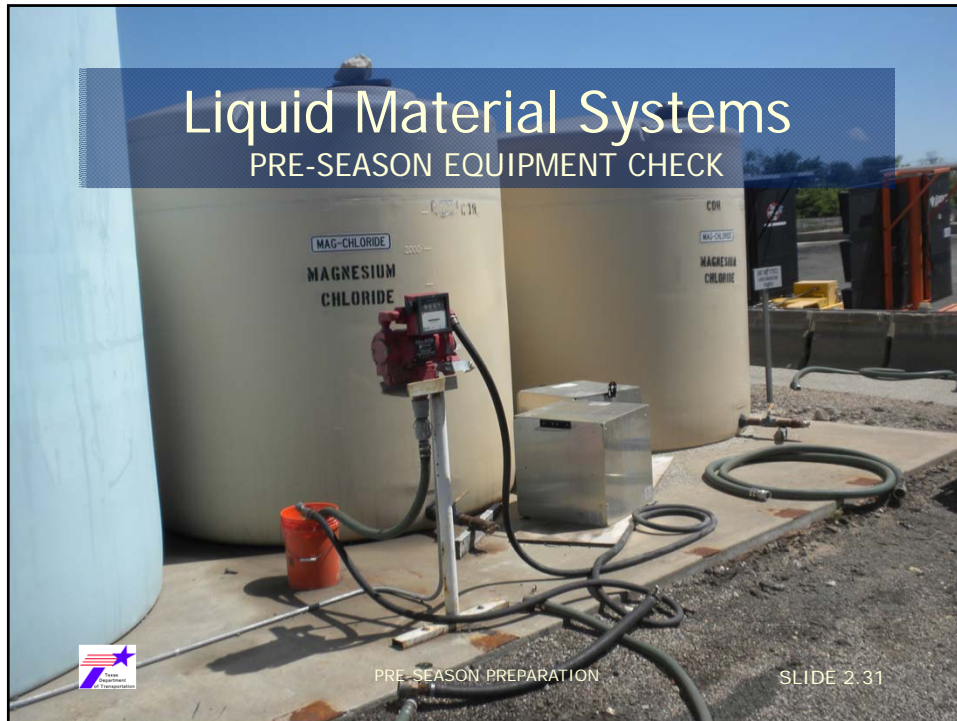
Reversible Plow Checklist
PRE-SEASON EQUIPMENT CHECK

- Mounting compatibility
- Hydraulics
- Cracks or broken welds
- Plow blade wear
- Test controls
- More... see Reference 2.5

 PRE-SEASON PREPARATION

R_{2.5}
[2.43]

SLIDE 2.30



Liquid Material Systems

PRE-SEASON EQUIPMENT CHECK

- Clean and maintain the liquid application trucks, tanks, brine-making systems, pumps and control systems according to manufacturer's specifications
- Test all equipment and control systems for proper performance after cleaning and all repairs have been made

PRE-SEASON PREPARATION SLIDE 2.32



Order Replacement Parts

PRE-SEASON EQUIPMENT CHECK

- Inventory replacement parts and consumables for all snow and ice control equipment:
 - Hydraulic components such as hoses and fittings
 - Electrical components such as rocker switches
 - Carbide blades and mild steel blades for snow plows, motor grader blades (snow, ice and slush capable)
 - Windshield wiper blades, scrapers and de-icer
 - For liquid anti-icing units, an extra pump



PRE-SEASON PREPARATION

SLIDE 2.34



What Materials are Used to Fight Snow and Ice?

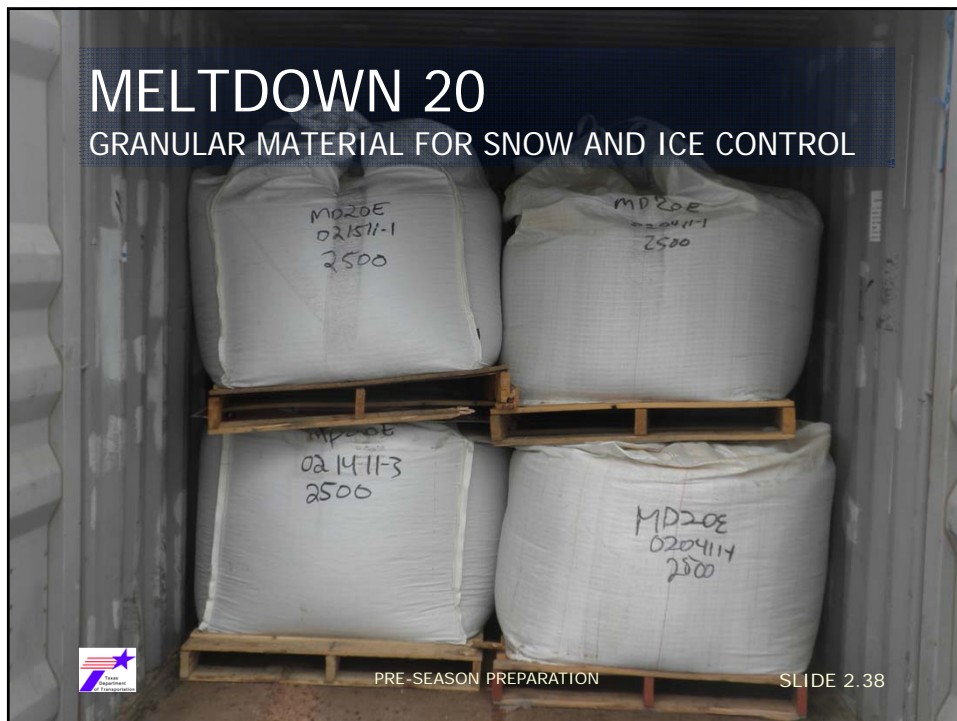
PRE-SEASON MATERIALS CHECK

- GRANULAR CHEMICAL
 - Road Salt
 - Meltdown 20
- LIQUID CHEMICAL
 - Meltdown Apex (magnesium chloride)
 - Salt Brine
- ABRASIVES... for traction improvement



PRE-SEASON PREPARATION

SLIDE 2.36







Exercise 2.2

Pre-Season Preparation - Materials



In groups of 3 to 4 persons:

1. Identify some of the tasks associated with preparing for the winter season related to snow and ice materials.
2. Jot down your ideas.

Be prepared to discuss your answers (5 minutes).



PRE-SEASON PREPARATION

SLIDE 2.43



Inventory

PRE-SEASON MATERIALS CHECK



PRE-SEASON PREPARATION

SLIDE 2.44

Inventory

PRE-SEASON MATERIALS CHECK

Conduct inventory of in-stock snow and ice control materials:

- Granular chemical materials
 - Stockpiled
 - Palletized
- Liquid chemical materials
- Abrasives

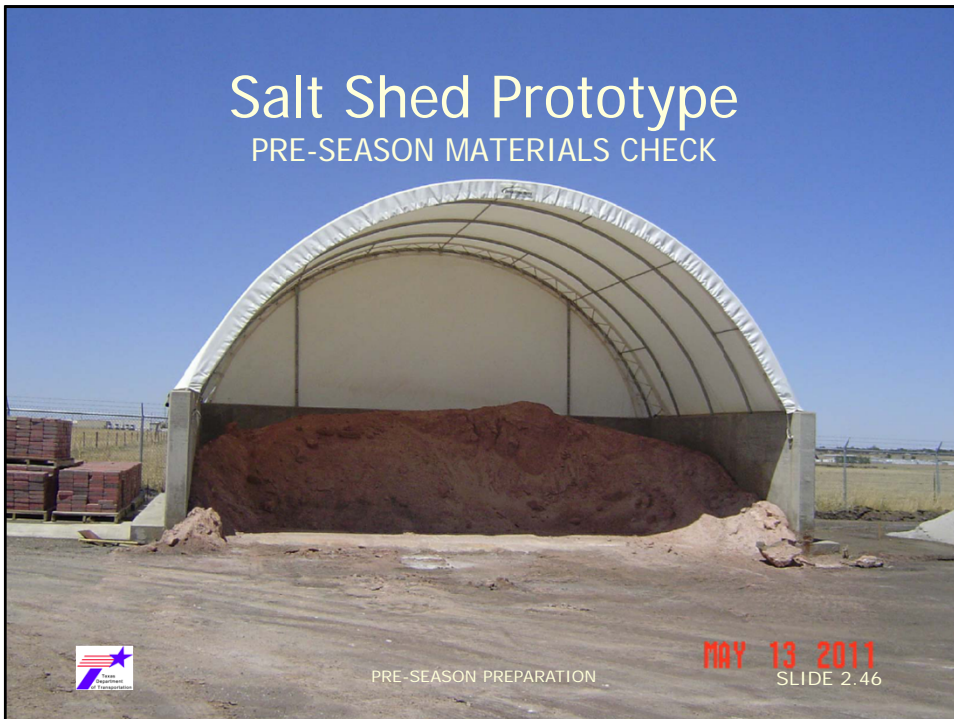


PRE-SEASON PREPARATION

SLIDE 2.45

Salt Shed Prototype

PRE-SEASON MATERIALS CHECK



PRE-SEASON PREPARATION

MAY 13 2011
SLIDE 2.46

Material Storage Facilities

PRE-SEASON MATERIALS CHECK

- Provide adequate storage facilities for granular and liquid snow and ice control chemicals:
 - Covered storage buildings for bulk granular materials
 - Storage tanks with secondary containment (as required) for bulk liquids



PRE-SEASON PREPARATION

SLIDE 2.47



PRE-SEASON PREPARATION

SLIDE 2.48



Open Stockpiles - Abrasives

PRE-SEASON MATERIALS CHECK

- Place open stockpiles of snow and ice control materials on an impervious pad
- Slope ground surface to drain away from stockpile in all directions
- Keep material away from bridge structure (columns)




PRE-SEASON PREPARATION

SLIDE 2.49

Sand Stockpiles

PRE-SEASON MATERIALS CHECK

- Pretreat sand/abrasives stockpiles to keep material flowable in freezing weather
- Apply salt brine or other suitable de-icer to stockpile at a rate of 4 to 6 gallons per ton of sand



PRE-SEASON PREPARATION

SLIDE 2.50

VIDEO 2.2 (01:25) Material Storage and Handling

CREDIT

“Winter Operations Training Series”

Iowa Department of
Transportation

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PRE-SEASON PREPARATION

SLIDE 2.51

Health and Safety Issues

PRE-SEASON MATERIALS CHECK

- Eye Irritant
- Skin Irritant
- Breathing Irritant
 - Dust Inhalation
 - Mist Inhalation
- Best Practices
 - Good Personal Hygiene
 - Personal Protective Equipment



PRE-SEASON PREPARATION

SLIDE 2.52



Summary and Review

1. Maintenance equipment used to fight snow and ice
2. Pre-season preparation for winter maintenance equipment
3. Common TxDOT snow and ice control materials
4. Pre-season preparation for snow and ice control materials



Exercise 2.1

Pre-Season Preparation - Equipment



In groups of 3 to 4 persons:

1. Identify some of the tasks necessary to prepare your equipment for the winter maintenance season.
2. Jot down your ideas.

Be prepared to discuss your answers (5 minutes).



Exercise 2.2

Pre-Season Preparation - Materials



In groups of 3 to 4 persons:

1. Identify some of the tasks associated with preparing for the winter season related to snow and ice materials.
2. Jot down your ideas.

Be prepared to discuss your answers (5 minutes).



END OF SEASON CHECKLIST

End-of-Season Tasks

- Remove trash and personal items
- Inventory tools
- Inventory safety equipment
- Remove and properly store winter-only tools/equipment
- Report damaged or missing items to supervisor
- Thoroughly wash vehicle and equipment; use chloride neutralizers
- Remove detachable equipment:
 - Perform additional cleaning as required
 - Lubricate
 - Safely store
- Clean and cover hydraulic connections
- Clean, apply silicon, and cover electrical connections
- Lubricate chains and sprockets
- Oil or collapse cylinders to protect rods
- Set air intake valve to summer use setting
- Paint or treat any bare metal parts
- Submit equipment requests
- Discuss modifications/improvement ideas with supervisor

Source: "End of Season Tasks," Documents, **Equipment Maintenance CD**, Version 1, AASHTO Clear Roads Computer Based Training, July 2007.

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VIDEO 2.1. EQUIPMENT CLEANING (00:27)

SCRIPT

Once a storm is over and the roads are open and clear, get the equipment cleaned up as soon as possible so you are ready for the next snowfall.

After you have emptied any material left on your truck and put it back into the stock pile, wash the truck, making sure to get all of the salt thoroughly washed off, as well as sand and dirt.

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DUMP TRUCK CHECKLIST

Pre-season Checklist

- Read equipment manuals
- Familiarize yourself with new or infrequently used equipment
- Review your agency's pre-trip inspection process
- Allow truck to sit on impermeable surface overnight so leaks can be detected
- Inspect tires:
 - Verify that the tire sizes are correct for the vehicle and equipment
 - Verify that the tire load ratings are correct for the vehicle and equipment
 - Make sure the tread design on the front tires is the same
 - Look for tire checking and cracking
 - Look for punctures, nails or other damage
 - Inspect sidewalls between dual tires
 - Tread must be at least 4/32nds of an inch
 - Tread should be even across width of tire
 - Set tire pressure to the PSI value on sidewall to handle winter loads
- Inspect wheels:
 - Check tightness of wheel lugs
 - Check tightness of axle bolts
 - Check for leaks around wheel seals
 - Check for cracks on rim
- Inspect mud flaps
 - Must be securely fastened
 - Must extend full width of tire(s)
 - Must extend down within 8 inches of ground
- Inspect hydraulic system:
 - Check for leaks on garage floor
 - Check for leaks around each hose and fitting
 - Be sure hoses are not pinched
 - Be sure hoses are not rubbing against each other
 - Be sure hoses are not rubbing against another surface
 - Check hydraulic oil level
- Inspect lights:
 - Brake lights
 - Headlights (both high and low beams)
 - Plow lights
 - Turn signals (left/right, front/back)
 - Cab lights
 - Warning lights
 - Clearance lights
 - Sander lights
 - Wing lights
 - Check light wiring: should not be loose or hanging
 - Reflectors
 - Conspicuity tape

- Air restriction indicator:
 - Change air filter if required
 - Make sure air intake valve is set for winter conditions
- Fuel system:
 - Change fuel filter
 - Drain any water in the fuel/water separator
 - Check for evidence of fuel leaks
 - Understand the fuel blends you'll be using
 - Cycle winter blends into storage tanks prior to winter season
- Engine oil:
 - Check oil level; do not overfill
 - Check oil color
 - Check for burnt smell of oil
 - Check for significant oil leaks
- Cooling system:
 - Check coolant level; do not overfill; use correct fluid
 - Check for coolant leaks
 - Check for plugged or damaged radiator fins
- Transmission:
 - Check automatic transmission fluid level at operating temperature; do not overfill
 - Check manual transmission fluid level at plug beneath truck, if applicable
 - Check for transmission fluid leaks
- Check fan and other belts for frays, cracks and tightness
- Inspect wiring
- Check battery level and charge
- Check windshield washer fluid level
- Verify that all brackets, bolts and welds are in good condition
- Check the PTO pump mounting and drive shaft
- Check exhaust pipe
- Check tailgate trip arm
- Check ladder to dump box
- Check tarp system
- Check tool racks and boxes

- Application equipment:
 - Check condition and operation of spinner
 - Check condition of gear box
 - Check condition and operation of chain
 - Inspect pumps, valves, nozzles and hydraulics of liquid applicator equipment
 - Sand flaps should be in place
 - Calibrate solid and liquid application equipment
 - Calibrate on-board pavement temperature sensors
 - Check augers, conveyors, and spinners
 - Check tailgate spreaders

- Tool inventory:
 - Tire cables or chains
 - Towing chain
 - Extra plow and wing pins
 - Hand shovel
 - Other tools (e.g. hammer, screwdrivers, wrenches)

- Cab checklist:
 - Check all of the dashboard lights.
 - Check dome lights.
 - Check the engine air restriction indicator
 - Check all gauges:
 - fuel gauge
 - temperature gauge
 - oil pressure,
 - speedometer
 - Check that the horn functions properly
 - Check windshield for damage.
 - Check condition/operation of wiper blades
 - Check the heating and defrosting systems outdoors
 - Cab should be clean of all debris
 - All items must be secure
 - Safety equipment:
 - Fire extinguisher:
 - full?
 - current inspection tag?
 - securely mounted?
 - readily accessible?
 - Flares and triangles
 - Flash light with good bulb and fresh batteries
 - First aid kit
 - CPR mask
 - Bloodborne pathogen protection kit
 - Emergency reflector kit
 - Verify that safety belts work properly
 - Ice scraper
 - Whisk broom or snow brush
 - Check 2-way radio
 - Supply of current accident/incident forms
 - Material/activity log sheets
 - Check mirrors for cracks and positioning
 - Check heated mirrors to ensure that they are operating properly

- Proper clothing
 - Loose fitting layers
 - Cotton t-shirts and underwear
 - 2-piece long thermal or wool underwear
 - Polypropylene socks
 - Wool socks serve well as a second layer
 - Comfortable jeans
 - Suspenders
 - Overalls or coveralls
 - Steel-toed boots
 - Ski mask
 - Mittens and gloves with cotton thermal liners
 - Sunglasses

Source: "Pre-Season Checklist," Documents, **Equipment Maintenance CD**, Version 1, AASHTO Clear Roads Computer Based Training, July 2007.

V-BOX SPREADER CHECKLIST

**TxDOT Pre-Trip Inspection Checklist
 V-Box Spreader**

Pre-Trip Inspection Task or Activity	
Drive chains and drag chains should be checked for proper tension (slack); adjust as necessary	
Check conveyor chain (drag chain) for excessive wear, proper lubrication and proper operation	
Check all hydraulics (pumps, hoses and connections) for proper operation and leaks	
Check for leaks and wear on hoses (hydraulic system)	
Check PTO and drive assembly	
Check drag chain (conveyor) oiler for proper fluid level	
Check oiler lines for any damage, restrictions, wear or leaks; repair or replace as necessary	
Check spinner assembly (hinge rod and disk) for excessive wear, proper lubrication and proper operation	
Check spreader box and frame for fatigue cracks and broken welds	
Check all bolts, nuts, washers, pins and clips to ensure none are missing or damaged	
Check all bolts, nuts and other fasteners to ensure they are tight	
Check spreader controls (conveyor speed and spinner speed) to ensure they are working properly	
Set the spinner speed as needed to attain the desired width of spread	
Set the conveyor speed as needed to attain the desired quantity of material to be spread	
Set the gate opening as required to attain the desired quantity of material to the spinner	
Check the material baffles (flaps) below the spinner to ensure they are not damaged and are working properly	
Set the material baffles (flaps) as needed to attain the most appropriate spread pattern on the road	
Grease all grease fittings as required by the equipment manufacturer	
Check the condition of all spreader-mounted reflectors; replace if damaged	
Make sure all lights are operational and clean on the spreader	

Source: Work in Progress. Texas Tech University.

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PRE-SEASON REVERSIBLE PLOW CHECKLIST

Points to Remember When Mounting and Inspecting a Reversible Plow

- Be sure to mount the correct plow to the corresponding truck.
- For ease and safety, two people are generally required to mount the plow.
- When hooking up hydraulics, wear gloves and goggles; turn off vehicle. Clean connectors to be sure they are free of all dirt, dust, grit, etc.
- Do not place any part of your body beneath a raised plow unless it is safely resting on secure mount or blocks.
- After attaching equipment, before performing a thorough inspection, lower plow to floor.
- Look for cuts or frays in cable.
- Check for broken links in chain.
- Check plow for cracks or broken welds.
- All hydraulic cylinders should be inspected.
- Check all hydraulic fittings to be sure they are tight and not leaking.
- Inspect the stop blocks.
- Check for proper plow trip adjustment.
- Check plow blade for cracks or excessive wear.
- Check turntable mounts.
- If carbide is missing from blade, you should replace blade. If this is not possible, at least be aware that the blade will wear much faster. Replace blade when 2 inches or less of the blade remains between the bottom of the moldboard and the bottom of the blade. Rotate blades on plow for longer wear.
- Check tightness of all nuts on plow blade. Replace any missing nuts and bolts.
- Grease all grease fittings.
- Check the condition of all plow-mounted reflectors; replace if damaged.
- Check the condition of the flags; worn or faded flags should be replaced.
- Be sure plow shield, if applicable, is secure.
- Test all plow controls.

Source: "Pre-Season Reversible Plow Checklist," Documents, **Equipment Maintenance CD**, Version 1, AASHTO Clear Roads Computer Based Training, July 2007.

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VIDEO 2.2. MATERIAL STORAGE AND HANDLING (01:25)

SCRIPT

Salt is stored at DOT garages in sheds and domes. It should be ordered, delivered, and put under cover well in advance of the winter season.

To store salt, use a loader to move the salt into the shed or dome filling from the back and working your way out. An auger or conveyor can be used to completely fill a dome by building a cone of salt in the center of the structure. For details about safe material handling practices, composition, and quality, ask your supervisor who has specifications and material safety data sheets for salt and all other de-icing chemicals.

Salt should be mixed with abrasives as a conditioner to prevent the sand stockpile from freezing and keep it workable during the winter. There are many ways to mix salt and sand. One way is to use a loader to move a quantity of sand out into an open area. Some garages use motor graders to do the mixing. A 10% salt mix, one loader bucket of salt and nine loader buckets of sand is a good mix when using salt as a sandpile conditioner. For road use, the percentage of salt you use and salt sand mixtures will vary depending on what you are trying to accomplish.

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Class Exercise – Review Questions

Module 2 – PRE-SEASON PREPARATION

MNT812 Winter Weather Operations Training

1. Traditional roadway maintenance equipment can be used/adapted for winter weather maintenance. Traditional maintenance equipment typically would NOT include:
 - A. Snow blower
 - B. Dump truck
 - C. Motor grader
 - D. V-box spreader

2. Pre-season tasks associated with winter maintenance equipment include:
 - A. Clean, inspect, and repair all snow and ice control equipment
 - B. Calibrate both granular and liquid snow and ice control application equipment
 - C. Procure an adequate supply of replacement parts and consumables
 - D. All of the above

3. Which of the following is NOT a common snow and ice control material used by TxDOT?
 - A. Road Salt
 - B. Freeze Guard
 - C. Salt Brine
 - D. Meltdown Apex

4. Pre-season tasks associated with snow and ice control materials would typically NOT include:
 - A. Provide adequate storage facilities for both liquid and granular snow and ice control materials
 - B. Inventory snow and ice control materials to ensure an adequate supply is on hand
 - C. Perform research and field testing to improve material effectiveness
 - D. Provide appropriate loading and delivery areas for all liquid and granular snow and ice control materials

MODULE 3 Mount a V-Box Spreader



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012

Learning Objectives

Upon completion of this section, the learner will be able to:

1. Identify major components of the V-box spreader
2. Explain the hanging storage rack method and the leg stand support method of storing a V-box spreader



Learning Objectives, cont'd

3. Remove the tailgate from a dump truck to facilitate mounting the V-box
4. Mount a slide-in V-box spreader in a dump truck bed
5. Secure, connect, and test the V-box spreader to confirm proper mounting



MOUNT A V-BOX SPREADER

SLIDE 3.3



MOUNT A V-BOX SPREADER

DESCRIPTION OF V-BOX SPREADER



MOUNT A V-BOX SPREADER

SLIDE 3.4



VIDEO 3.1 (00:53) TxDOT V-Box Spreader



CREDIT

Fort Worth District
Texas Department of
Transportation



R_{3.1}
[3.39]



MOUNT A V-BOX SPREADER

SLIDE 3.7

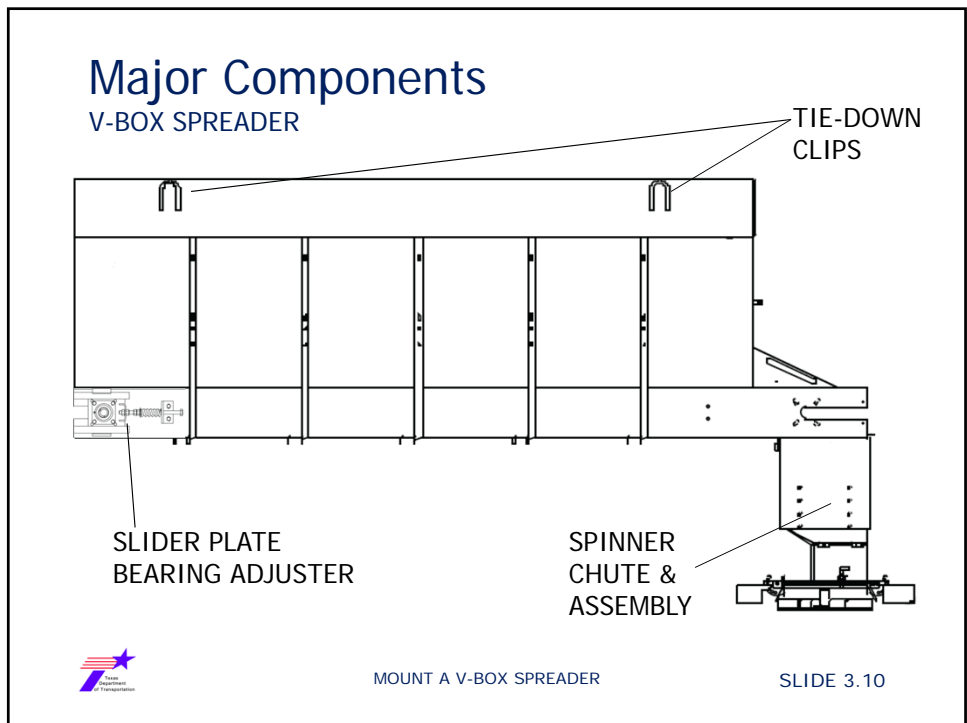
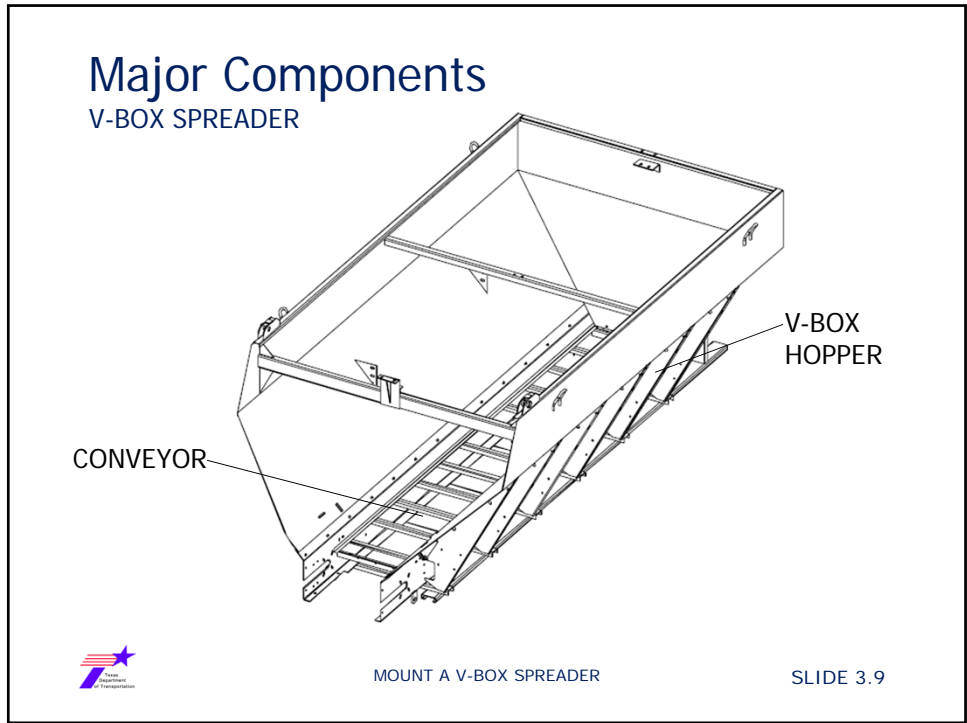
Major Components V-BOX SPREADER

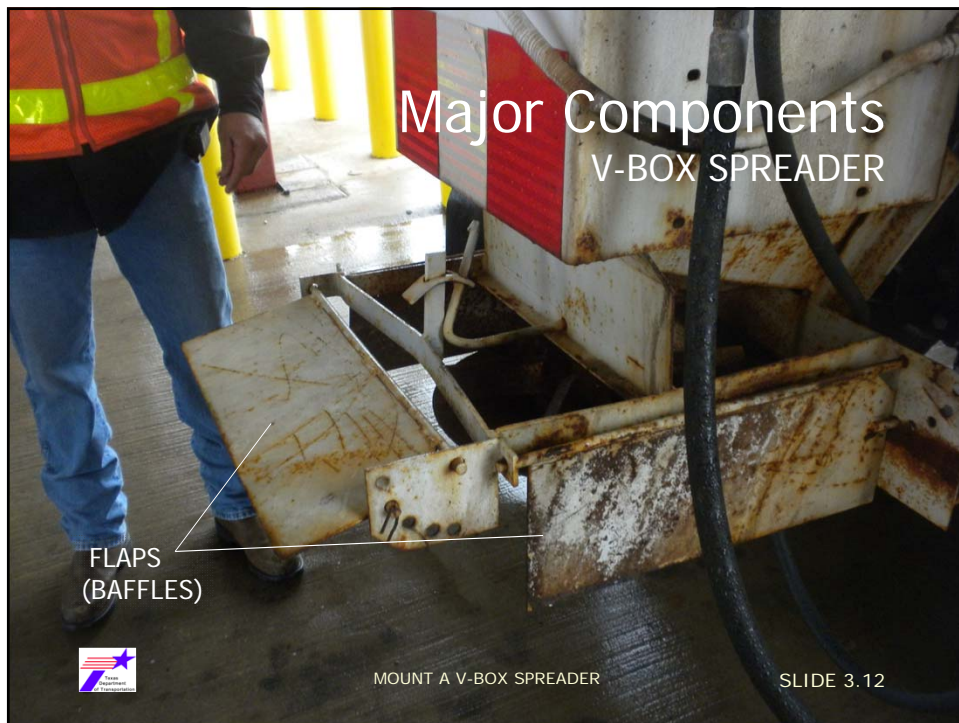
- V-Box Hopper
- Grate
- Tie-Down Clips
- Mounting Pins
- Conveyor
- Chain Tensioner
- Vibrator
- Hydraulic Pump
- Gearbox
- Spinner
- Flaps (Baffles)
- Controls

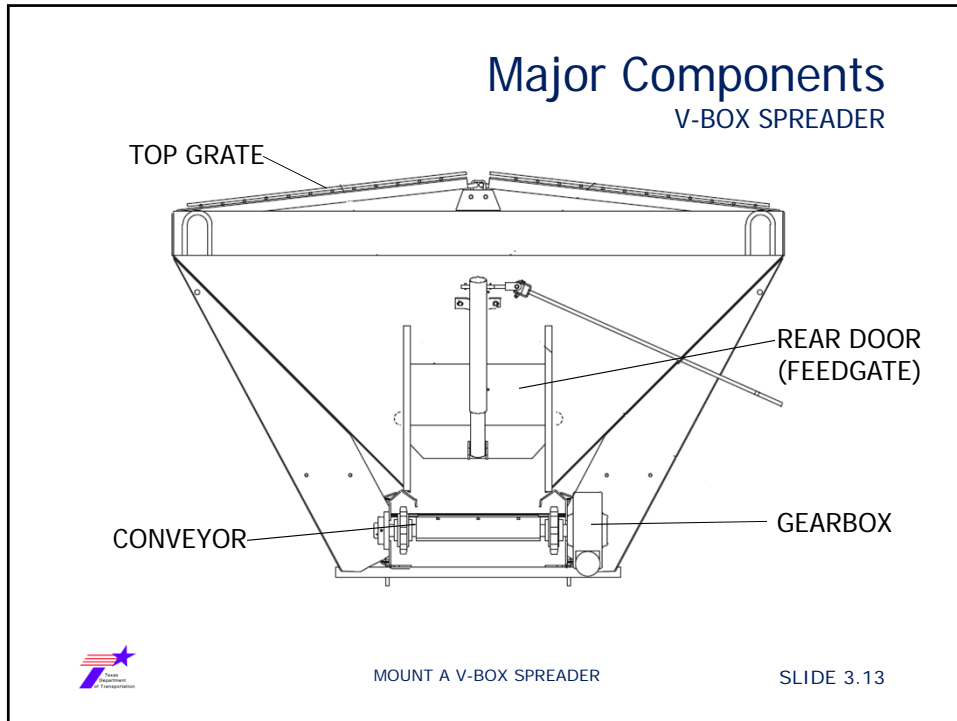


MOUNT A V-BOX SPREADER

SLIDE 3.8







V-BOX SAFETY



CAUTION
Use care when mounting or dismounting.
IF DEFACED - ORDER PART NO. 9505140

CAUTION

1. Keep all guards/shields in place.
2. Make certain everyone is clear of machine before starting engine or operation.
3. Keep hands, feet and clothing away from power driven parts.
4. Disengage PTO, shut off hydraulic valve and set parking brake before leaving operator's position. Make sure all movement has stopped before servicing or unlogging machine.
5. Make sure machine is stably supported when it is being mounted, dismounted or stored.
6. Use flashing lights when operating machine.

IF DEFACED - ORDER PART NO. 9505140



DANGER
Moving conveyor/auger!
- Disconnect and lockout power before servicing, adjusting or cleaning.
- Keep hands, feet, hair and loose clothing away from moving parts at all times.
- Never remove or modify guards or shields.
Failure to heed will result in death or serious injury.
IF DEFACED - ORDER PART NO. 9505140



WARNING
Flying debris. Stay clear and wear eye protection. Failure to heed will result in serious injury.
IF DEFACED - ORDER PART NO. 9505147



WARNING
Turning spinners throw material. Stay clear & wear eye protection while spinner is turning. Failure to heed will result in serious injury.
IF DEFACED - ORDER PART NO. 9505142



DANGER
Moving conveyor!
- Disconnect and lockout power before servicing, adjusting or cleaning.
- Keep hands, feet, hair and loose clothing away from moving parts at all times.
- Never remove or modify guards or shields.
Failure to heed will result in death or serious injury.
IF DEFACED - ORDER PART NO. 9505140

DANGER
Keep all guards/shields in place. Moving parts can crush and dismember.
IF DEFACED - ORDER PART NO. 95052310

MOUNT A V-BOX SPREADER

SLIDE 3.15

SAFETY DECAL SIGNAL WORDS

DANGER

DANGER (*Red*) indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING (*Orange*) indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION (*Yellow*) indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION

CAUTION (*Yellow*) used without the safety risk alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

MOUNT A V-BOX SPREADER

SLIDE 3.16

Different Types of Spreaders

V-BOX SPREADER

- Large V-Box
 - Swenson
 - Monroe
 - Flink
- Pickup Version
 - 2.5 CY
 - 0.5 CY
 - Smaller



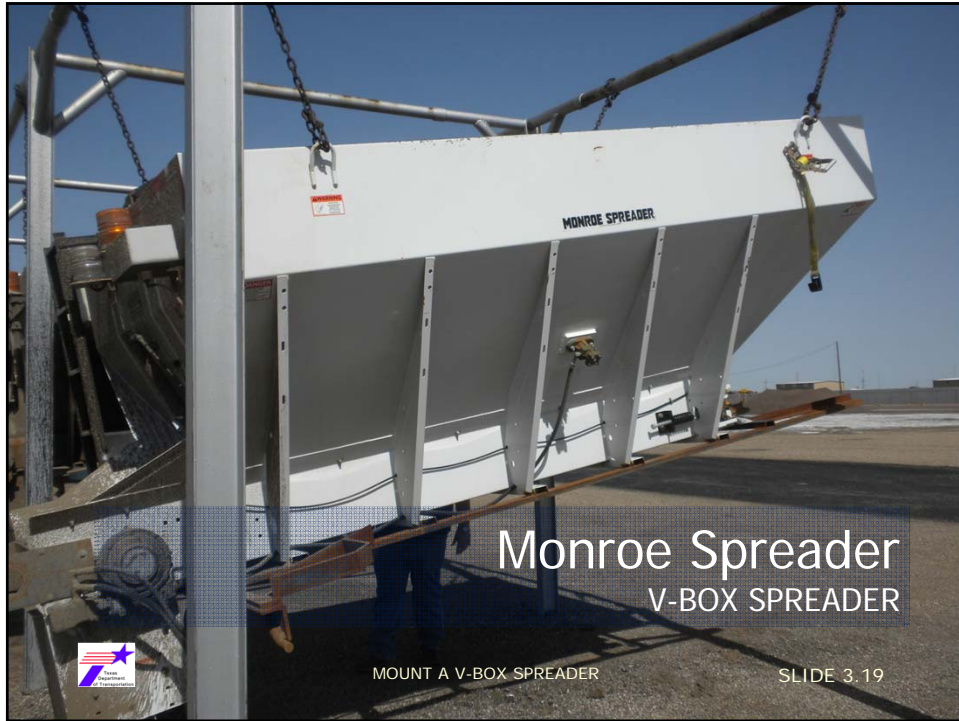
MOUNT A V-BOX SPREADER

SLIDE 3.17



MOUNT A V-BOX SPREADER

SLIDE 3.18





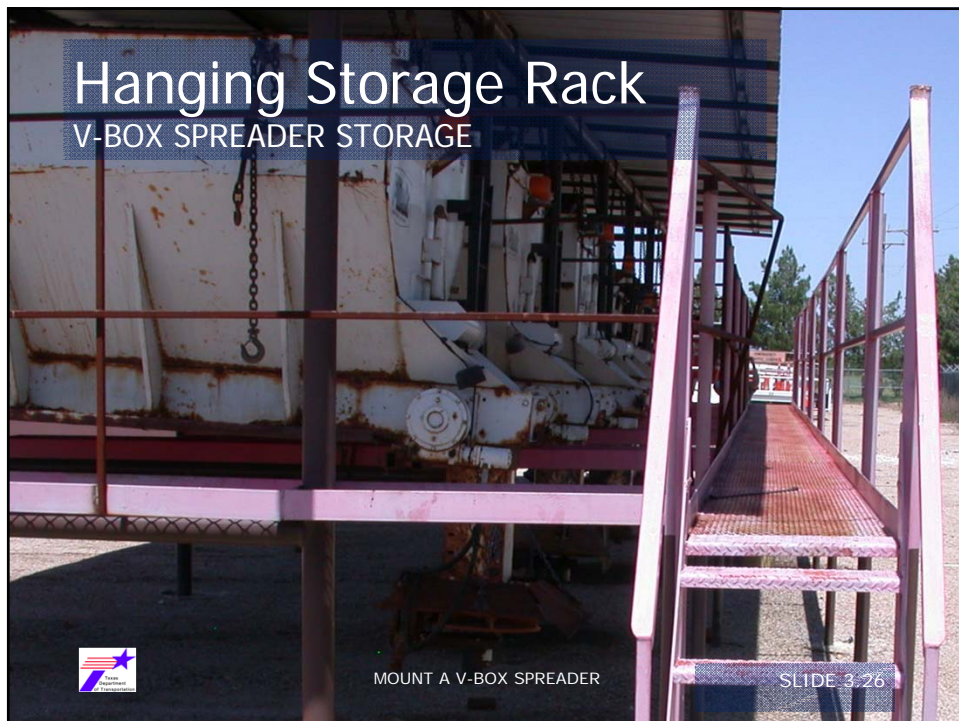


V-Box Spreader Storage

MOUNT A V-BOX SPREADER

- Hanging Storage Racks
- Leg Stand Supports
- Metal Saw Horses

 MOUNT A V-BOX SPREADER SLIDE 3.24













Remove Dump Truck Tailgate V-BOX SPREADER

- Remove with Forklift
- Remove with Hoist or Crane
- Tailgate Storage

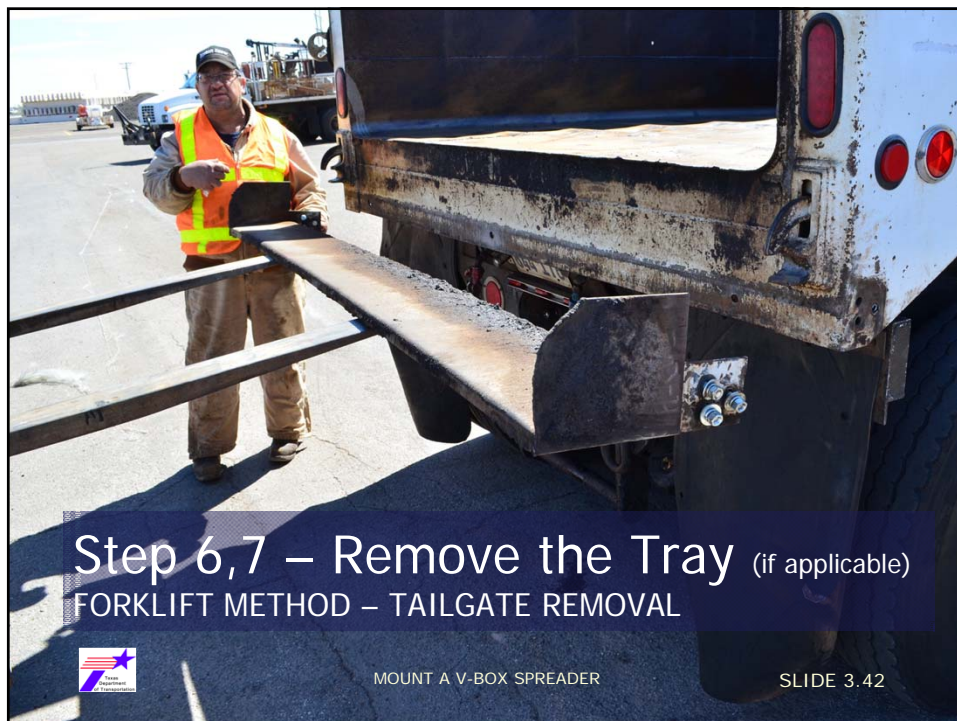


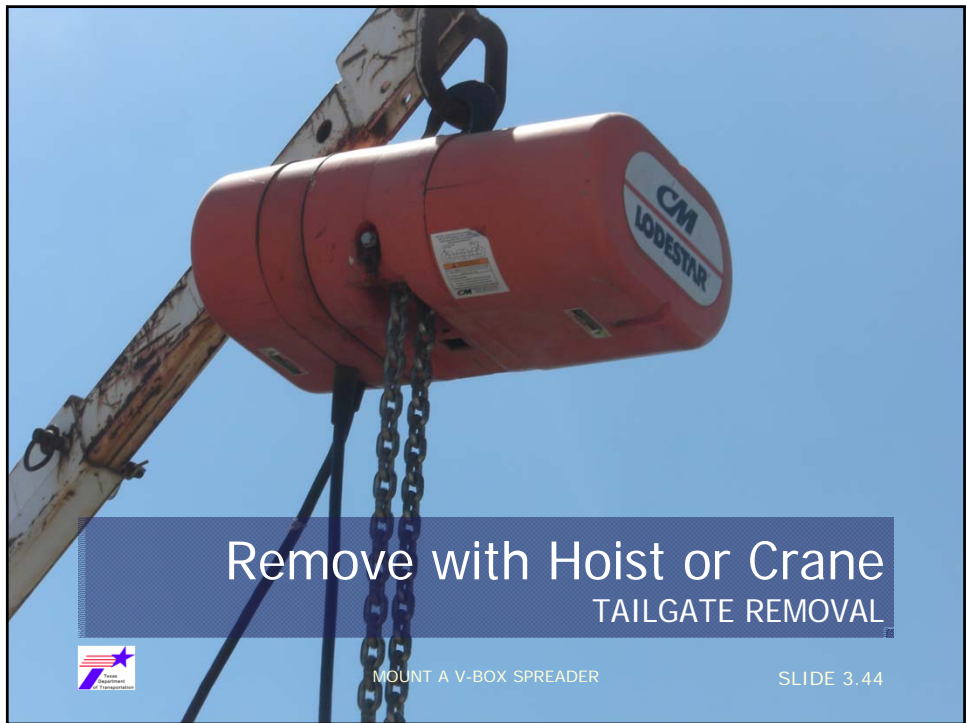
MOUNT A V-BOX SPREADER

SLIDE 3.36














Mount a V-Box Spreader

MOUNT A V-BOX SPREADER

- Mount from Leg Stand Supports
- Secure, Connect and Test the V-Box
- Mount from Hanging Storage Rack
- Dismount V-Box Spreader

 MOUNT A V-BOX SPREADER SLIDE 3.49



VIDEO 3.2 (01:45) Mount a V-Box Spreader from a Leg Stand Support



CREDIT

Childress District

Texas Department of
Transportation



R_{3.2}
[3.40]



MOUNT A V-BOX SPREADER

SLIDE 3.51

Secure, Connect and Test MOUNT A V-BOX SPREADER



MOUNT A V-BOX SPREADER

SLIDE 3.52

VIDEO 3.3 (01:30) Secure, Connect, and Test a V-Box Spreader



CREDIT
Childress District
Texas Department of
Transportation



R_{3.3}
[3.41]



MOUNT A V-BOX SPREADER

SLIDE 3.53



Hanging Storage Rack MOUNT A V-BOX SPREADER



MOUNT A V-BOX SPREADER

SLIDE 3.54

VIDEO 3.4 (02:34) Mount a V-Box Spreader from a Hanging Storage Rack



CREDIT
Lubbock District
Texas Department of
Transportation



R_{3.4}
[3.42]



MOUNT A V-BOX SPREADER

SLIDE 3.55



MOUNT A V-BOX SPREADER

SLIDE 3.56

VIDEO 3.5 (02:00) Dismount a V-Box Spreader to a Leg Stand Support



CREDIT

Childress District

Texas Department of
Transportation



R_{3.5}
[3.43]



MOUNT A V-BOX SPREADER

SLIDE 3.57

FIELD Exercise 3.1 Mount a V-Box Spreader



Stored on:

1. Hanging storage rack...

<OR>

2. Leg stand support...

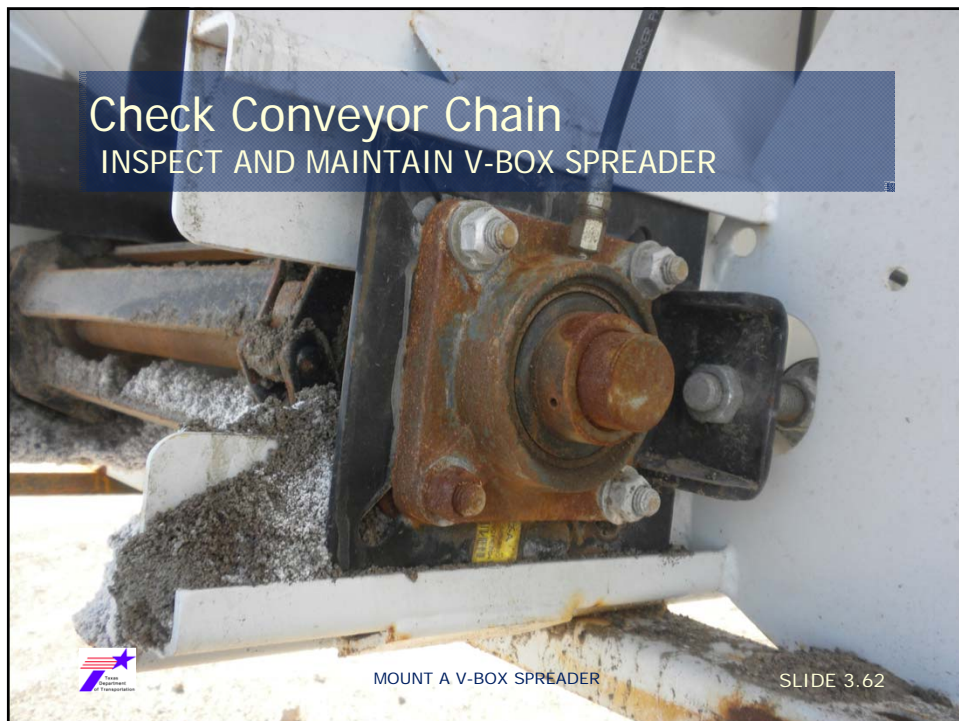
R_{3.6}
[3.45]



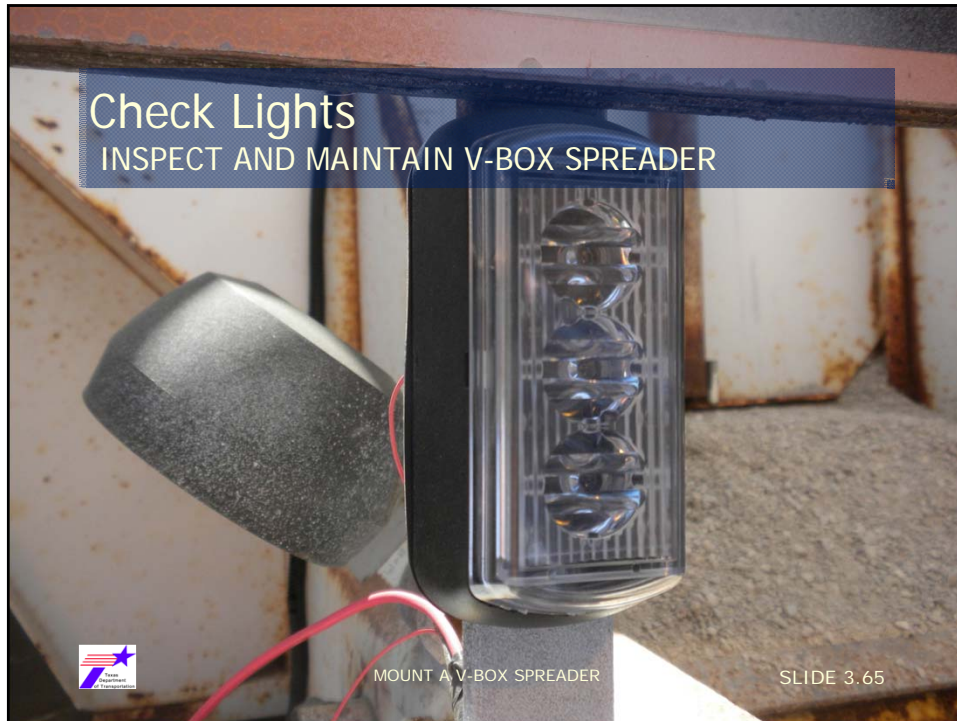
MOUNT A V-BOX SPREADER

SLIDE 3.58










Thoroughly Clean After Use
INSPECT AND MAINTAIN V-BOX SPREADER

- Remove remaining snow and ice control material from spreader box
- Carefully, completely, and thoroughly clean and wash the V-box spreader
- Thoroughly oil the conveyor chain system and apply an anti-corrosion protective sealer

 MOUNT A V-BOX SPREADER SLIDE 3.66





Summary and Review

1. Components of V-box spreader
2. The hanging rack and leg stand support methods of storing V-boxes
3. How to remove a dump truck tailgate
4. Mount and secure a slide-in V-box spreader
5. Inspection and maintenance



FIELD Exercise 3.1
Mount a V-Box Spreader



Stored on:

1. Hanging storage rack...

<OR>

2. Leg stand support...



R_{3.6}
[3.45]

MOUNT A V-BOX SPREADER SLIDE 3.58

VIDEO 3.1. TXDOT V-BOX SPREADER (00:53)

SCRIPT

Whether you are distributing sand for traction improvement as shown here, or distributing chemicals such as road salt or Meltdown20, the V-Box spreader features prominently in TxDOT's equipment used to fight ice and snow.

This particular video, showing multiple snowplows and spreaders operating in tandem, was taken in Fort Worth during TxDOT's response to the 2011 Superbowl storm.

Most all TxDOT maintenance sections have V-Box spreaders. Some are used with 10-yard trucks as shown in this video, some are used with 6 yard trucks, and some fit into the back of a pickup.

The V-Box spreaders in this video are distributing Meltdown 20 on an icy section of freeway, in a de-icing application.

The goal is always the same: the spreader distributes snow and ice control material onto the road surface.

VIDEO 3.2. MOUNT A V-BOX SPREADER FROM A LEG STAND SUPPORT (01:45)

SCRIPT

This V-Box is supported by leg stands. Notice the front leg stands which swing, and the rear leg stands, which are fixed into the ground.

Although designs vary in TxDOT, the rear leg stand showing here incorporates a cradle that supports the rear of the V-Box.

This particular setup includes a stand for the tailgate. The tailgate, of course, must be removed from the dump truck before the V-Box can be inserted into the dump bed.

Mounting a V-Box spreader from a leg stand support begins with carefully aligning the dump truck so that you can cleanly back underneath the V-Box.

A spotter is required to guide the truck operator.

Be sure to move any tie-down chains that might snag the dump truck bed during V-Box insertion.

To mount the V-Box, the operator raises the dump bed slightly and slowly backs the dump truck bed under the V-Box. When the front leg supports contact the rear of the truck, these legs swing back.

Guided by the spotter, the operator lowers the truck bed, and this causes a pivot which lifts the rear of the V-Box out of the cradle of the rear leg stands.

Insertion into the dump truck bed then continues until rear mounting pins on the V-Box align with the tailgate latches. The operator clasps the mounting pins with the tailgate latch.

The V-Box is now fully inserted into the dump truck bed.

VIDEO 3.3. SECURE, CONNECT, AND TEST A V-BOX SPREADER (01:30)

SCRIPT

With the V-Box inserted into the dump truck bed, the next step is to secure and connect the V-Box.

Connect the hydraulic lines, as shown here, which operate the conveyor and the spinner. You will also need to connect the lighting harness.

Securing the V-Box involves more than simply closing the tailgate latch. This particular V-Box is being secured with two tie-downs, one on each side, that use chains and ratchet binders. Other tie-down approaches include securement straps and anchor bolts. This will vary among maintenance sections.

The entire process takes a couple of minutes or so.

Once secured and connected, you should test the V-Box. Make sure the conveyor is working properly on its settings. Also, check the spinner.

VIDEO 3.4. MOUNT A V-BOX SPREADER FROM A HANGING STORAGE RACK (02:34)

SCRIPT

Mounting a V-Box spreader from a hanging storage rack begins with carefully orienting and aligning the dump truck so that you can cleanly back underneath the V-Box. Your spotter will help guide you.

Notice that the V-Box fits snugly within the dump bed, with very little extra room on either side.

Once you insert the V-Box into the dump truck bed, you will need to remove the rack support chains. This may require that you get up on top of the V-Box, as shown here. Safety is a key concern; use caution when doing this.

Some maintenance sections have fabricated hanging storage racks that include catwalks, and this does not require their personnel to get on top of the V-Box. Some use ladders for the same reason.

Releasing the V-Box from the storage rack is done in different ways. Here, the truck operator carefully raises the dump bed slightly to create slack in the forward chains, allowing them to be removed. He then lowers the dump bed to create slack in the rear chains, allowing them to be removed. The V-Box is now free from the hanging storage rack.

Other approaches are also used. For example, some maintenance sections use a winch and pulley system to lower the V-Box in the truck bed.

With the V-Box in the truck, it must be secured. Claspings the tailgate latches is not sufficient.

This V-Box uses a steel anchor-bolt type of securement system, one anchor bolt in each corner of the V-Box. Other approaches, such as straps or chains and binders, can also be used.

VIDEO 3.5. DISMOUNT A V-BOX SPREADER TO A LEG STAND SUPPORT (02:00)

SCRIPT

The process of dismounting a V-Box spreader is simply a reversal of the mounting process.

Disconnect the hydraulics and wiring harness.

Carefully orient and align the truck as it is backed into position for V-Box removal. A spotter is required for this.

Remove the securement from the V-Box, in this case, ratchet binders and chains. Place the chains inside the dump bed so they do not snag on the truck as the V-Box is removed. Also, be sure to have the operator unclasp the tailgate latch.

The truck operator will now slightly raise the truck bed. This transfers support of the back part of the V-Box from the truck to the rear leg stand. Recall that the rear legs are permanently fixed into the ground.

With the dump bed in the raised orientation, the operator slowly pulls the truck forward, removing the V-Box and allowing the front legs to swing into place.

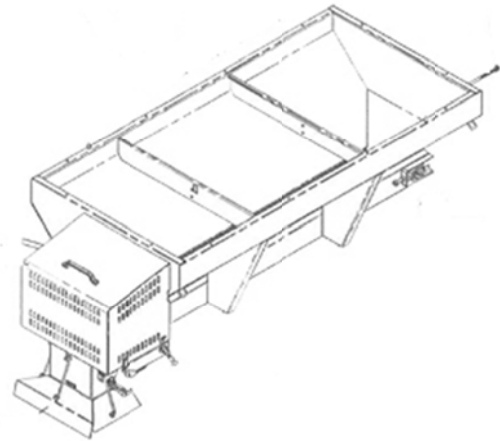
This completes the dismounting operation.

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LEARNING EXERCISE 3.1
Mount a V-Box Spreader
Winter Weather Operations Training

Equipment Needed for this Exercise

1. Slide-in V-box spreader, 6 cubic yard (CY) or 10 CY model
2. Dump truck, 6 CY or 10 CY capacity
3. Forklift, crane, hoist or other approved lifting device for dump truck tailgate removal
4. Anchor bolts, chains, straps, tie-downs or other approved devices to secure the V-box spreader to the dump truck bed
5. Hand tools as needed for bolted connections and tailgate pin removal



V-BOX SPREADER SAFETY

- Read all installation, safety and maintenance instructions completely before operating this equipment.
 - Keep all personnel clear of moving parts while equipment is being operated.
 - While operating this equipment, use common sense, use caution, be alert and be safety-conscious.
-

Learning Objectives

Upon completion of this field exercise, the learner will be able to:

1. Identify major components of the V-box spreader
2. Explain the hanging storage rack method and the leg stand support method of storing a V-box spreader
3. Remove the tailgate from a dump truck to facilitate mounting the V-box
4. Mount and secure a slide-in V-box spreader in a dump truck bed
5. Inspect and maintain critical components on a V-box spreader

Description

The V-box spreader is a slide-in attachment for 6 CY and 10 CY dump bed trucks. Because of unique mounting and operational factors, each V-box spreader is matched to a specific dump truck and may not be used interchangeably with other trucks. Every V-box spreader is clearly marked with the equipment number of its corresponding truck.

TxDOT almost exclusively uses V-box (hopper type) spreaders instead of tailgate spreaders for winter weather maintenance. TxDOT's inventory of V-box spreaders includes several different makes and models that vary in age. Three common manufacturers are Monroe, Flink, and Swenson.

V-box spreaders are used to spread granular snow and ice control chemicals such as road salt and Meltdown 20 for deicing roadways where snow and ice bonds have formed on the pavement surface. The V-box spreader is also used to spread abrasives such as chat, flyash, ice rock, screenings, bottom ash or Grade 5 rock on roadways, bridges and trouble spots to improve traction.

Granular material application rates are controlled by adjusting the gate opening at the rear of the hopper, the conveyor chain (belt) speed and the spinner speed. The spinner speed and flap positions define the pavement area to be covered (one, two or three lanes) by the granular material.

Conveyor and spinner speed may be adjusted by turning the appropriate dial on the control panel. The control panel for the V-box spreader is normally mounted in the cab of the truck. Some older model spreaders have the controls mounted on the truck frame.

Storage for V-Box Spreaders

TxDOT maintenance yards store their V-box spreaders in one of two ways. These are (1) metal storage racks and (2) leg stand supports. A few maintenance sections use metal saw horses.

Metal Storage Racks V-box spreaders have traditionally been stored in TxDOT maintenance section yards on metal-frame storage racks. These storage racks use chains, one at each corner of the hopper, to suspend, or hang, the spreader box. Storage racks are sometimes covered with a roof to protect the spreader boxes from the elements.

Some storage rack designs require maintenance section personnel to climb on top of the spreader/truck bed or to work from a ladder to disconnect or connect the chains when loading or unloading the spreader. Some storage racks have fabricated catwalks with stairs in their rack designs as well as other innovations to facilitate safer access to the spreader boxes during loading and unloading.

Leg Stand Supports Some TxDOT maintenance sections store their V-box spreaders on leg frames or leg stands which typically have been designed and fabricated by local shop or operations personnel. Proprietary leg-stand systems are also available for purchase from some V-box manufacturers. As the name implies, the leg stand system uses legs to support the V-box directly on the ground rather than chains to suspend the V-box in the air.

Some leg stand designs enable the spreader to be mounted in the dump bed using only one man (the dump truck operator). The use of some leg stand designs may also reduce or eliminate the amount of time that a worker has to be on top of the spreader or dump bed, thus minimizing safety risks associated with falls.

The rear leg stands are securely anchored to maximize stability during the loading and unloading operation and while the spreader is being stored. The rear leg stands may be anchored in the ground using drilled shafts filled with concrete or otherwise connected to some type of rigid structure.

The front leg stands are attached to the front of the spreader box frame so that the legs are allowed to rotate during the loading and unloading process. During V-box loading, the front legs will rotate back underneath the V-box as the legs come into contact with the dump truck bed. The legs fold up completely alongside the hopper when the V-box is fully loaded.

During unloading, as the V-box spreader is being returned to storage, the front legs fall or rotate forward to the vertical position as the V-box slides out of the truck bed. In this way, the V-box is stored on two (rear) anchored leg supports and two (front) rotating leg supports.

Removing and Storing the Dump Truck Tailgate

The dump truck tailgate must be removed from the dump bed before the V-box spreader can be mounted in the truck. This requires a temporary storage location for the tailgate while the spreader box is on the truck.

TxDOT maintenance personnel use a variety of methods to remove the tailgate from the truck. Some use a forklift to remove the tailgate from the truck and transport the tailgate to its storage location or rack/fixture. Others prefer to employ a hoist or crane to lift the tailgate off the truck and store it in an adjacent rack or fixture.

For this learning exercise, we will describe the steps involved using both methods of tailgate removal.

Forklift Method

1. Completely raise the dump bed of the dump truck so the tailgate will open. The tailgate will be hanging vertically, connected to two pins at the rear/top of the dump bed.
2. Position the forks of the forklift beneath the bottom edge of the tailgate, as it is hanging vertically.
3. Raise the forks of the forklift to a point where the inside face of the tailgate is fully supported by the forks in a level position while still being connected to the large pins at the top back end of the dump bed. The tailgate will revolve on the pins as the forks are raised as the tailgate moves from a vertical to level position on the forks.
4. Remove the two pins that connect the upper portion of the tailgate to the dump bed.
5. Suspend or store the tailgate in an appropriate storage rack or location.

Some trucks are equipped with a tray, also called a pan or footpiece, at the bottom/rear of the dump bed. This tray serves as an extension to the truck bed and as a transition piece from the dump bed to an asphalt laydown machine or drag box to minimize spillage of material. The tray must be removed from the truck bed before the V-box spreader can be mounted. If so:

6. While supporting the tray with a forklift, remove the three nuts and bolts that fasten the tray to the dump truck bed on each side of the bed/tray.
7. Remove the tray from the bed of the truck and store the tray in an appropriate storage location.

Hoist or Crane Method

1. Position the dump truck in the area where the hoist and storage rack are located.
2. Connect the lifting sling of the hoist or crane to the lift points on the tailgate.
3. Take the slack out of the lifting sling so that the tailgate will be supported by the hoist when the tailgate is disconnected from the dump bed.
4. Disengage the lower tailgate latches using the controls in the truck cab.
5. Remove the two pins that connect the upper portion of the tailgate to the dump bed.
6. Lift the tailgate away from the truck bed, and move the truck away from the tailgate storage location.
7. Use the hoist or crane to position and set the tailgate in the storage location or rack.

8. Disconnect the lifting sling from the tailgate and return the hoist or crane to its ready position.

With the tailgate removed, the V-box spreader can now be mounted in the dump bed.

Mounting a V-box Spreader

Mounting a slide-in V-box spreader in a dump truck bed is typically a two-man operation, consisting of a dump truck operator and a spotter as a minimum. The spotter is responsible to guide the dump truck operator as he backs the truck into position to facilitate safe and efficient spreader installation. This section provides step-by-step instructions for mounting the spreader from either an elevated storage rack or from a leg-stand support system.

Elevated Storage Rack

1. The spotter confirms that the equipment number on the V-box matches the equipment number on the dump truck.
2. The operator backs the dump truck into position near the front of the suspended spreader box.
3. The operator raises the dump truck bed slightly to permit clearance of the front end of the V-box as the operator begins to back under the spreader.
4. The operator continues to back the truck into (toward) the spreader, making sure that the upper edges of the dump truck bed are carefully aligned with the sides of the V-box.

Note that less than three inches of total clearance space exists between the V-box spreader and the sides of the bed when installed.

5. The spotter guides the operator to continue to back the truck into the spreader until the lower back portion of the truck bed contacts (mates with) the latch bars on both sides of the spreader frame. The latch bars should engage the latches on either side of the truck bed that normally receive and lock the tailgate in the closed position.
6. Once the latch bars engage the tailgate latches, the spotter directs the operator to close the air-controlled tailgate latches.
7. The spotter directs the operator to raise the dump truck bed to a point until the weight of the front of the spreader is supported by the truck bed and the two front chains on the elevated rack start to become slack.
8. The two front chains can be removed from the spreader box.
9. The spotter directs the operator to lower the dump bed onto the truck chassis. This fully transfers the weight of the spreader to the truck. At this point, the two chains which formerly supported the rear of the spreader in the storage rack are fully slack, allowing the spotter to disconnect the rear chains from the spreader box.

10. The spotter and operator secure the V-box spreader to the dump truck bed. Dependent on the make and model of the V-box spreader, some units are equipped with anchor bolts for this purpose. Most units use chains and binders or tiedown straps.
11. Once the V-box spreader is fully secured to the dump truck bed, the operator connects the electrical wiring harness from the spreader to the truck (for lighting)
12. The operator connects the hydraulic lines from the spreader to the truck (for hydraulic power to run the conveyor/drag chain and the spinner).

SAFTEY NOTE: Exercise caution when connecting hydraulic lines. Hydraulic lines should be connected either when the truck is not running or when the hydraulic pump that supplies power to the spreader is disengaged.

Leg Stand Support System

1. The spotter confirms that the equipment number on the V-box matches the equipment number on the dump truck.
2. The operator backs the dump truck into position near the front of the spreader box. It is critical that the truck be kept square with the spreader box at all times. The sides of the truck bed should be carefully aligned with the sides of the spreader box to ensure a smooth, bind-free spreader installation.
3. The spotter directs the operator to raise the dump truck bed to a point where the plane of the truck bed will clear the front of the spreader box frame, below the point of rotation of the front folding leg stands, as the driver begins to back under the spreader.
4. The spotter makes sure the tiedowns at the front of the spreader box are positioned such that they will be draped along the outside of the truck bed rails as the truck is backed into the spreader box. This will facilitate a quick connection to the truck bed after the spreader box is loaded.
5. The operator backs the truck into the spreader box so that the lower back portion of the truck bed contacts the upper portion of the front leg supports. The front legs will begin to rotate as the driver continues to back the truck toward the anchored (rear) leg stand set. The front legs will fold completely underneath the spreader box.
6. The spotter directs the operator to continue backing toward the keyways or slots in the rear leg stand set until the welded bracket on the back of the spreader box frame fully engages the keyways in the rear leg stands. At the same time, the horizontal mounting pins at the ends of the welded bracket will engage the tailgate latches on either side of the truck bed. When these two things occur, the rear end of the spreader box is in intimate contact with the back end of the truck bed.

7. The spotter directs the operator to close the air-controlled tailgate latches which lock the rear end of the spreader box to the back of the truck bed.
8. The operator fully lowers the truck bed onto the truck chassis, freeing the back of the spreader box from the anchored rear leg stand set.
9. The spotter directs the operator to pull the truck forward to provide adequate working room between the back of the spreader and the spreader storage area.
10. The spotter and operator secure the front end of the spreader box to the truck bed using the two load tiedowns which are permanently attached to the upper tiedown points at the top/front portion of each side of the spreader box. Tighten as required by load and tiedown regulations.
11. Once the V-box spreader is fully secured to the dump truck bed, the operator connects the electrical wiring harness from the spreader to the truck (for lighting)
12. The operator connects the hydraulic lines from the spreader to the truck (for hydraulic power to run the conveyor/drag chain and the spinner).

SAFETY NOTE: Exercise caution when connecting hydraulic lines. Hydraulic lines should be connected either when the truck is not running or when the hydraulic pump that supplies power to the spreader is disengaged.

Special Equipment Inspection and Maintenance

Snow and ice control operations are very demanding on equipment. Cold weather, a corrosive environment, impact loadings, over-loadings, and increased potential for collision with other vehicles or roadside features are some of the factors that increase equipment stress. As a result, particular attention has to be given to maintaining and repairing mobile snow and ice control equipment such as the V-box spreader.

The routine maintenance schedule recommended by the equipment manufacturer should be regarded as the absolute minimum requirement for mobile snow and ice control equipment. More frequent lubrication and inspection schedules usually result in greater up time. Strategic pre-operational and post-operational inspections should be conducted for each shift to help identify small problems, that if not corrected, can result in major or expensive repairs.

The following equipment inspections and maintenance activities on the V-box spreader will maximize equipment performance and minimize down time.

Pre-Storm Activities

Before a storm strikes, be sure to:

- Perform a V-box Spreader Inspection Checklist

- Check spinner assembly (hinge rod and disk) for excessive wear, proper lubrication and proper operation
- Check conveyor chain (drag chain) for excessive wear, proper lubrication and proper operation
- Check all hydraulics (pumps, hoses and connections) for proper operation and leaks
- Check PTO and drive assembly

During the Storm Activities

While using the equipment during the storm:

- Check for accurate dispersal of materials
- Perform a visual inspection of the equipment during operation to check for any problems (lights, leaks, etc.)
- Check drag chain (conveyor) oiler for proper fluid level

Post-Storm Activities

Once the storm is over, be sure to:

- Remove remaining snow and ice control material from spreader box
- Carefully, completely, and thoroughly clean and wash the V-box spreader
- Check for leaks and wear on hoses (hydraulic system)
- Make sure all lights are operational on the spreader
- Check the conveyor system (belt and chain)

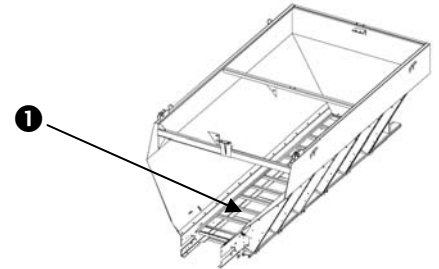
When storing the V-box after the winter season, it is recommended to thoroughly oil the conveyor chain system and to apply an anti-corrosion protective sealer to all parts of the spreader box.

Class Exercise – Review Questions
Module 3 – MOUNT A V-BOX SPREADER

MNT812 Winter Weather Operations Training

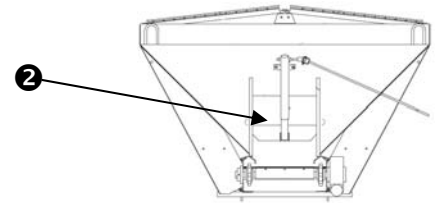
1. Identify component ❶ in V-box spreader drawing to right.

- A. Tie-down clips
- B. Spinner chute and assembly
- C. Conveyor
- D. V-box hopper



2. Identify component ❷ in V-box spreader drawing to right.

- A. Slider plate
- B. Spinner baffle
- C. Rear door (feedgate)
- D. Top grate



3. [True or False] The hanging storage rack method for storing V-box spreaders may require maintenance personnel to get on top of the V-box during mounting and dismounting.

- A. True
- B. False

4. [True or False] Dump bed tailgate removal can be accomplished by forklift or by hoist/crane.

- A. True
- B. False

5. [True or False] So long as the capacities are the same, any V-box can be mounted in any dump truck.

- A. True
- B. False

6. [True or False] Securing the V-box spreader to the dump truck bed is complete when the mounting pins engage the tailgate latch.

- A. True
- B. False

7. [True or False] Proper cleaning of the V-box spreader after using road salt or Meltdown 20 requires that the V-box be removed from the dump truck bed.

- A. True
- B. False

MODULE 4

Mount a Reversible Snow Plow



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012

Learning Objectives

Upon completion of this section, the learner will be able to:

1. Identify major components of the reversible snow plow
2. Mount a reversible snow plow on a dump truck



Learning Objectives, cont'd

3. Secure, connect, and test the snow plow to confirm proper mounting
4. Change the blade on a snow plow
5. Inspect and maintain critical components on a snow plow



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.3



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.4



VIDEO 4.1 (01:00) TxDOT Snow Plow Operation



CREDIT

Fort Worth District
Texas Department of
Transportation



R_{4.1}
[4.43]



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.7

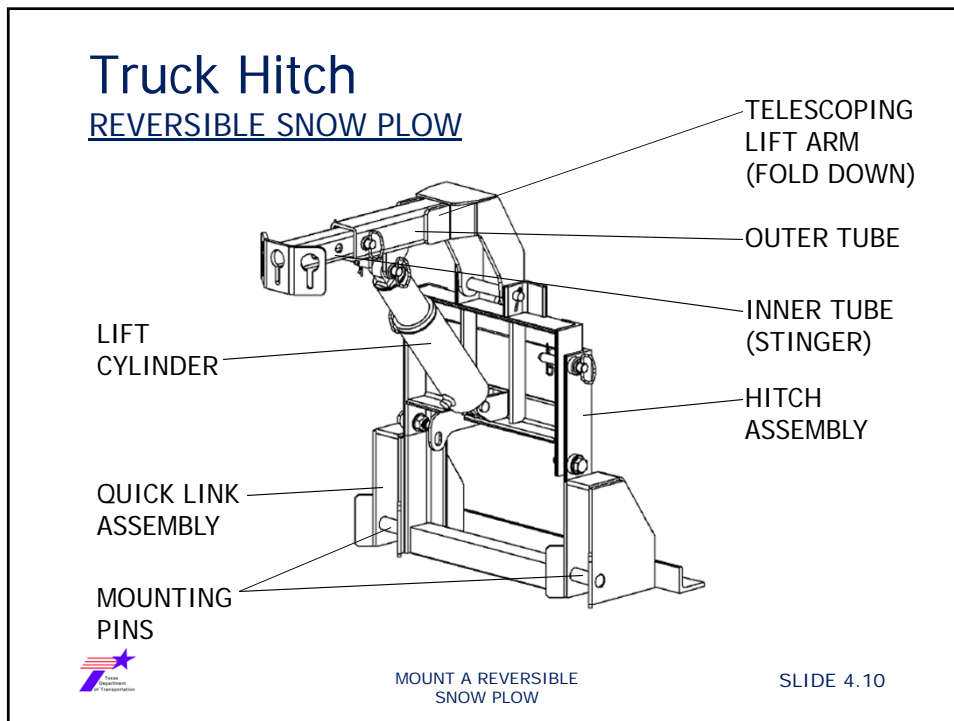
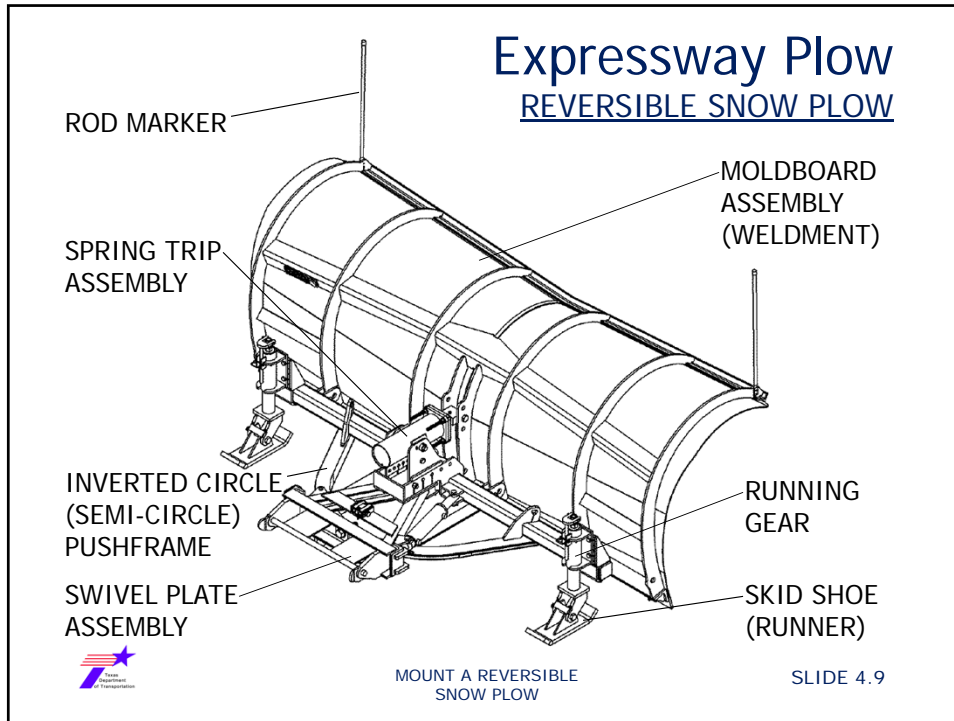
Major Components REVERSIBLE SNOW PLOW

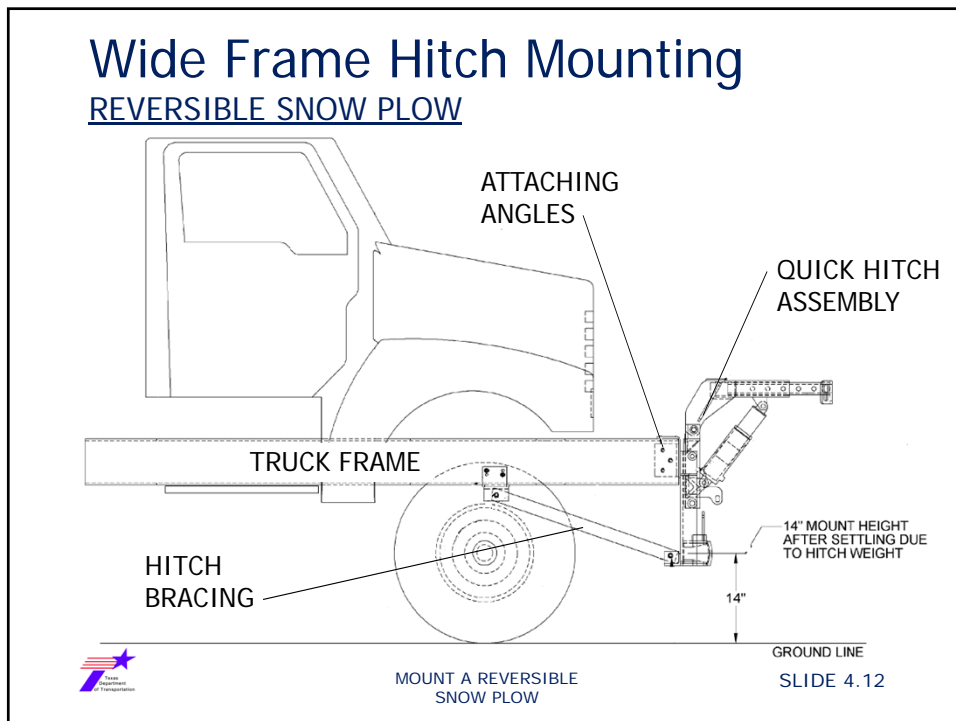
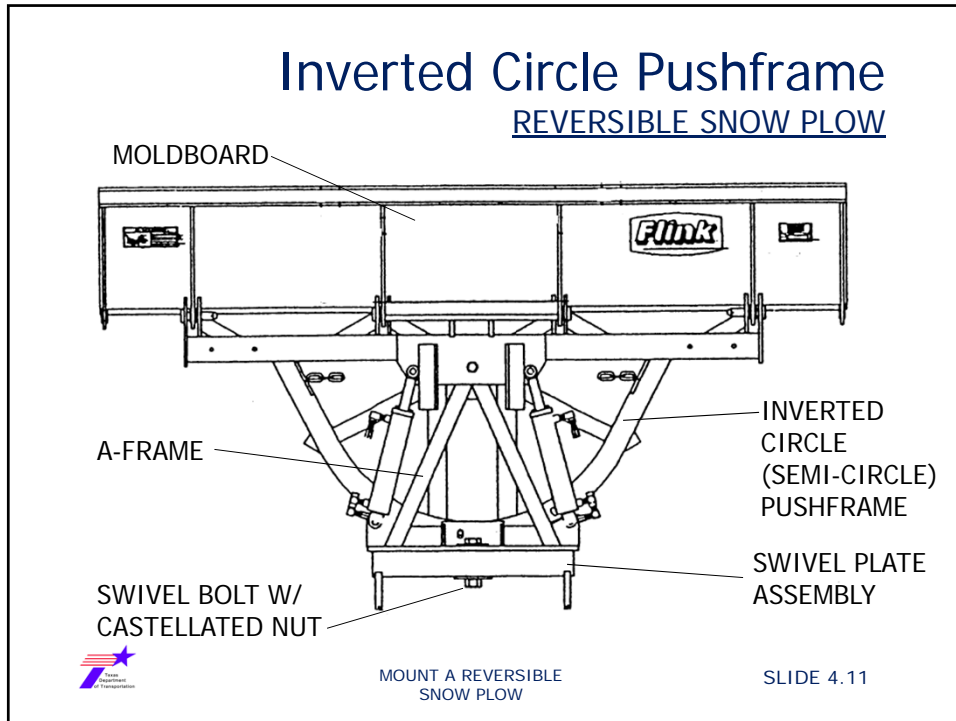
- Moldboard Assembly
 - Moldboard
 - Cutting Edge (Blade)
- Truck Hitch
 - Hitch Assembly
 - Telescoping Lift Arm
 - Mounting Pins
- Inverted Circle Pushframe
 - Swivel Plate
 - Swivel Bolt & Castellated Nut
 - A-Frame
- Compression Spring Trip Assembly

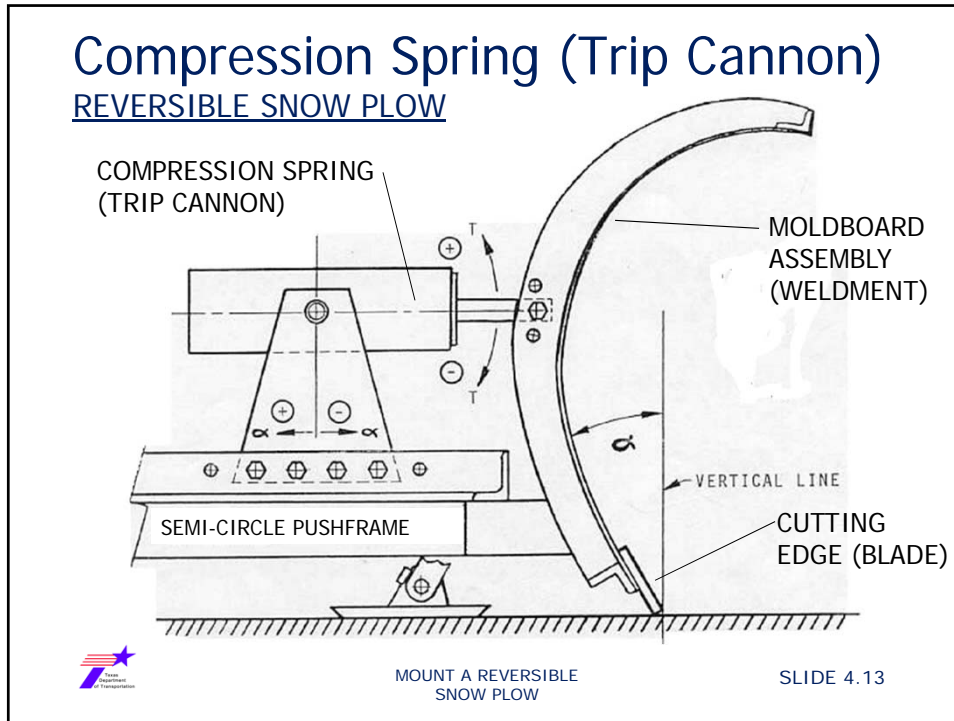


MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.8







SNOW PLOW SAFETY

<p>WARNING</p> <p>Failure to comply could result in death or serious injury.</p> <p>Operator must be trained and must read and understand operator and safety manuals.</p> <p>PELIGRO</p> <p>Si no lee inglés, pida ayuda a alguien que se lo lea para que le traduzca las medidas de seguridad.</p> <p style="text-align: right; font-size: small;">72310207</p>	<p>IMPORTANT</p> <p>Raise Plow before backing up to prevent equipment damage.</p> <p style="text-align: right; font-size: small;">72310202</p>
<p>WARNING</p> <p>MOVING PARTS could crush or cut.</p> <p>STOP ENGINE and REMOVE KEY before performing maintenance.</p> <p style="text-align: right; font-size: small;">72310202</p>	<p>IMPORTANT</p> <p>Keep Push-Frame parallel to ground while plowing.</p> <p style="text-align: right; font-size: small;">72310202</p>
<p>WARNING</p> <p>FALLING BODY could crush.</p> <p>SECURE BODY with Blocks before going under elevated body.</p> <p style="text-align: right; font-size: small;">72310202</p>	<p>IMPORTANT</p> <p>Use genuine Henke replacement parts.</p> <p style="text-align: right; font-size: small;">72310202</p>


MOUNT A REVERSIBLE SNOW PLOW

SLIDE 4.14



SAFETY DECAL SIGNAL WORDS

⚠ DANGER	DANGER (<i>Red</i>) indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	WARNING (<i>Orange</i>) indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	CAUTION (<i>Yellow</i>) indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
CAUTION	CAUTION (<i>Yellow</i>) used without the safety risk alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.



MOUNT A REVERSIBLE SNOW PLOW

SLIDE 4.16

VIDEO 4.2 (01:09) Reversible Snow Plow



CREDIT

“Winter Operations Training Series”

Iowa Department of Transportation

Used with permission.



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.17

Different Types of Plows REVERSIBLE SNOW PLOW

- Henke
- Flink
- Henderson
- Monroe
- Valk



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.18







The Mounting Process

MOUNT A REVERSIBLE SNOW PLOW

1. Identify the type of hitch
2. Mount the reversible snow plow
3. Connect and test the snow plow



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.25



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.26



Two-Man Operation

MOUNT A REVERSIBLE SNOW PLOW

- Mounting a snow plow is a two-man operation.
- One man must operate the truck while the other acts as a spotter to direct and guide the operator through the use of hand signals.



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.29



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.30



VIDEO 4.3 (04:45) Mount and Inspect a Reversible Snow Plow

CREDIT

"Winter Operations Training Series"

Iowa Department of
Transportation

Used with permission.



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.32

Proper Mounting Height MOUNT A REVERSIBLE SNOW PLOW

- The snow plow frame should be blocked up or jacked up at the correct height to facilitate a smooth (bind free) connection with the latching mechanism on the truck hitch.



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.33



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.34

Approach Square to Frame

MOUNT A REVERSIBLE SNOW PLOW

- Spotter directs the truck operator in such a manner so that the snow plow frame is square to the truck mounting frame, and is aligned with the latching mechanism on the truck hitch.



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.35



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.36

Engage Latch, Lock in Place

MOUNT A REVERSIBLE SNOW PLOW

- As soon as the plow frame's mating rod has fully engaged the latches on the truck hitch, the locking lever on the truck hitch should automatically lock the snow plow to the truck hitch.



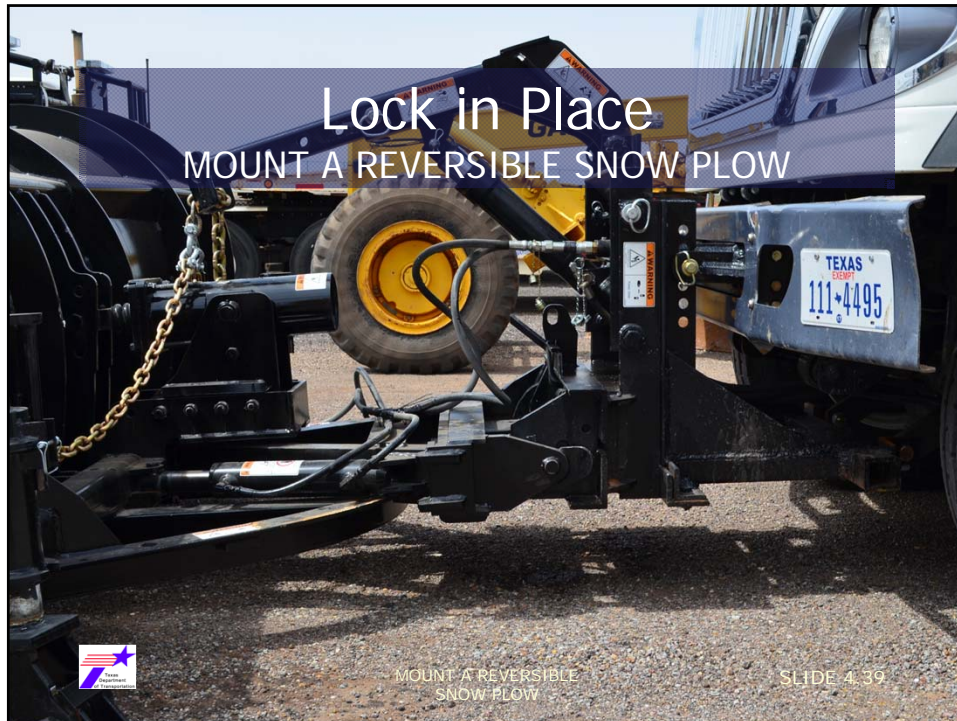
MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.37



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.38



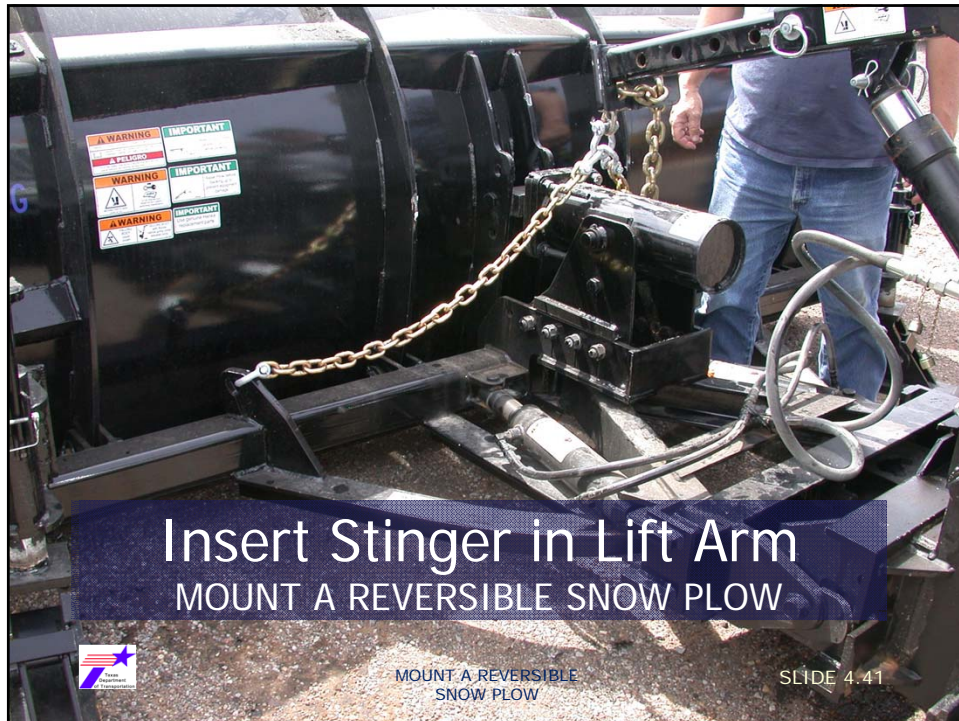
Insert Stinger in Lift Arm MOUNT A REVERSIBLE SNOW PLOW

- Insert the stinger into the outer tube of the telescoping lift arm above the hydraulic lift cylinder.
- Align so that the stinger head is located directly above the adjustment chain lift points. Secure the stinger in position.



MOUNT A REVERSIBLE
SNOW PLOW

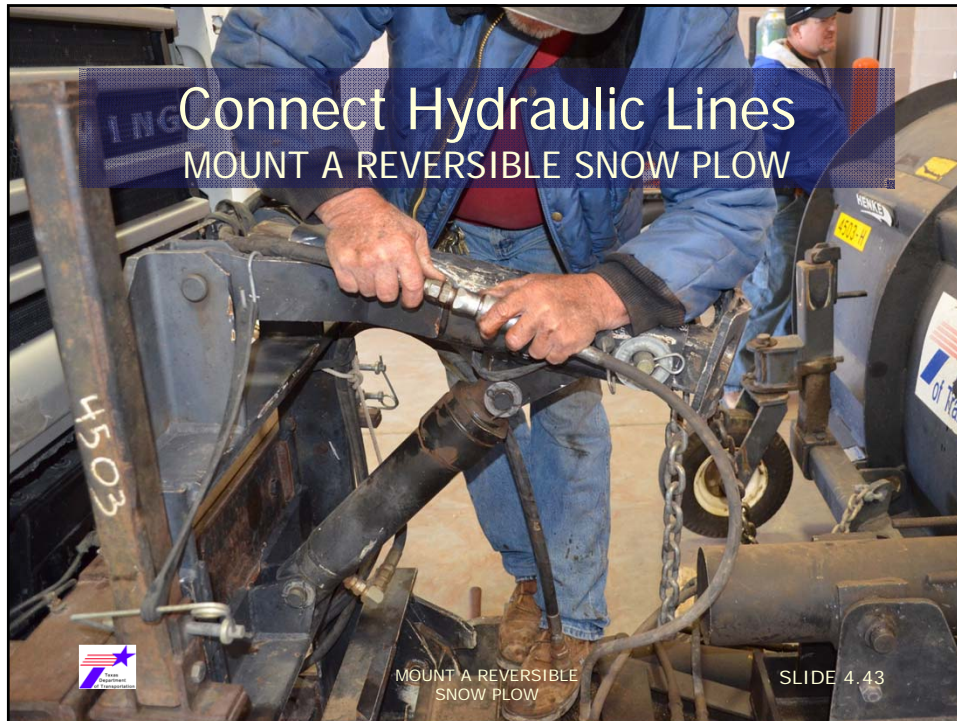
SLIDE 4.40



Connect Hydraulic Lines MOUNT A REVERSIBLE SNOW PLOW

- Connect the hydraulic lines from the snow plow to the truck
- The connection may encounter residual, or trapped, static pressure due to thermal expansion or other reasons





Connect Under Residual Pressure

MOUNT A REVERSIBLE SNOW PLOW

- Trapped static pressure in hydraulic lines makes it virtually impossible to achieve connection
- Two options to relieve pressure off the hose:
 1. Manipulate hydraulic controls in an alternating pattern when connecting hoses: push left plow button and hook up the right hose; then push the right plow button and hook up the left hose. Same thing when disconnecting
 2. Consider installing a "Connect Under Pressure Coupling" such as from the Parker Hannifin 9200 Series... select coupling based on system specs



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.44

Check the Push Frame

MOUNT A REVERSIBLE SNOW PLOW

- Make sure the plow is mounted so that the push frame is horizontal and in line with the truck frame



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.45



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.46

Proper Alignment of Lift Arm MOUNT A REVERSIBLE SNOW PLOW

- The stinger should be horizontal and extended forward so that the adjustment chains to the plow hang vertically



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.47



Running Gear (Skid) Adjustment

MOUNT A REVERSIBLE SNOW PLOW

- Running gear comes in various types
- Can help extend the life of the blade by handling some of the weight of the plow
- Reduces how quickly the edge wears down
- Use when plowing snow on gravel, dirt, or uneven terrain to run the cutting edge just off the ground

MOUNT A REVERSIBLE
SNOW PLOW**R**_{4.4}
[4.47]

SLIDE 4.49

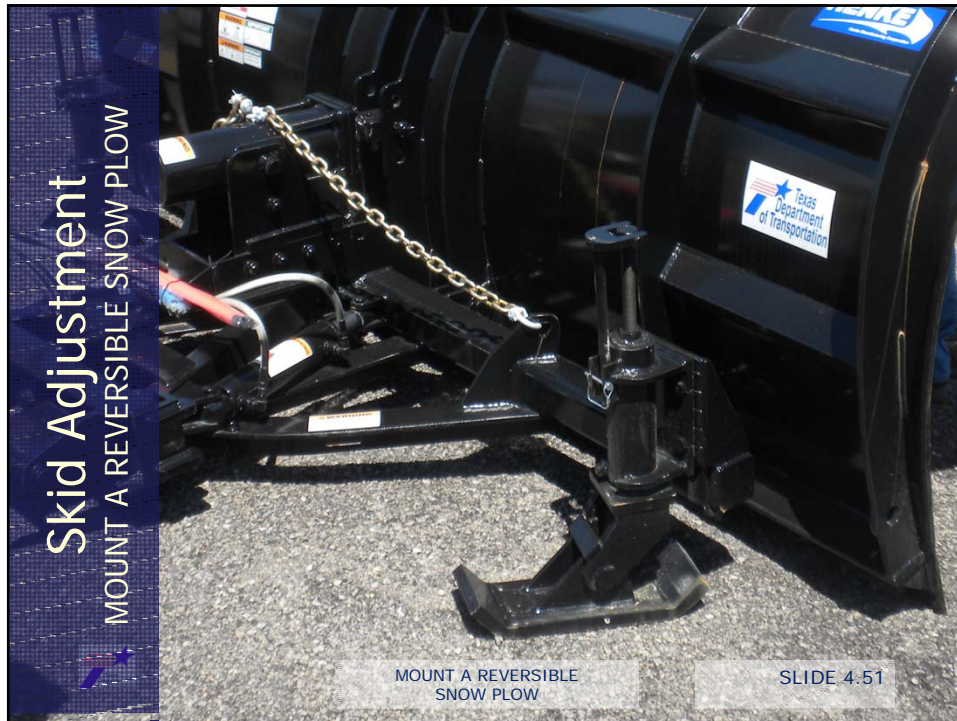
Running Gear (Skid) Adjustment

MOUNT A REVERSIBLE SNOW PLOW

- Running gear is not strictly necessary when plowing on improved pavement surfaces including concrete, asphalt, and seal coats
- Plow manufacturers report that most agencies which plow only on improved surfaces do not purchase running gear
- Some TxDOT Districts remove the running gear

MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.50



Check Snow Plow Controls

MOUNT A REVERSIBLE SNOW PLOW

- Check the snow plow controls to ensure they are working:
 - Plow up and down
 - Plow casting snow right or left





Check Snow Plow Lights

MOUNT A REVERSIBLE SNOW PLOW

- Check to make sure the lights are working properly.


 MOUNT A REVERSIBLE SNOW PLOW SLIDE 4.54



Orientation of Cutting Edge

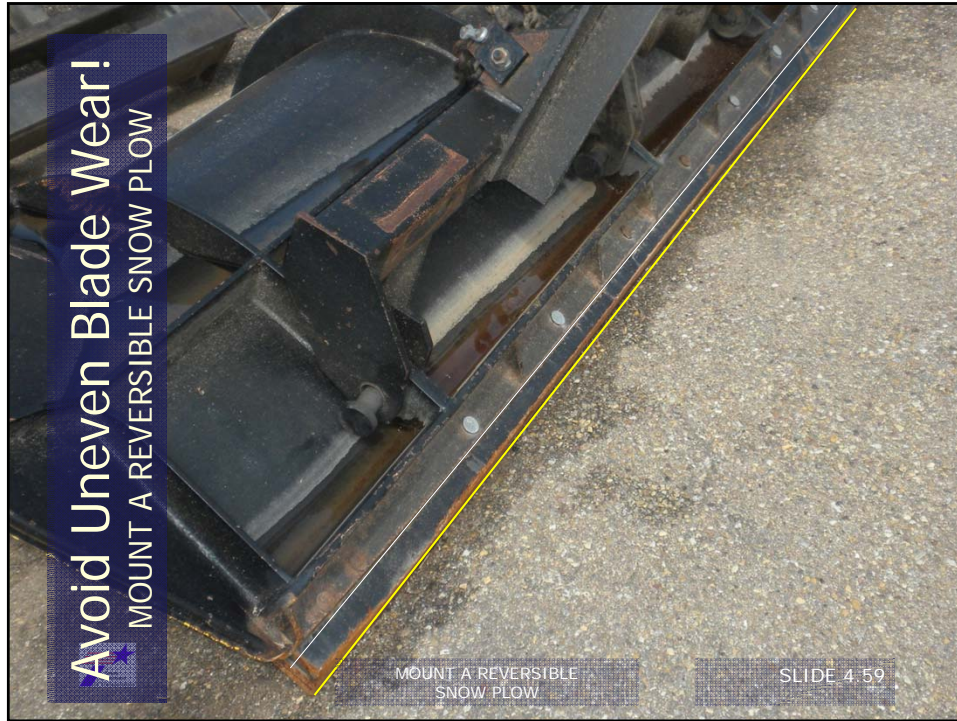
MOUNT A REVERSIBLE SNOW PLOW

- Chains should be adjusted as necessary
- The snow plow blade should be oriented so that it is parallel to the pavement surface that will be plowed

 MOUNT A REVERSIBLE SNOW PLOW SLIDE 4.56

A dark blue rectangular box containing white text. At the top, it says 'Orientation of Cutting Edge' in a large font, followed by 'MOUNT A REVERSIBLE SNOW PLOW' in a smaller font. Below this is a bulleted list with two items: 'Chains should be adjusted as necessary' and 'The snow plow blade should be oriented so that it is parallel to the pavement surface that will be plowed'. In the bottom left corner, there is a small Texas Department of Transportation logo. In the bottom right corner, the text 'MOUNT A REVERSIBLE SNOW PLOW' and 'SLIDE 4.56' is visible.





FIELD Exercise 4.1 Mount a Reversible Snow Plow



1. Truck Hitch
 - ...Quick Hitch
 - ...Fixed Pin
2. Mount Plow
3. Connect, Test



MOUNT A REVERSIBLE
SNOW PLOW

R_{4.5}
[4.49]

SLIDE 4.60



Change Snow Plow Blade

MOUNT A REVERSIBLE SNOW PLOW

- Use safety jacks to block plow blade above ground
- Remove existing fasteners
- Remove old blade(s)
- Position new blade(s)
- Install new fasteners and secure



VIDEO 4.4 (05:42) Change a Snow Plow Blade



CREDIT

Amarillo District

Texas Department of
Transportation



R_{4.6}
[4.57]



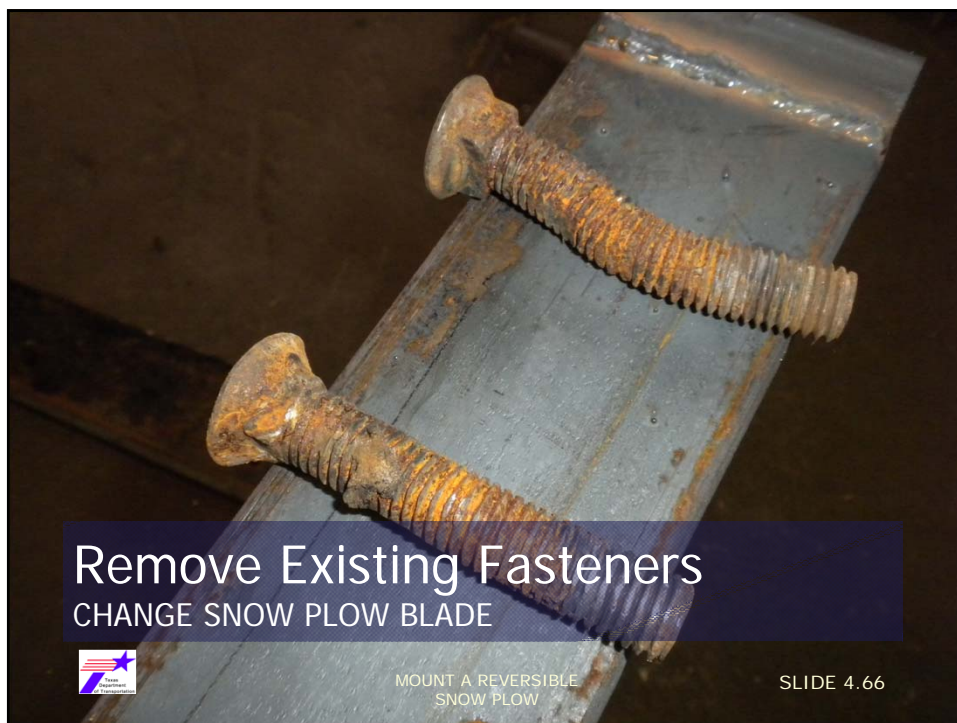
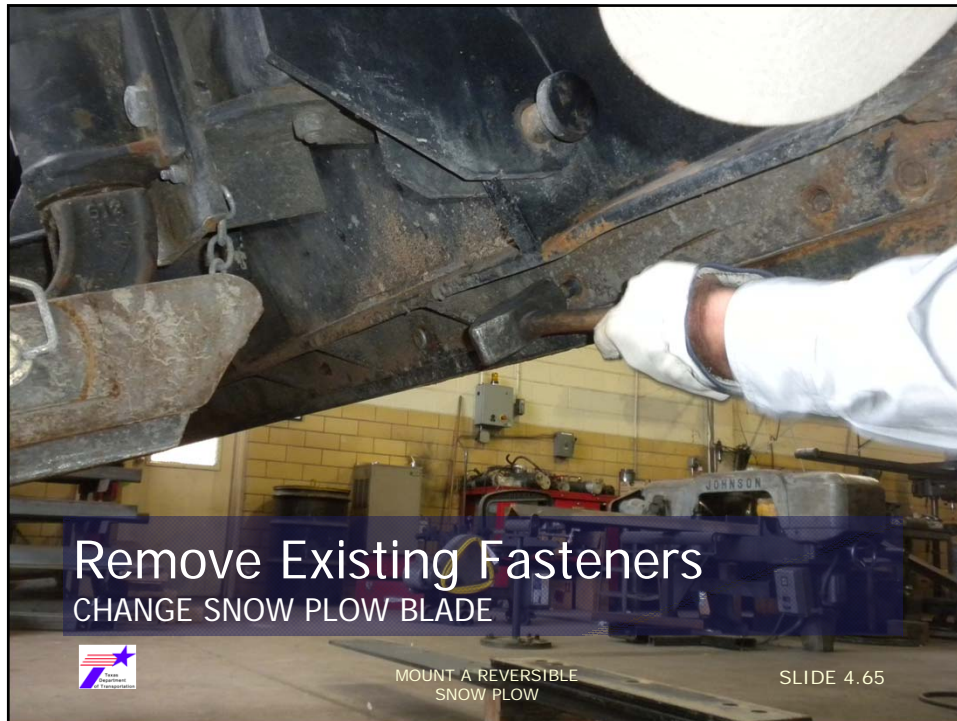
MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.63



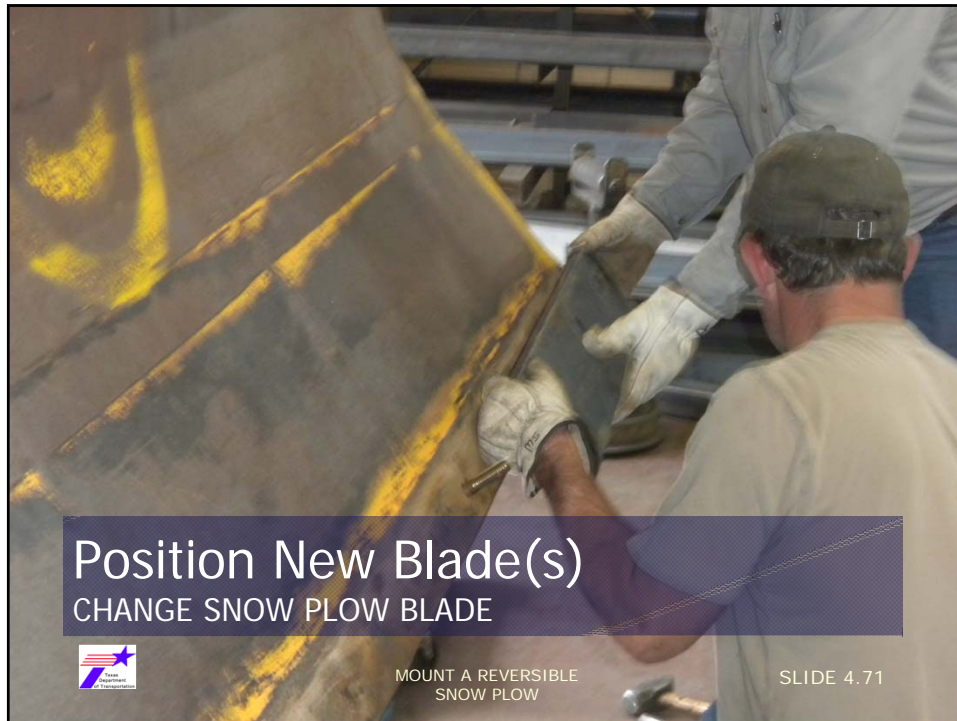
MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.64











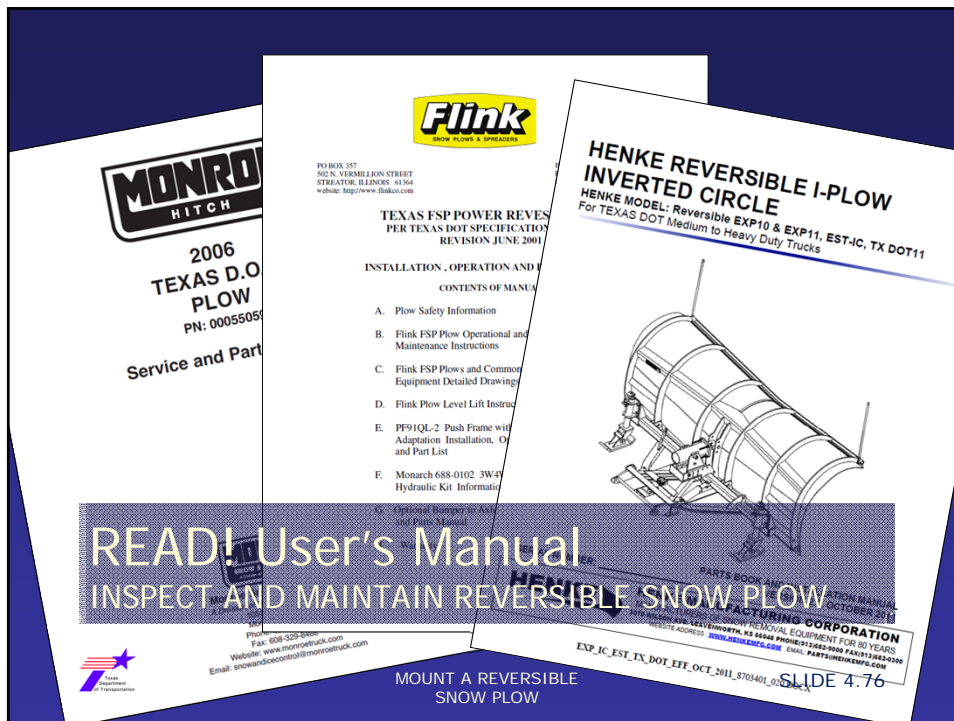
Off-Season Maintenance MOUNT A REVERSIBLE SNOW PLOW

- Follow User's Manual
- Thoroughly clean
- Repaint as necessary
- Inspect and replace worn parts
- Coat exposed cylinder rods
- More... see User's Manual



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.75



MONROE HITCH
2006 TEXAS D.O. PLOW
PN: 0005505
Service and Part

Flink
SNOW PLOWS & SPREADERS
PO BOX 357
502 N. VERMILION STREET
STRAUERS, ILLINOIS 61364
website: <http://www.flinkco.com>

TEXAS FSP POWER REVES
PER TEXAS DOT SPECIFICATION
REVISION JUNE 2001

INSTALLATION, OPERATION AND
CONTENTS OF MANUAL

- Plow Safety Information
- Flink FSP Plow Operational and Maintenance Instructions
- Flink FSP Plows and Common Equipment Detailed Drawings
- Flink Plow Level Lift Instrus
- PP91QL-2 Push Frame with Adaptation, Installation, Operation and Part List
- Mosarch 688-0102 3W-1 Hydraulic Kit Information
- Optional Bumpers and Pumps

**HENKE REVERSIBLE I-PLOW
INVERTED CIRCLE**
HENKE MODEL: Reversible EXP10 & EXP11, EST-IC, TX DOT11
For TEXAS DOT Medium to Heavy Duty Trucks

**READ! User's Manual
INSPECT AND MAINTAIN REVERSIBLE SNOW PLOW**

HENKE MANUFACTURING CORPORATION
PARTS BOOK AND OPERATION MANUAL
OCTOBER 2011

EXP_IC_EST_TX_DOT_EFF_OCT_2011_8703401_01

MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.76

In-Season Maintenance

MOUNT A REVERSIBLE SNOW PLOW

- Pre-Trip Inspection Checklist daily
- Grease all fittings
- Check the compression spring assembly (trip cannon)
- Check swivel assembly for excessive slack
- Wash/rinse after each use



MOUNT A REVERSIBLE
SNOW PLOW

SLIDE 4.77



TxDOT District

Snowplow Daily Inspection Checklist

Date: _____ Annual Service due: _____

Equipment Number: _____

Section: _____

	Su	M	T	W	Th	F	Sa
System							
MOLDBOARD/ CUTTING EDGE							
TRIP SPRING							
HITCH/PUSH FRAME							
LIFT CHAINS							
SKIDS/WHEELS							
GENERAL CONDITION							

Pre-Trip Checklist... see Module 5
INSPECT AND MAINTAIN REVERSIBLE SNOW PLOW

✓ = Condition is safe for operation
*Weekly inspection items (complete at least once per week)
X = Discrepancy repaired
____ = Inspected
____ = Not inspected

MOUNT A REVERSIBLE SNOW PLOW

SLIDE 4.78



Summary and Review

1. Components of reversible snow plow
2. Mount a reversible snow plow
3. Secure, connect and test snow plow
3. How to change a snow plow blade
4. Inspection and maintenance



FIELD Exercise 4.1
Mount a Reversible Snow Plow

1. Truck Hitch
 - ...Quick Hitch
 - ...Fixed Pin
2. Mount Plow
3. Connect, Test

R_{4.5}
[4.51]

MOUNT A REVERSIBLE SNOW
PLOW

VIDEO 4.1. TXDOT SNOW PLOW OPERATION (01:00)

SCRIPT

TxDOT uses snow plows to remove snow from the roadway surface.

Because our climate is such is that snow most frequently occurs in the Texas panhandle, that is where most of the snow plowing happens at TxDOT, but on occasion, snow falls in other districts.

This particular video, showing multiple snowplows operating in tandem, was taken on a stretch of freeway in Fort Worth.

Winter weather is no respecter of schedule. TxDOT snow plow operations sometimes require night shifts.

This snow plow operation is clearing part of a divided highway, plowing snow into the median.

The goal is to clear the road and keep traffic moving.

VIDEO 4.2. REVERSIBLE SNOW PLOW (01:09)

SCRIPT

The most universally used piece of snow removal equipment is the reversible plow, which can be mounted on a wide range of trucks as well as motor graders.

As its name implies, the reversible plow is fully adjustable so that it can move snow to the left or right as well as straight ahead.

In cab adjustments on the reversible plow include raising and lowering the plow and turning the plow to the left and to the right.

The location and appearance of the controls in the truck you operate may be different from these but the basic functions will be the same, raising and lowering, turning left and right.

All reversible plows are equipped with a trip mechanism which allows the plow to tip forward to reduce damage to the plow and truck if an immovable object is hit. The trip is reset by putting the plow on the ground and backing up the truck.

VIDEO 4.3. MOUNT AND INSPECT A REVERSIBLE SNOW PLOW (04:45)

SCRIPT

We'll start by mounting the reversible plow, the most commonly used plow.

When mounting the reversible plow, it is preferable that there be two people present; one person to drive the truck and the second person to guide the truck driver into position.

Each plow is fitted for a specific truck. Many shops stencil the truck number on the plow so you can quickly identify the correct plow for your truck.

When mounting a reversible plow, first raise the plow with a chain hoist. Some shops use floor jacks; others have jacks permanently attached to raise the plow.

Even with the plow raised to the proper height, a pinch bar is helpful in moving the plow slightly to line up mounting holes so plow pins can be inserted.

Make sure you also insert the safety or retainer clips at the end of each pin.

Next, hook the cable pulley to the lift cylinder and insert the life pin and safety clip.

Finally, you are ready to hook up the hydraulics. But before you do, make sure to shut off the truck engine.

Hydraulic power comes from oil forced through the lines at tremendous pressure. To hookup the hydraulics, simply switch the female coupling from the truck to the plow and the plow coupling to the truck.

With the plow mounted and resting on the ground, you are now ready to begin your pre-season check.

Remember to never move in or around a plow when it is raised. If the hydraulics fail, a raised plow would drop and you could be seriously hurt.

Take a close look at the plow life. Make sure that there is enough slack in the lift cable or chain so the blade completely touches the garage floor and will be able to come into contact with the roadway.

Inspect the life cable or chain. Look for cuts or frays in the cable, or for badly worn or broken links in the chain.

Look over the entire plow for any cracks or broken welds. If you find any, point them out to your shop mechanic.

Both the lift and reverse cylinders should also be checked to see that they are operating correctly and all hydraulic fittings are tight and free from leaking.

Check the condition of the hydraulic hoses too. Look for cuts or serious abrasions that may weaken the hose and lead to leaks.

Again, never check the hydraulic hoses when the truck engine is running. If there is a small hole in the line and the engine is running, the stream of fluids can shoot so hard it can slice your skin like a knife.

Next, check for proper plow trip adjustment. A faulty or improperly adjusted trip can cause a lot of damage to the plow and truck if an immovable object is hit.

Check the plow blade to make sure it is not cracked or excessively worn. Some plow blades have a carbide insert in the bottom to help resist wear. If the carbide insert is visible, the carbide is still doing its job to slow the wear on the blade.

If the carbide is merely worn through, either replace the blade, or be aware that the blade will wear much more quickly without the carbide.

The blade should be replaced when there is approximately two inches remaining between the bottom of the moldboard and the bottom of the blade.

Never wear the blade down to the point that the moldboard is on the roadway surface. This could result in an expensive moldboard repair or replacement.

Also, make certain the plow blade is tightly attached by checking the tightness of all nuts.

Also, replace any missing or broken bolts. When replacing bolts, always make sure the bolt is fully seated so the nut remains tight.

Grease all Zerks. Make sure reflectors are in place and in good condition on each end of the plow; amber reflectors on front; red reflectors on the back.

At the same time you are checking reflectors, make sure there is a red-orange flag in good condition and properly mounted at each end of the plow.

If the plow has a plow shield, check to see that it is securely mounted.

Finally, check the plow controls to make sure that they are all functioning properly. Raise the plow to its full height. It should be high enough to clean obstacles you may encounter. The plow lift height can be adjusted by lengthening or shortening the lift cable or chain.

RUNNING GEAR FACT SHEET (HENKE SNOW PLOWS)



Office: (913) 682-9000
Toll: (888) 682-9010
Fax: (913) 682-0300

Parts Department

Runner Applications w/ Max Speed

Running gear is designed for recommended maximum plowing speeds. It is the conditions of operation that are important, a.k.a. 'application'. Follow these guidelines for proper service life:

Hitop Skid Shoe

- ✓ Max 25- 30 mph on gravel/dirt roads
- ✓ Can be used on concrete/asphalt, if cutting edge is bearing 50% of plow weight



Steel Wheels

- ✓ Max 25 mph on hard, smooth road surface



Pneumatics

- ✓ Max 25-30 mph
- ✓ Acceptable on all surfaces, except for soft (dirt) roads



Mushroom Shoes

- ✓ Max 25-30 mph on most smooth road surfaces, when the cutting edge is bearing 50% of plow weight
- ✓ Commonly recommended by Sales reps for rough roads w/ rocky surface, cattle grates, bad or no shoulder etc.

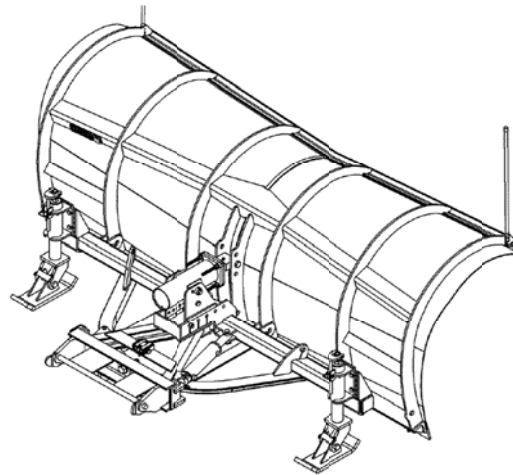


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LEARNING EXERCISE 4.1
Mount a Reversible Snow Plow
Winter Weather Operations Training

Equipment Needed for this Exercise

1. Dump truck (6 CY or 10 CY capacity)
fitted with snow plow mounting frame
2. Reversible snow plow
3. Floor jack, trailer jack, jack stands,
pinch bar and wooden blocking, as
required to properly position the
snow plow for connection to the
mounting frame
4. Hand tools as needed to make
connections and adjustments



SNOW PLOW SAFETY

- Read all installation, safety and maintenance instructions completely before operating this equipment.
- Keep all personnel clear of moving parts while equipment is being operated.
- While operating this equipment, use common sense, use caution, be alert and be safety-conscious.

Learning Objectives

Upon completion of this field exercise, the learner will be able to:

1. Identify snow plow components
2. Mount a reversible snow plow on a dump truck
3. Inspect and maintain critical components on a snow plow
4. Change the blade on a snow plow

Description

A snow plow is an attachment for a 6 CY or 10 CY dump truck. Snow plows are used to mechanically remove snow and slush that have accumulated on the roadway. Snow plows are often used in conjunction with a chemical-based deicing strategy which breaks the bond between snow/ice and the road surface, allowing more efficient removal by plowing. Proper equipment, used effectively, can reduce the need for snow and ice control chemicals.

TxDOT almost exclusively uses the reversible snow plow for snow removal operations. Reversible snow plows are so called because the plow has the capability to orient the moldboard to cast snow either to the right (which is typical) or to the left while plowing.

Plow widths typically vary from 10 to 12 feet. In-cab toggle switches control the up and down movements of the reversible plow and facilitate casting of snow and ice to the right or to the left of the truck.

TxDOT uses several different makes and models of truck-mounted snow plows that vary in age. The mounting procedure for each snow plow is basically the same, with a few minor differences.

Each snow plow assembly includes a mounting frame, also termed a “truck hitch,” that stays with and is fixed to the truck. The snow plow connects to this mounting frame. Because of the mounting process, each snow plow is mated or matched with a specific truck mounting frame and may not be used interchangeably with other trucks. Each snow plow and truck are clearly marked with the truck’s equipment number which consists of a four-digit number followed by a dash and one capital letter (4503-H for example). As a piece of major equipment, the snow plow also carries its own equipment number.

A snow plow may be stored inside the maintenance section garage bay so it can be mounted, adjusted and serviced in a climate-controlled environment. Some maintenance sections store their plows outside.

Mounting a Reversible Snow Plow

Mounting a snow plow is a two-man operation. One man must operate the truck while the other acts as a spotter to direct and guide the operator through the process using hand signals.

For the purposes of this training, we will be mounting a Henke reversible snow plow on a truck fitted with a Henke quick link truck hitch. Henke plows feature an enclosed trip spring and 1” x 6” runners. This type and brand of snow plow appears to be the most common plow being currently used and purchased by the snow and ice districts in Texas.

1. Locate the appropriate snow plow for the dump truck by verifying that the equipment numbers match.
2. Ensure that the snow plow frame is blocked up or jacked up to the correct height to facilitate a smooth (bind free) connection with the latching mechanism on the truck hitch.

Note that in some maintenance sections, the snow plow frame is stored at the correct height for the truck during the snow plow removal process. Alternatively, operations personnel sometimes permanently install a trailer jack on the snow plow frame to allow easy adjustment of the snow plow frame height.

3. The spotter directs the operator to move the truck forward toward the snow plow. The mating rod of the snow plow frame is designed to engage the two latches on the quick link truck hitch.
4. The spotter directs the operator to approach the plow so that the snow plow frame is square to the truck mounting frame and is aligned with the latching mechanism on the truck hitch.
5. As soon as the plow frame mating rod has fully engaged the latches on the truck hitch, the locking lever on the truck hitch should automatically lock the snow plow to the truck hitch.

Note that if the locking lever has not moved into its locked position, the snow plow is not fully attached to the truck hitch.

6. The spotter inserts the stinger, which is normally stored with the snow plow when it is not attached to the truck, into the large square tube above the hydraulic lift cylinder on the truck hitch. The stinger must align with the proper hole set to lock the stinger in position.

Note that the hole position for the snow plow stinger should always be the same for the corresponding truck hitch/snow plow combination.

7. The spotter inserts the large pin through the appropriate hole set in the stinger and large square tube, and secures the pin at its end with an R-clip.

Note that the hydraulic lift cylinder that controls the up and down movement of the snow plow is now linked to the snow plow through the stinger. The attached chain loops through the stinger to a connection on each side of the snow plow frame.

8. The operator connects the hydraulic lines from the snow plow to the truck.

SAFTEY NOTE: Exercise caution when connecting hydraulic lines. Hydraulic lines should be connected either when the truck is not running or when the hydraulic pump that supplies power to the spreader is disengaged.

9. As applicable, the operator connects the electrical cable from the snow plow to the truck for any lights that may be part of the snow plow.

Note that it is common for snow plow lights to be permanently attached to the truck and powered directly from the truck's electrical system. In this situation, no electrical connection to the snow plow is required.

Checking and Adjusting the Snow Plow

Once the snow plow is mounted, various checks should be made to ensure proper plow alignment and function.

1. Check the push frame. The plow should be mounted such that the push frame is horizontal and in line with the truck frame. If the push frame is not horizontal, a shop adjustment to the mounting hitch will be necessary.
2. Check the stinger. The stinger should be horizontal and extended forward so that the adjustment chains to the plow hang vertically.
3. Check the snow plow controls to ensure that they are working properly:
 - Plow up and down
 - Plow casting snow right or left
4. Check the snow plow lights to ensure they are working properly.
5. Lift the snow plow blade off the ground. Check the reveal (space) between the bottom of the snow plow blade and the pavement surface.
6. Check the orientation of the cutting edge. The snow plow blade should be parallel to the pavement surface that will be plowed. If the blade is not parallel to the road surface, the snow plow will need to be adjusted to conform to the pavement surface. This may be accomplished by adjusting the length of the chains that attach to the stinger and connect to the back of the snow plow on both sides.

Changing a Snow Plow Blade

Snow plow blades are the cutting edge of the plow. The blades are attached to the lower part of the moldboard and should be monitored frequently for proper mounting and excessive wear. Snow plow blades should be replaced before damage occurs to the moldboard. One rule of thumb is to replace the blade if there is less than 1½ inches (two fingers) of blade remaining.

Most TxDOT districts use standard-duty steel snow plow blades. Alternatively, some use steel blades with carbide inserts (carbide blades) alone or in conjunction with a standard-duty steel blade. Wear grade carbide inserts resist deterioration caused by blade downpressure and abrasion which results in a cutting edge that will last up to 5 times longer than a standard steel blade.

Changing a snow plow blade is a two-man operation. For the purposes of this training, we will describe how to replace a standard-duty steel blade. Carbide snow plow replacement blades come in 3-ft and 4-ft sections; whereas, the standard duty (mild steel) snow plow blades come as one full-length blade.

Equipment Needed to Change a Snow Plow Blade:

1. Dump truck (6 or 10 CY capacity) with snow plow mounted on the truck
2. Full length or multi-section steel snow plow blade set
3. Floor jack, trailer jack, jack stands and wooden blocking to support the snow plow while changing the blade
4. Pinch bar to help move or lift snow plow components
5. Impact tool with sockets, wrenches and other hand tools as needed to replace the snow plow blade
6. Replacement snow plow fasteners (bolts and nuts) as needed
7. Spud wrench and/or drift punches to line up the holes in the moldboard with the holes in the snow plow blade

Steps for Changing a Snow Plow Blade:

1. If available, drive the truck into a mechanic's garage bay where there is a paved floor surface, compressed air and the proper tools for the job.
2. Use the hydraulic lift cylinder on the truck mounting frame to lift the plow to a comfortable working level, say, 15" to 18" above the floor surface.
3. Using safety jacks or equivalent, securely support the bottom of snow plow so that the blade is safely above the ground.
4. Remove the existing fasteners from the blade and moldboard.
5. Remove old blade(s).
6. Position new blade and line up the holes. Fasten with bolt and nut at each end to hold in place. Repeat as necessary for each section of a multi-section blade. If necessary, use a spud wrench or drift punches to line up the holes.

7. Install remaining fasteners and tighten securely.
8. Raise snow plow and remove jacks and blocking that supported the snow plow during the blade replacement operation.

Special Equipment Maintenance and Fleet Management Requirements

Snow and ice control operations are very demanding on equipment. Cold weather, a corrosive environment, impact loadings, over-loadings and increased potential for collisions with other vehicles or roadside features are some of the factors that increase equipment stress. As a result, particular attention has to be given to maintaining and repairing mobile snow and ice control equipment.

The routine maintenance schedule recommended by the equipment manufacturer should be regarded as the absolute minimum requirement for mobile snow and ice control equipment. More frequent lubrication and inspection schedules usually result in greater up time. Strategic pre-operational and post-operational inspections should be conducted for each shift to help identify small problems, that if not corrected, can result in large or expensive repairs.

The following equipment inspections and maintenance activities on a snow plow assembly will maximize equipment performance and minimize down time.

Pre-Storm Activities

Before a storm strikes, be sure to:

- Perform a Snow Plow Inspection Checklist
- Check blade and moldboard on snow plow for proper mounting and excessive wear
- Mount snow plow on the truck and make the necessary adjustments to ensure proper operation
- Check hydraulic hoses and fittings for leaks and excessive wear
- Check snow plow attachment to ensure all connections are tight
- Check snow plow for fatigue cracks
- Perform a visual check for leaks
- Check controls in cab to make sure blade will go side to side for easy snow removal
- Install snow plow lights to maximize visibility while plowing snow at night
- Service and/or adjust trip chain mechanism as needed to ensure proper operation when plowing snow

During the Storm Activities

While using the equipment during the storm:

- Keep constant check on snow plow blade wear to protect the moldboard
- Perform an occasional walk around to check for any problems that may arise (lights, leaks, tires, wiper blades, mirrors, etc.)
- Monitor hydraulic oil levels to assure proper operation of the snow plow

Post-Storm Activities

Once the storm is over, be sure to:

- Clean and wash equipment as necessary
- Check all hydraulic lines and fittings for wear and leaks
- Make sure equipment is ready for next storm event
- Remove and store attachments as directed by the maintenance section supervisor
- Check snow plow for fatigue cracks
- If necessary, install new blade on snow plow

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VIDEO 4.4. CHANGE A SNOW PLOW BLADE (05:42)

SCRIPT

The cutting edge, or blade, of a snow plow is a wear part, and it must be changed from time to time.

The blade changing operation involves several steps, and it should be said at the outset that this video shows one way to change a blade, a method which is both safe and efficient. We realize there are other ways, and you will want to follow the instructions of your supervisor.

Blade changing can be done on the road in an emergency, but it is always preferable to change the blade in the shop. Not only is it warmer and drier, it is also a safer work environment.

The snow plow can be raised for convenience. As a safety precaution to prevent crushing, always block the heavy steel plow such as is being done here with the safety jacks.

With the snow plow properly and safely positioned, remove the plow bolts that secure the blade to the moldboard. Here this is being done with an impact wrench and a hammer.

A word about when to change the blade.

The key thing that determines when it is time to change your snow plow blade is if the blade is worn down enough such that further plowing will get into the moldboard. The blade must be changed before this happens.

Back to blade removal. Oftentimes, plow bolts are worn or misshapen such that the nuts cannot be removed. If so, the bolts will need to be cut out with a torch.

Use care when driving bolts out of the moldboard.

The carbide blade is removed in sections. In this case, the Flink plow moldboard is 10 feet wide, so the carbide blade consists of two 3-foot sections on the ends and one 4-foot section in the middle. Moldboard widths of 10 feet, 11 feet, and 12 feet are typical, and can be accommodated with the proper blade sections.

Notice that although the blade is pinned for safety purposes, it does not readily fall off, but has to be pried loose. This is because asphalt has worked its way between the moldboard and the blade while plowing, and the asphalt kind of glues the blade to the moldboard.

But don't count on this. Safety first. Always pin the blade sections so they do not fall away during removal.

Once the carbide blade is removed, it is time to remove the mild steel blade, which is the full width of the moldboard, or 10 feet. This is pried loose also, and once removed, the exposed moldboard surface should be cleaned in preparation to receive the new blade.

For the replacement blades, we will be using a blade set consisting of two blades, a carbide blade and a mild steel blade.

The blade replacement approach being recommended here is to tack weld plow bolts for each end of the three carbide blade segments. These tack-welded bolts provide a means to temporarily support the blade until both the carbide blade and the mild steel blade can be placed and secured.

It is recommended that the carbide blade be installed first, directly on the moldboard, where it will provide the greatest wear. The blade needs to be oriented properly, so that the blade angle matches the moldboard orientation when plowing.

Sometimes the tack-welded bolts require adjustment. Again, make sure the blade is oriented correctly.

After the three carbide blade sections are placed on their pins, install the mild steel blade over the carbide blade. This will be the front of the blade set.

Notice that the mild steel blade is 8 inches high, whereas the carbide blade is only 6 inches high. This means that, during plowing immediately following blade replacement, the mild steel blade will quickly wear down to match the carbide blade, at which time the two blades will work and wear together.

Snow plow bolts for the blades are secured with nuts. Lock washers are not required and in fact are not recommended, as the use of washers can result in premature loosening of the plow bolts.

Note that the nuts are placed in front of the blade, rather than behind the moldboard. This makes for better access to the nuts, and a quicker installation, without any significant negative effect on snow plowing.

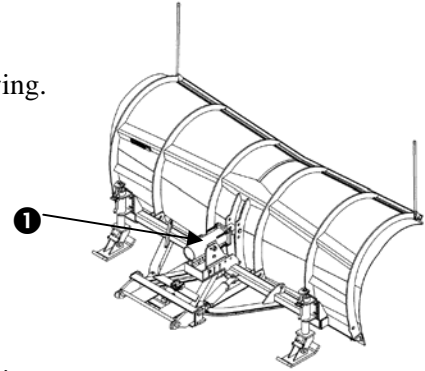
Once the nuts are placed, they are tightened. Usually it is necessary to back up the bolts when doing so.

With the bolts installed and secured, the blade change is complete. You may remove the safety jacks, and return the plow to service.

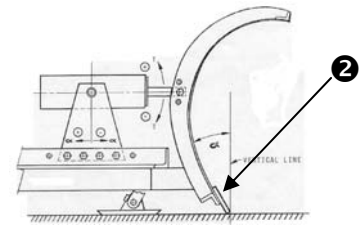
Class Exercise – Review Questions
Module 4 – MOUNT A REVERSIBLE SNOW PLOW

MNT812 Winter Weather Operations Training

1. Identify component ❶ in the reversible snow plow drawing.
 - A. Swivel plate assembly
 - B. Moldboard assembly
 - C. Hitch assembly
 - D. Spring trip assembly



2. Identify component ❷ in the reversible snow plow drawing.
 - A. Trip cannon
 - B. Blade
 - C. Running gear
 - D. Stinger



3. [True or False] So long as the hitch mechanisms are the same, any snow plow can be mounted on any dump truck.
 - A. True
 - B. False
4. [True or False] Mounting the snow plow is complete when the trip cannon “trips.”
 - A. True
 - B. False
5. [True or False] The chains which hang from the stinger (lift arm) should be adjusted so that the snow plow blade is parallel to the pavement surface you will be plowing.
 - A. True
 - B. False
6. [True or False] When changing the snow plow blade, always use safety jacks or similar type of blocking to support the plow frame.
 - A. True
 - B. False
7. [True or False] When installing a two-blade set (carbide and mild steel), the mild steel blade goes on first, directly against the moldboard.
 - A. True
 - B. False

MODULE 5 Pre-Trip Inspection



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012

Learning Objectives

Upon completion of this section, the learner will be able to:

1. Explain the basic idea of a pre-trip inspection
2. Perform a pre-trip inspection relative to winter weather operations for a dump truck



Equipment Preventive Maintenance (PM) PRE-TRIP INSPECTION

- Particular attention has to be given to maintaining and repairing mobile snow and ice control equipment



PRE-TRIP INSPECTION

SLIDE 5.5



PRE-TRIP INSPECTION

SLIDE 5.6



Winter Weather... is Hard on Equipment

PRE-TRIP INSPECTION

- Cold weather, a corrosive environment, impact loadings, over-loadings and increased potential for collisions with other vehicles or roadside features are some of the factors that increase equipment stress...



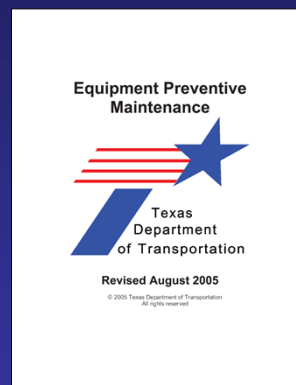
PRE-TRIP INSPECTION

SLIDE 5.9

Equipment Preventive Maintenance Manual

TXDOT POLICY DOCUMENT

- Chapter 7, Preventive Maintenance Inspections
 - Daily Inspection Checklist
 - Dump Truck
 - Periodic/Major Inspection Checklist
 - V-Box Spreaders
 - Snow Plows



PRE-TRIP INSPECTION

SLIDE 5.10

Daily PM Inspection

PRE-TRIP INSPECTION

Purpose

“The purpose of the daily PM inspection is to ensure operator and equipment safety and to ensure that the equipment functions properly as designed.”

-Chapter 7, Equipment PM Manual



PRE-TRIP INSPECTION

SLIDE 5.11

Daily PM Inspection

PRE-TRIP INSPECTION

Frequency

“The inspection should be performed and documented prior to equipment use. More frequent inspections may be necessary...”

-Chapter 7, Equipment PM Manual



PRE-TRIP INSPECTION

SLIDE 5.12

Daily PM Inspection

PRE-TRIP INSPECTION

Who Performs the Daily Inspection?

“The daily PM inspection is the primary responsibility of the operator.”

-Chapter 7, Equipment PM Manual



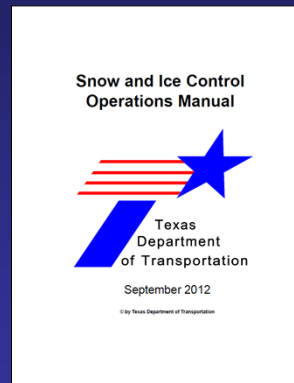
PRE-TRIP INSPECTION

SLIDE 5.13

Snow and Ice Control Operations Manual

TXDOT GUIDANCE DOCUMENT

- Chapter 3, Equipment Maintenance
 - Section 2
 - Dump Truck
 - Section 5
 - Snow Plow
 - Section 6
 - V-Box Spreader

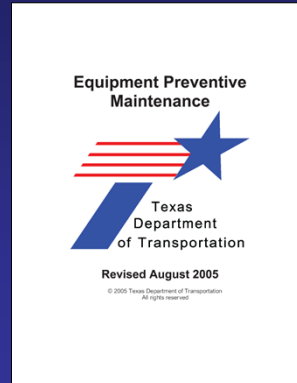


PRE-TRIP INSPECTION

SLIDE 5.14

PM Checklists PRE-TRIP INSPECTION

- Daily Inspection Checklist
 - Dump Truck
- Periodic/Major Inspection Checklist
 - V-Box Spreaders
 - Snow Plows



PRE-TRIP INSPECTION

SLIDE 5.19

VIDEO 5.2 (01:15) PM Checklists



CREDIT

“TxDOT Preventive Maintenance: Taking Charge of Your Safety”

Texas Department of Transportation



R_{5.2}
[5.30]



PRE-TRIP INSPECTION

SLIDE 5.20

PM Checklists

PRE-TRIP INSPECTION

- The pre-trip checklist is a guide for completing the pre-trip inspection...
- Refer to:
 - Equipment Preventive Maintenance Manual
 - Snow and Ice Control Operations Manual



PRE-TRIP INSPECTION

SLIDE 5.21

Dump Truck Daily Inspection Checklist

PRE-TRIP INSPECTION



Dump Truck Daily Inspection Checklist

Form 2132
8/2004
DHT # 161035

Date:	Section:	Mileage/Hours:
Equipment Number:		
	POWER OFF	POWER ON
WALKAROUND	Body/Glass Condition D	FRONT LAMPS Head/Dimmer D
	Leaks (Fluid/Air) D	Parking D
UNDER HOOD	Oil level D	Turn Signal D
# Automatic	Transmission Fluid D	Four Way D
	Coolant/Radiator D	I.D. Lamps/Clearance D
	Brake/PTO Fluid D	Strobe/Beacon D
	Power Steering Fluid D	Swing Lamps D
	Belts D	SIDE LAMPS Marker Lamps D
	Hoses D	Reflectors D
	Air Cleaner D	Conspicuity D
BATTERY	Leaks (Fluid/Air) D	REAR LAMPS Tail Lamps D
	Cells Condition W	I.D. Lamps D
	Acid/Water Level W	Stop Lamps D
	Mountings/Hold Down W	Turn Signal D
	Cover Secured W	Lamp/Alarm D
TIRES	Treads/Match D	Back-up Loose Lamp D
	Tire Condition D	CAB 1st Aid Kit D
	Tire PSI D	Fire Extinguisher D
	Wheel Condition D	Warning Triangles D
	Mud Flaps (8") D	Seat Belts D
BRAKES	Tank/Drain D	W/S Windows D
	Air Leaks/Brake On/Off D	Wipers/Washer D
	Glad-hands D	Horn (Ar & Electric) D
	Slack Adjuster W	Mirrors D
HYDRAULICS	Emergency Brakes D	W/S/Steer SE/DOJ Insp. due date D
	Reservoir Level D	Alt. Fuel Tank D
	PTO Operation D	Dump/Trk Bed Lock Lamp D
	Hose Condition D	Air Press. Buzzer/Lamp D
	Cylinder Leakage D	PTO Lamp D
FRAME	Loose Bolts W	Clutch Travel (Min. 1") D
	Lift Cylinder & Pin W	Loose Items D
BED	Ladder D	
	Cover D	
	Loose Cargo D	
	Dumpled safety bar W	
PINTLE HOOK	Lube/Service/Adjust D	
	Safety Pin D	
	Backplate Security D	

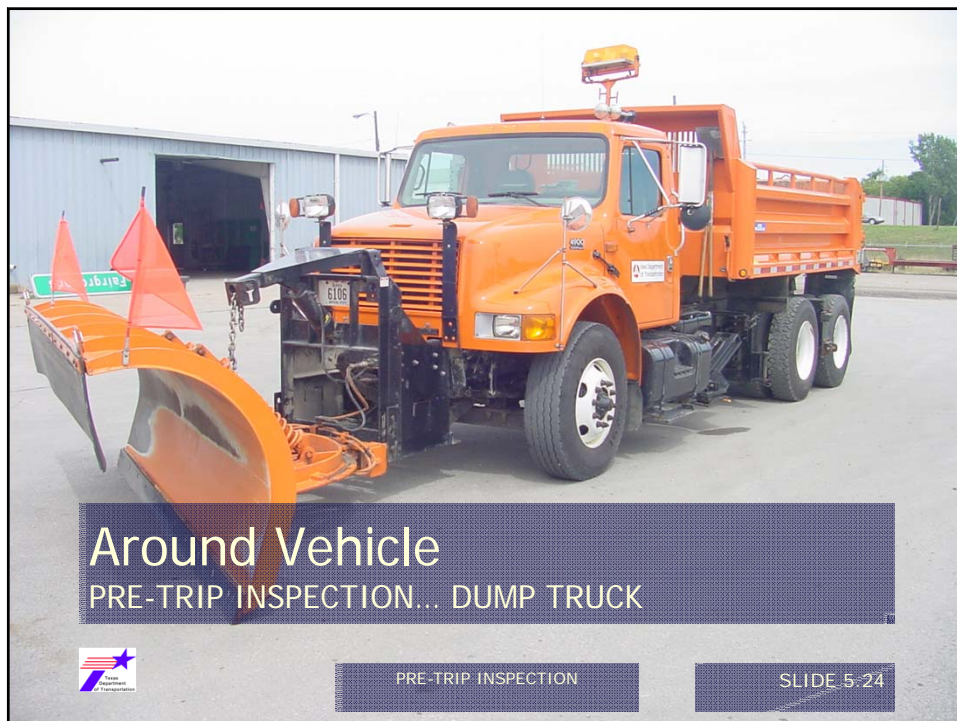
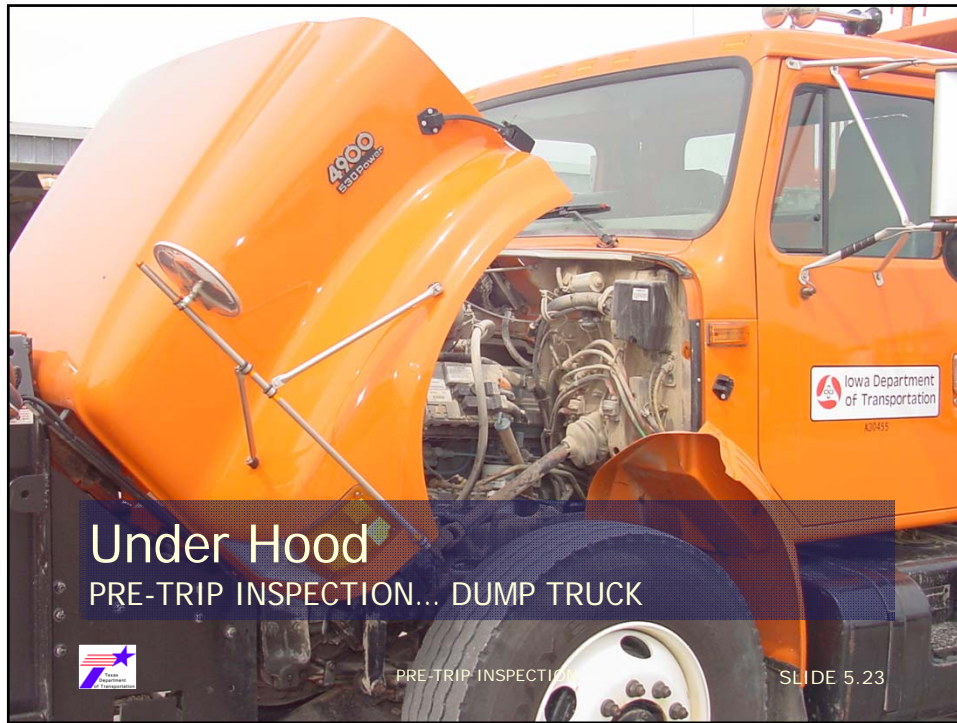
√ = Condition is safe for operation X = Discrepancy discovered (X) = Discrepancy repaired
D = Daily Inspection Items W = Weekly Inspection Items (to be completed on the first working day of the week).

Comments:

Operator's Printed Name & Signature _____ Supervisors Signature of Release (if required)
Equipment PM Manual inspection checklist items are minimum standards and are meant to supplement the operator's manual. Districts may add inspection items as needed.

R_{5.3}
[5.31]

SLIDE 5.22





VIDEO 5.3 (04:49) Plow Truck Inspection



CREDIT

“Winter Operations Training Series”

Iowa Department of Transportation

Used with permission.




R
5.4
[5.33]



PRE-TRIP INSPECTION

SLIDE 5.26

V-Box Spreader
Periodic/Major Inspection Checklist
PRE-TRIP INSPECTION



PERIODIC/MAJOR INSPECTION CHECKLIST

V-BOX SPREADER

Make/Model/Year: _____ Equipment No. _____

Mileage/Hours: _____ Date: _____ Inspector Printed Name and Signature: _____

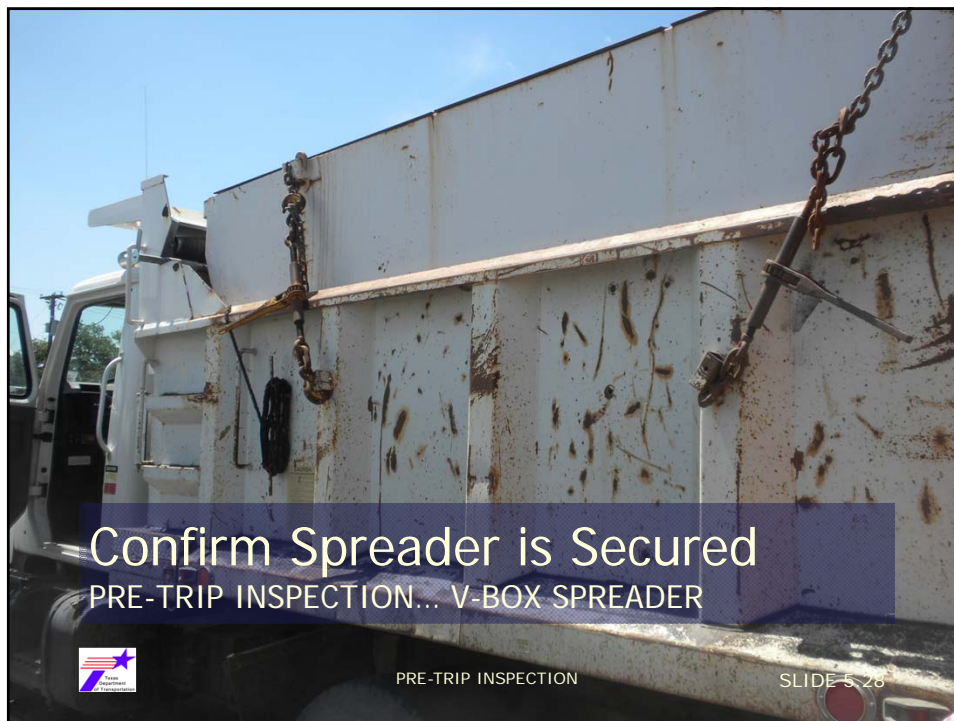
Ref. Repair Order No. _____

Required Action Key: (R) = Restore (A) = Adjust, Replace if necessary All Others = Inspect
Inspection Marking Key: = Satisfactory = Not Applicable = Deficiency = Deficiency Corrected (Circled X)

SYSTEM	PM OPERATION	PERIODIC INTERVAL	MAJOR INTERVAL	ACTION TAKEN	INITIAL	SIG BLOCK
AUX ENGINE (WHEN APPL.)	Engine oil	R	R			
	Engine oil filter	R	R			
	Fuel filter					
	Drive belts			A		
	Exhaust system					
	Batteries					
HYDRAULICS/ GEAR BOX	Electrical					
	Tune - up			A		
	Oil levels			A		
	Filter cartridge (R twice per year)			R		
	Quick disconnects					
SPINNER ASSEMBLY	Flow control valve					
	Air vents					
	Bearings					
	Hinge rod					
CONVEYOR ASSEMBLY	Spinner disk					
	Conveyor chain			A		
PTO DRIVE ASSEMBLY	Conveyor belt					
	U-joints					
	Drive shaft					

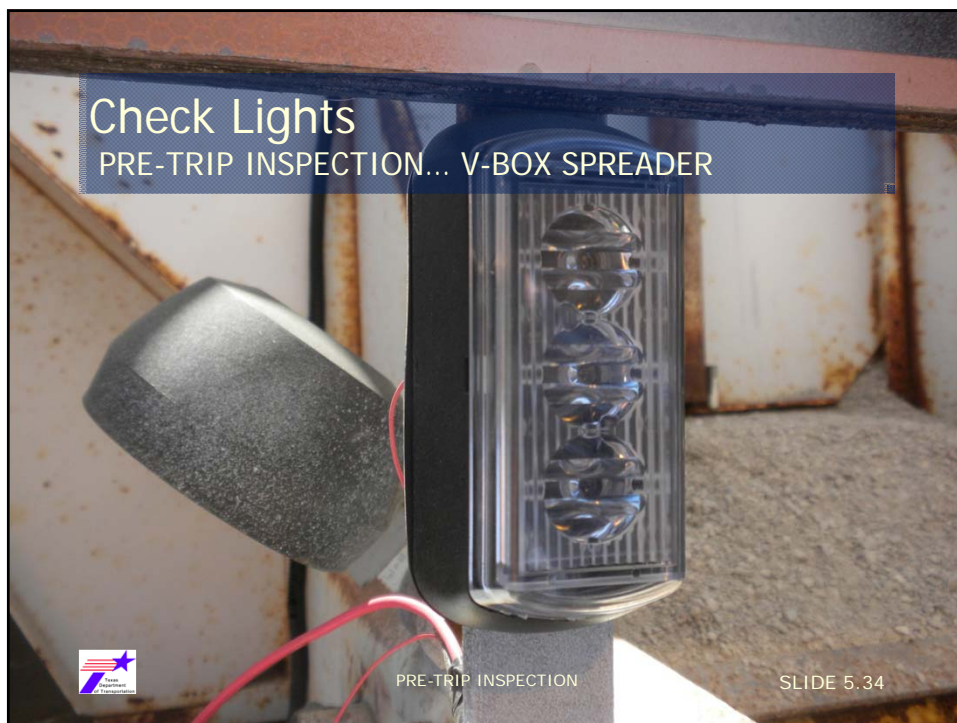
R_{5.5}
[5.35]

SLIDE 5.27

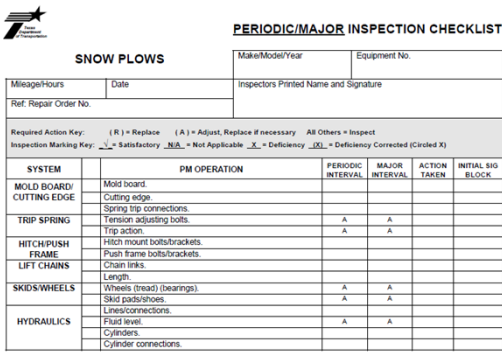








Snow Plows
Periodic/Major Inspection Checklist
PRE-TRIP INSPECTION



PERIODIC/MAJOR INSPECTION CHECKLIST

SNOW PLOWS

Make/Model/Year: _____ Equipment No.: _____

Mileage/Hours: _____ Date: _____ Inspectors Printed Name and Signature: _____

Ref. Repair Order No.: _____

Required Action Key: (R) = Replace (A) = Adjust, Replace if necessary All Others = Inspect
 Inspection Marking Key: = Satisfactory NA = Not Applicable X = Deficiency DL = Deficiency Corrected (Circled X)

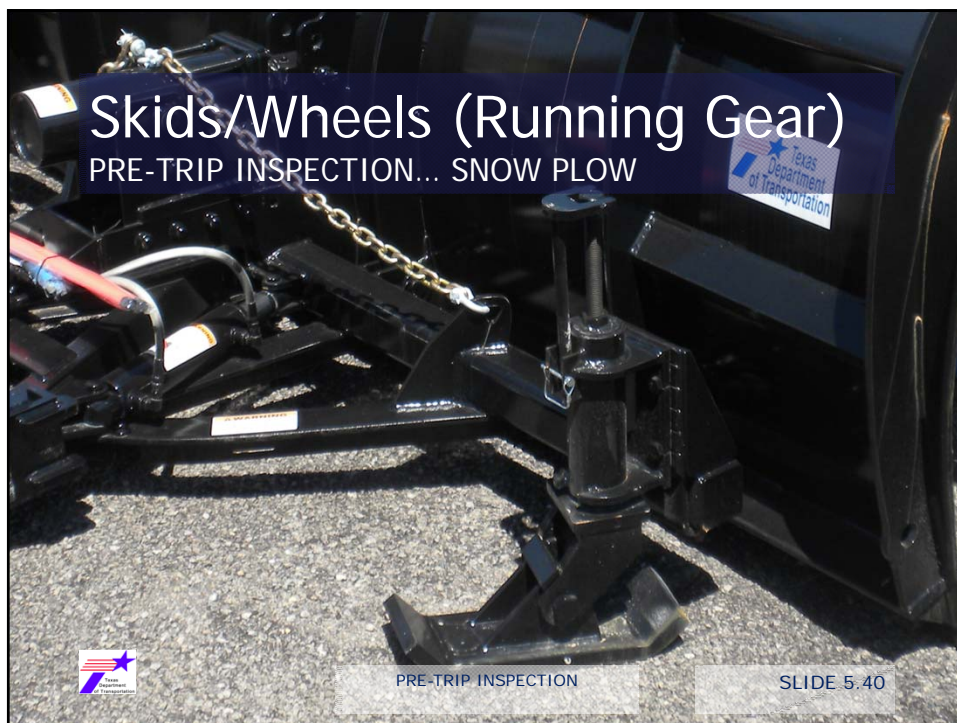
SYSTEM	PM OPERATION	PERIODIC INTERVAL	MAJOR INTERVAL	ACTION TAKEN	INITIAL SIG	BLOCK
MOLD BOARD/ CUTTING EDGE	Mold board					
	Cutting edge					
TRIP SPRING	Spring tie connections					
	Tension adjusting bolts	A	A			
HITCH/PUSH FRAME	Trips action	A	A			
	Hitch mount bolts/brackets					
LIFT CHAINS	Push frame bolts/brackets					
	Chain links					
SKIDS/WHEELS	Length					
	Wheels (tread) (bearings)	A	A			
HYDRAULICS	Skid pads/shoes	A	A			
	Lines/connections					
	Fluid level	A	A			
	Cylinders					
	Cylinder connections					

R_{5.6}
[5.37]

SLIDE 5.35














VIDEO 5.4 (02:21)
Snow Plow Inspection



CREDIT
Rocky Andrews
Amarillo District
Texas Department of Transportation





PRE-TRIP INSPECTION SLIDE 5.44

FIELD Exercise 5.1

Perform a Pre-Trip Inspection



Using the TxDOT PM Checklists, perform a pre-trip inspection for:

1. Dump Truck
2. V-Box Spreader
3. Snow Plow



PRE-TRIP INSPECTION

SLIDE 5.45



PRE-TRIP INSPECTION

SLIDE 5.46



Summary and Review

1. The basic idea of the pre-trip inspection
2. Pre-trip inspection for dump truck
3. Pre-trip inspection for V-box spreader
4. Pre-trip inspection for snow plow



FIELD Exercise 5.1 Perform a Pre-Trip Inspection



Using the TxDOT PM Checklists, perform a pre-trip inspection for:

1. Dump Truck
2. V-Box Spreader
3. Snow Plow



VIDEO 5.1. PRE-TRIP INSPECTION (05:49)

SCRIPT

When roads are snow covered and icy, safety is your number one concern. After all, isn't that what snow plowing is all about?

Safety begins with a reliable vehicle. Inspecting your equipment thoroughly before and after use is an important part of your job.

Use a checklist. This helps make sure you don't miss something. Write up any problems you see so the shop can take care of them.

Your headlights do two jobs; they let you see and they let other see you. Make sure they are clean and not damaged. If they are loose in their holders, they are more likely to rattle around and burn out.

Take a look at the other exterior lights and reflectors on your truck. Make sure the turn signals and reverse lights and reverse alarms are working. Use a helper for this.

If you are inspecting a wheel loader or motor grader, the visibility issue is twice as important for you, because of the start and stop nature of your work and the fact that you are often working along the road's perimeter, your machine is more difficult to see.

Check your beacon and other warning devices. Check the plow edge markers. It's vital that you know at all times where the edge of that plow is.

The plow frame keeps the plow on your truck; make sure all pins, bolts, and connections are solid.

Inspect the blade and cutting edges for wear and damage. Look for cracks, broken or missing bolts or pins.

Generally, if you don't have at least two fingers left on the cutting edge, you should replace it. That cutting edge is critical to the quality of job you are able to do.

Your snow deflectors should be intact. When high-speed plowing, this prevents the snow from flying up over the plow and hitting the windshield.

The only thing between you and the road are your tires. Don't compromise your truck's traction. Make sure you've got good tread and check the tire pressure. Inspect the wheel lugs too.

Look behind the tire at the leaf springs and for steering pump hose leaks.

At the back of the truck once again check all your lights and reflectors.

See that the spreaders are in good working order. You want a good concentration of salt in the proper area. The auger should be running true. The tailgate should be pinned so that you don't dump a load behind you.

Check the hoses underneath for leaks or loose connections.

Check the dump box for any loose objects that could jam in the salt feeding system.

Open the hood or side panels. In addition to checking the engine oil, take a look around at the hoses, clamps, fuel injection lines; anything that could leak or come loose.

Check all the fluid levels. This includes the fuel level; check it visually at the tank and inside the cab. You never ever want to run out of fuel.

Check the other fluids levels including the oil, engine coolant, hydraulics, transmission, power steering, alcohol evaporation, and windshield washer levels.

Be careful climbing up into the cab, slipping on an icy step or grasping for a hand hold and losing your balance is no way to start your shift.

Once you are inside the cab, fasten your seat belt. Excuses like your back hurts or it's uncomfortable or its rusted shut don't cut it. If you want to prevent yourself from flying through the front windshield or if you have a desire to live to retirement age, wear your seat belt.

You can always spot a rookie operator because he's got his thumbs wrapped around the steering wheel. If your blade hits an expansion joint at a bridge or some other immovable object, the wheel can jerk and break or bruise your thumbs and cause you to lose control of the truck.

This is the correct way to hold the steering wheel on a truck plow.

Next, adjust the mirrors; and if they are heated, be sure the heater is working.

The windshield should be clean and wiper blades intact.

Make sure the heater and defroster are working and that you don't smell antifreeze in the cab. If you do, you may have a leaking heater core or hose on your hands.

Warm up the engine and the hydraulics and give your controls a run through. Test the operation of your truck's hydraulics. Do you have full control of your plow?

Test the brakes and the steering.

The last thing to do before you head out is to check your two-way radio communication. As one operator told us, you haven't been stuck in the storm 'til you've been stuck in a plow. How 'bout being stuck in a plow without a radio?

VIDEO 5.2. PM CHECKLISTS (01:15)

SCRIPT

Work at the Texas Department of Transportation requires employees to use many types of vehicles and equipment.

Everyone from the District Engineer to the Equipment Operator takes part in an effective preventive maintenance program. Of the 3 levels of inspections, we will focus on the routine or daily inspections performed by the equipment operator.

The routine PM Inspection is the operators best opportunity to ensure equipment safety and should be done at the beginning of each day.

This inspection is concerned with primarily with fuel, fluids, and beginning symptoms of more serious mechanical problems.

TxDOT developed a check list of items to be inspected each day. As you inspect the vehicle, place a check mark next to each item that passes. Mark unsatisfactory items with an x. Once the item is repaired, circle the x to indicate a passed inspection.



Form 2132
(5/2004)
DHT # 161535

Dump Truck Daily Inspection Checklist

Date:	Section:	Mileage/Hours:
Equipment Number:		

POWER OFF			POWER ON		
WALKAROUND	Body/Glass Condition	D	FRONT LAMPS	Head/Dimmer	D
	Leaks (Fluid/Air)	D		Parking	D
UNDER HOOD	Oil level	D		Turn Signal	D
	If Automatic			Four Way	D
	Transmission Fluid	D		I.D. Lamps/Clearance	D
	Coolant/Radiator	D	DOT	Strobe/Beacon	D
	Brake/PTO Fluid	D		Swing Lamps	D
	Power Steering Fluid	D		Marker Lamps	D
	Belts	D	SIDE LAMPS	Reflectors	D
	Hoses	D		Conspicuity	D
	Air Cleaner	D		Tail Lamps	D
	Leaks (Fluid/Air)	D	REAR LAMPS	I.D. Lamps	D
BATTERY	Cable Condition	W	DOT	Stop Lamps	D
	Acid/Water Level	W		Turn Signal	D
	Mountings/Hold Down	W		Lamp/Alarm	D
	Cover Secured	W	Back-up	License Lamp	D
TIRES	Tread/Match	D		1st Aid Kit	D
	Tire Condition	D	CAB	Fire Extinguisher	D
	Tire PSI	D		Warning Triangles	D
	Wheel Condition	D		Seat Belts	D
	Mud Flaps (8")	D		WS/Windows	D
BRAKES	Tank/Drain	D		Wipers/Washer	D
	Air Leaks/Brake On/Off	D		Horn (Air & Electric)	D
	Glad-hands	D		Mirrors	D
	Slack Adjuster	W		SE/DOT Insp.due date	D
	Emergency Brakes	D	WS/Sticker	Alt. Fuel Tax	D
HYDRAULICS	Reservoir Level	D		Bed Lock Lamp	D
	PTO Operation	D	Dump/Trk	Air Press Buzzer&Lamp	D
	Hose Condition	D	Air Brakes	PTO Lamp	D
	Cylinder Leakage	D		Clutch Travel (Min. 1")	D
FRAME	Loose Bolts	W		Loose Items	D
	Lift Cylinder & Pin	W			
BED	Ladder	D	MISC.		
	Cover	D			
	Loose Cargo	D			
	Dumped safety bar	W			
PINTLE HOOK	Lube/Service/Adjust	D			
	Safety Pin	D			
	Backplate Security	D			

√ = Condition is safe for operation X = Discrepancy discovered (X) = Discrepancy repaired
D = Daily Inspection Items W = Weekly Inspection Items (to be completed on the first working day of the week).

Comments:

Operator's Printed Name & Signature _____ Supervisors Signature of Release (if required) _____

Equipment PM Manual inspection checklist items are minimum standards and are meant to supplement the operator's manual. Districts may add inspection items as needed.

Pre-Trip Inspection Checklist All Trucks and Aerials Above 1 Ton

Equipment Number: _____	Section: _____
Equipment Type: _____	Mileage/Hours: _____

√ = Okay X = Needs Repair N/A = Not Applicable

Under Hood

Engine Oil	Check engine oil level and check under vehicle for evidence of leaks.	
Trans Fluid	Check transmission fluid level and check under vehicle for evidence of leaks.	
Power Steering Fluid	Check power steering fluid level and reservoir. Check hoses and lines for leaks.	
Brake/Clutch Master Cyl	Check brake / clutch fluid level and master cylinder. Check lines for leaks.	
Air Compressor	If applicable, check air compressor and air supply system.	
Radiator	Check coolant level, radiator condition and mounting, fan and shroud.	
Belts	Check belt condition, tension and tension idler.	
Hoses	Check hose condition and routing. Check for loose clamps and leaks.	
Battery	Check battery, terminals, cables and hold down.	
Air Cleaner	Check restriction indicator, dust collector, filter housing and ducting.	

Around Vehicle

Lights	Check all lights, signals, strobes and reflectors.	
Markings	Check decals, equipment numbers, height & weight decals and conspicuity.	
Battery	Check battery terminals, cables, hold down device and covers.	
Tires	Check tires for proper air pressure, wear and matched height.	
Wheels	Check wheels for damage, cracks, loose and missing lug nuts.	
Hubs	Check hubs for loose bearings, oil level, water contamination and leaking seals.	
Mud Flaps	Check mud flaps for damage and correct height of 4" to 12" above ground.	
Exhaust	Check exhaust for damage and leaks.	
Hydraulic System	Check fluid level, pto, pump and valve operation, check for damage and leaks.	
Dump Bed / Hoist	Check safety props, cylinder, pins, ladders, tarps, tail gates and limit valves.	
Trailer Hitch	Check receiver, pintle and fifth wheel hitches for tightness, operation and wear.	
Crane / Winch	Check operation and inspect boom, cable and hooks for damage.	
Aerial	Check pedestal, boom and bucket for cleanliness, cracks, loose pins and rollers.	
	Check aerial and outrigger operation. Check harness and lanyard for damage.	
Auxiliary Equipment	Check attenuators, herbicide rigs, water tanks and etc. per operators manual.	

In Cab

Instruments	Check instrument panel for proper operation of all gauges, indicators and lamps.	
Glass / Mirrors	Check windshield, wipers, and washer, all other glass and mirrors.	
Horn	Check electric and air horns for operation.	
Safety Equipment	Check seat belts, fire extinguisher, first aid kit, warning triangles and flags.	
Clutch	Check clutch for proper operation and 1" to 1-1/2" of free play.	
Brakes	Check service brakes and parking brake. If air brakes, check low air warning devices for proper operation. Check air lines, hoses and park brake valve for leaks.	
PTO / Bed Indicator	Check PTO and Bed Up indicator lamps for operation.	
Back up Alarm	Check operation.	
Appearance	Check vehicle for cleanliness, clutter and loose objects.	
Inspectons	Check for current safety, aerial, crane inspections and alternative fuel decals.	

Comments: _____

Operator's Name: _____ **Date:** _____

Operator's Signature: _____

VIDEO 5.3. PLOW TRUCK INSPECTION (04:49)

SCRIPT

Our plan here is to do a detailed inspection of the entire truck. Inside the cab from front to back and under the hood.

There are different models of trucks in each garage and the one you will be checking may be different than the model you will see in this video. However, the pre-season checklist is very similar for all trucks.

It's a good idea to plan to do your inspection after the truck has sat inside the garage, at least overnight, because we will be using the garage floor to help detect any oil and/or fluids leaks.

Lights are next on your checklist. Start with the amber warning lights mounted above the truck cab. These lights should be on at all times when the truck is operated with the snow plow or wing because this equipment makes the truck over-width. Make certain they work properly.

Brake lights; so they work when you depress the brake pedal? If there is no one else around to help you check, look for reflections on the garage door.

Headlights; turn them on and then get out of the cab to make certain both sets are working; the chassis headlights and the higher plow lights; and don't forget to check both high and low beams.

Turn signals; check both the left and right turn signals. You cannot always trust the dash indicator arrow; so the only sure way to ensure your turn signals are working properly is to get out of the truck and check both the front and back signals for correct operation.

Clearance lights; these mark the width of your truck for other drivers. Make sure those on the front of the cab are working as well as those at the front and rear corners of the dump box.

Sander light or lights; located on or underneath the back of the truck box; these light the spinner so you can see the material.

Strobe light; located at the back of the dump box; the strobe light helps make certain drivers can see the truck in poor visibility conditions.

Lastly, check to see that all reflectors are in place; amber to the front and red to the rear on all four corners of the truck body.

We are now on the home stretch of your truck pre-season inspection. Take a look inside the truck tool box; check first for tire cables or chains, pull them out and make sure they are in good condition.

It is also a good idea to mount them just to be sure they fit.

Also, make certain the tool box contains towing chains; extra plow and wing pins; extra pin safety clips and the tools you think you may need out on the road.

Check too that you have a hand shovel which can be in many places; but usually is attached or in a holder behind the cab or on the dump box.

Now check one last time inside the truck cab. Make sure the cab is clean and there are no loose items like pop cans, bottles or log chains in the cab.

Make sure you have a fire extinguisher that is properly mounted and fully charged; an ice scraper; a whisk broom or snow brush for cleaning snow off your lights and a flashlight.

Also on your checklist should be a first aid kit. Check the contents of the kit and replace any missing or damaged items; and the emergency reflector kit.

Climb back into the cab and try the safety belts making sure the lock works. Check the two-way radio and make certain the display or power light comes on. Check the dash lights and all of the gauges to make certain they are all working.

Go over the windshield and make sure it doesn't have serious pits, scratches or cracks. Report any problems to the shop mechanic.

And lastly, check the wiper blades. Tell the mechanic if you feel they need to be replaced. Also, make sure the wipers are working properly.

Your truck has numerous mounting brackets or supports that are bolted to your truck to support the snow removal equipment. Check all of these brackets to make sure they are secure and that all bolts are in place and tight.

One last thing to thoroughly check is your heating and defrosting system.

Back your truck out of the garage and turn on your heater with the engine running. Let the engine heat up and then make sure all fan speeds are operational and the heat provided by your heater and defroster are adequate.

With this thorough inspection completed, your truck should be in shape to meet the rigorous of the winter season.



PERIODIC/MAJOR INSPECTION CHECKLIST

V-BOX SPREADER

Mileage/Hours		Date	Make/Model/Year	Equipment No.		
Ref: Repair Order No.		Inspector Printed Name and Signature				
Required Action Key: (R) = Replace (A) = Adjust, Replace if necessary All Others = Inspect Inspection Marking Key: <u>√</u> = Satisfactory <u>N/A</u> = Not Applicable <u>X</u> = Deficiency <u>(X)</u> = Deficiency Corrected (Circled X)						
SYSTEM		PM OPERATION	PERIODIC INTERVAL	MAJOR INTERVAL	ACTION TAKEN	INITIAL SIG BLOCK
AUX ENGINE (WHEN APPL.)		Engine oil.	R	R		
		Engine oil filter.	R	R		
		Fuel filter.				
		Drive belts.		A		
		Exhaust system.				
		Batteries.				
		Electrical.				
HYDRAULICS/ GEAR BOX		Tune - up.		A		
		Oil levels.	A	R		
		Filter cartridge (R twice per year).	R	R		
		Quick disconnects.				
		Flow control valve.				
SPINNER ASSEMBLY		Air vents				
		Bearings				
CONVEYOR ASSEMBLY		Hinge rod.				
		Spinner disk.				
PTO/DRIVE ASSEMBLY		Conveyor chain.	A	A		
		Conveyor belt.				
		U-joints.				
		Drive shaft.				

V-BOX SPREADER
PERIODIC/MAJOR INSPECTION CHECKLIST (Cont'd)

Inspection Remarks _____

Review By _____

Repair Remarks _____



PERIODIC/MAJOR INSPECTION CHECKLIST

SNOW PLOWS

Mileage/Hours		Date	Make/Model/Year	Equipment No.		
Ref. Repair Order No.		Inspectors Printed Name and Signature				
Required Action Key: (R) = Replace (A) = Adjust, Replace if necessary All Others = Inspect Inspection Marking Key: <u> </u> = Satisfactory <u> N/A </u> = Not Applicable <u> X </u> = Deficiency <u> (X) </u> = Deficiency Corrected (Circled X)						
SYSTEM	PM OPERATION	PERIODIC INTERVAL	MAJOR INTERVAL	ACTION TAKEN	INITIAL SIG BLOCK	
MOLD BOARD/ CUTTING EDGE	Mold board.					
	Cutting edge.					
	Spring trip connections.					
TRIP SPRING	Tension adjusting bolts.	A	A			
	Trip action.	A	A			
HITCH/PUSH FRAME	Hitch mount bolts/brackets.					
	Push frame bolts/brackets.					
LIFT CHAINS	Chain links					
	Length.					
SKIDS/WHEELS	Wheels (tread) (bearings).	A	A			
	Skid pads/shoes.	A	A			
HYDRAULICS	Lines/connections.					
	Fluid level.	A	A			
	Cylinders.					
	Cylinder connections.					

SNOW PLOWS
PERIODIC/MAJOR INSPECTION CHECKLIST (Cont'd)

Inspection Remarks _____

Review By _____

Repair Remarks _____

VIDEO 5.4. SNOW PLOW INSPECTION (02:21)

SCRIPT

Rocky: I guess there is a different terminology, some people call this a carriage, some of us call it a push frame. This can be called a push frame; but right here is where the plow separates from the truck.

So the carriage or the push frame on the truck needs to be looked at for cracks in the welds, broken places due to all the vibrations, and just normal wear and tear. So when you are doing your daily inspection you need to check all your pins, welds, and bolts and even back on the truck frame. You want to look back underneath there to make sure that your supports aren't bent, that you hadn't hit something and bent those. They actually bolt to the frame of the truck so you want to check where it bolts to the frame of the truck, make sure that those nuts are all good and tight. Check to make sure that's all the way it ought to be.

Rocky: Same thing on the carriage, or on the push frame on the plow. You got welds that need to be inspected, and your circle where it swivels left to right. You want to check your tension on this swivel bolt, this is the place that lets it swivel to meet the contours of the road. So you want it pretty snug but not so tight that it won't swivel.

Rocky: There is a fatigue crack right there I see that will need to be watched. That's probably okay for right now but when the storm is over and we're done; well, that's something that probably that needs to be looked at and sure need to keep an eye on it during the storm.

Bill: So like in pre-season that's something that would definitely be repaired getting ready for the next season. But should it be in the middle of a storm, you would not necessarily have to take it off of service. You would just watch it if it got more severe, you would do something about it.

Rocky: That's right.

Rocky: And then you want to come around to the front of your plow, and you want to check your cutting edges, make sure they're okay. Make sure the face of the plow doesn't have any big holes or damage to it.

An extra set of the pre-trip inspection checklists is attached, as follows:

- Dump Truck Daily Inspection Checklist (1 page)
- Pre-trip Inspection Checklist All Trucks and Aerials Above 1 Ton (1 page)
- V-Box Spreader... Periodic/Major Inspection Checklist (2 pages)
- Snow Plows... Periodic/Major Inspection Checklist (2 pages)



Dump Truck Daily Inspection Checklist

Date:	Section:
Equipment Number:	Mileage/Hours:

POWER OFF			POWER ON		
WALKAROUND	Body/Glass Condition	D	FRONT LAMPS	Head/Dimmer	D
	Leaks (Fluid/Air)	D		Parking	D
UNDER HOOD	Oil level	D		Turn Signal	D
	If Automatic Transmission Fluid	D		Four Way	D
	Coolant/Radiator	D	DOT	I.D. Lamps/Clearance	D
	Brake/PTO Fluid	D		Strobe/Beacon	D
	Power Steering Fluid	D		Swing Lamps	D
	Belts	D	SIDE LAMPS	Marker Lamps	D
	Hoses	D		Reflectors	D
	Air Cleaner	D		Conspicuity	D
	Leaks (Fluid/Air)	D	REAR LAMPS	Tail Lamps	D
BATTERY	Cable Condition	W	DOT	I.D. Lamps	D
	Acid/Water Level	W		Stop Lamps	D
	Mountings/Hold Down	W		Turn Signal	D
	Cover Secured	W	Back-up	Lamp/Alarm	D
TIRES	Tread/Match	D		License Lamp	D
	Tire Condition	D	CAB	1st Aid Kit	D
	Tire PSI	D		Fire Extinguisher	D
	Wheel Condition	D		Warning Triangles	D
	Mud Flaps (8")	D		Seat Belts	D
BRAKES	Tank/Drain	D		WS/Windows	D
	Air Leaks/Brake On/Off	D		Wipers/Washer	D
	Glad-hands	D		Horn (Air & Electric)	D
	Slack Adjuster	W		Mirrors	D
	Emergency Brakes	D	WS/Sticker	SE/DOT Insp.due date	D
HYDRAULICS	Reservoir Level	D		Alt. Fuel Tax	D
	PTO Operation	D	Dump/Trk	Bed Lock Lamp	D
	Hose Condition	D	Air Brakes	Air Press.Buzzer&Lamp	D
	Cylinder Leakage	D		PTO Lamp	D
FRAME	Loose Bolts	W		Clutch Travel (Min. 1")	D
	Lift Cylinder & Pin	W		Loose Items	D
BED	Ladder	D	MISC.		
	Cover	D			
	Loose Cargo	D			
	Dumped safety bar	W			
PINTLE HOOK	Lube/Service/Adjust	D			
	Safety Pin	D			
	Backplate Security	D			

√ = Condition is safe for operation **X** = Discrepancy discovered **(X)** = Discrepancy repaired
D = Daily Inspection Items **W** = Weekly Inspection items (to be completed on the first working day of the week).

Comments:

Operator's Printed Name & Signature

Supervisors Signature of Release (if required)

Equipment PM Manual inspection checklist items are minimum standards and are meant to supplement the operator's manual. Districts may add inspection items as needed.

Pre-Trip Inspection Checklist All Trucks and Aerials Above 1 Ton

Equipment Number:	Section:
Equipment Type:	Mileage/Hours:

√ = Okay X = Needs Repair N/A = Not Applicable

Under Hood

Engine Oil	Check engine oil level and check under vehicle for evidence of leaks.	
Trans Fluid	Check transmission fluid level and check under vehicle for evidence of leaks.	
Power Steering Fluid	Check power steering fluid level and reservoir. Check hoses and lines for leaks.	
Brake/Clutch Master Cyl	Check brake / clutch fluid level and master cylinder. Check lines for leaks.	
Air Compressor	If applicable, check air compressor and air supply system.	
Radiator	Check coolant level, radiator condition and mounting, fan and shroud.	
Belts	Check belt condition, tension and tension idler.	
Hoses	Check hose condition and routing. Check for loose clamps and leaks.	
Battery	Check battery, terminals, cables and hold down.	
Air Cleaner	Check restriction indicator, dust collector, filter housing and ducting.	

Around Vehicle

Lights	Check all lights, signals, strobes and reflectors.	
Markings	Check decals, equipment numbers, height & weight decals and conspicuity.	
Battery	Check battery terminals, cables, hold down device and covers.	
Tires	Check tires for proper air pressure, wear and matched height.	
Wheels	Check wheels for damage, cracks, loose and missing lug nuts.	
Hubs	Check hubs for loose bearings, oil level, water contamination and leaking seals.	
Mud Flaps	Check mud flaps for damage and correct height of 4" to 12" above ground.	
Exhaust	Check exhaust for damage and leaks.	
Hydraulic System	Check fluid level, pto, pump and valve operation, check for damage and leaks.	
Dump Bed / Hoist	Check safety props, cylinder, pins, ladders, tarps, tail gates and limit valves.	
Trailer Hitch	Check receiver, pintle and fifth wheel hitches for tightness, operation and wear.	
Crane / Winch	Check operation and inspect boom, cable and hooks for damage.	
Aerial	Check pedestal, boom and bucket for cleanliness, cracks, loose pins and rollers.	
	Check aerial and outrigger operation. Check harness and lanyard for damage.	
Auxillary Equipment	Check attenuators, herbicide rigs, water tanks and etc. per operators manual.	

In Cab

Instruments	Check instrument panel for proper operation of all gauges, indicators and lamps.	
Glass / Mirrors	Check windshield, wipers, and washer, all other glass and mirrors.	
Horn	Check electric and air horns for operation.	
Safety Equipment	Check seat belts, fire extinguisher, first aid kit, warning triangles and flags.	
Clutch	Check clutch for proper operation and 1" to 1-1/2" of free play.	
Brakes	Check service brakes and parking brake. If air brakes, check low air warning devices for proper operation. Check air lines, hoses and park brake valve for leaks.	
PTO / Bed Indicator	Check PTO and Bed Up indicator lamps for operation.	
Back up Alarm	Check operation.	
Appearance	Check vehicle for cleanliness, clutter and loose objects.	
Inspections	Check for current safety, aerial, crane inspections and alternative fuel decals.	

Comments: _____

Operator's Name: _____

Date: _____

Operator's Signature: _____



PERIODIC/MAJOR INSPECTION CHECKLIST

V-BOX SPREADER

Make/Model/Year	Equipment No.
-----------------	---------------

Mileage/Hours	Date	Inspector Printed Name and Signature
Ref: Repair Order No.		

Required Action Key: (R) = Replace (A) = Adjust, Replace if necessary All Others = Inspect
Inspection Marking Key: ✓ = Satisfactory N/A = Not Applicable X = Deficiency (X) = Deficiency Corrected (Circled X)

SYSTEM	PM OPERATION	PERIODIC INTERVAL	MAJOR INTERVAL	ACTION TAKEN	INITIAL SIG BLOCK
AUX ENGINE (WHEN APPL.)	Engine oil.	R	R		
	Engine oil filter.	R	R		
	Fuel filter.				
	Drive belts.		A		
	Exhaust system.				
	Batteries.				
	Electrical.				
	Tune - up.		A		
HYDRAULICS/ GEAR BOX	Oil levels.	A	R		
	Filter cartridge (R twice per year).	R	R		
	Quick disconnects.				
	Flow control valve.				
	Air vents.				
	Bearings.				
SPINNER ASSEMBLY	Hinge rod.				
	Spinner disk.				
CONVEYOR ASSEMBLY	Conveyor chain.	A	A		
	Conveyor belt.				
PTO/DRIVE ASSEMBLY	U-joints.				
	Drive shaft.				

V-BOX SPREADER
PERIODIC/MAJOR INSPECTION CHECKLIST (Cont'd)

Inspection Remarks _____

Review By _____

Repair Remarks _____



PERIODIC/MAJOR INSPECTION CHECKLIST

SNOW PLOWS

Make/Model/Year	Equipment No.
-----------------	---------------

Mileage/Hours	Date	Inspectors Printed Name and Signature
Ref: Repair Order No.		

Required Action Key: (R) = Replace (A) = Adjust, Replace if necessary All Others = Inspect
Inspection Marking Key: √ = Satisfactory N/A = Not Applicable X = Deficiency (X) = Deficiency Corrected (Circled X)

SYSTEM	PM OPERATION	PERIODIC INTERVAL	MAJOR INTERVAL	ACTION TAKEN	INITIAL SIG BLOCK
MOLD BOARD/ CUTTING EDGE	Mold board.				
	Cutting edge.				
	Spring trip connections.				
TRIP SPRING	Tension adjusting bolts.	A	A		
	Trip action.	A	A		
HITCH/PUSH FRAME	Hitch mount bolts/brackets.				
	Push frame bolts/brackets.				
LIFT CHAINS	Chain links.				
	Length.				
SKIDS/WHEELS	Wheels (tread) (bearings).	A	A		
	Skid pads/shoes.	A	A		
HYDRAULICS	Lines/connections.				
	Fluid level.	A	A		
	Cylinders.				
	Cylinder connections.				

SNOW PLOWS
PERIODIC/MAJOR INSPECTION CHECKLIST (Cont'd)

Inspection Remarks _____

Review By _____

Repair Remarks _____

Class Exercise – Review Questions

Module 5 – PRE-TRIP INSPECTION

MNT812 Winter Weather Operations Training

1. [True/False] The pre-trip inspection, also known as the preventive maintenance (PM) inspection, is required as part of equipment preventive maintenance.
 - A. True
 - B. False
2. At TxDOT, the pre-trip inspection is the primary responsibility of the:
 - A. Shop Supervisor
 - B. Equipment Operator
 - C. Maintenance Supervisor
 - D. Newest Employee
3. The main purpose of the pre-trip inspection is to:
 - A. Document equipment use
 - B. Minimize costs of major repairs
 - C. Ensure operator and equipment safety
 - D. Reduce time lost due to equipment breakdown
4. The TxDOT Equipment PM Manual has *daily* inspection checklists for the following:
 - A. Dump truck
 - B. V-box spreader
 - C. Snow plow
 - D. All of the above
5. [True/False] The “in cab” part of the pre-trip inspection for a dump truck should include checking the heater/defroster.
 - A. True
 - B. False
6. [True/False] The pre-trip inspection for a V-box spreader should include checking that the unit is tied down properly.
 - A. True
 - B. False
7. [True/False] The pre-trip inspection for a snow plow should include checking the controls for up-down and left-right.
 - A. True
 - B. False

MODULE 6

Snow and Ice Control Materials



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012

Learning Objectives

SNOW AND ICE CONTROL MATERIALS

Upon completion of this section, the learner will be able to:

1. List the typical materials that TxDOT uses for snow and ice control
2. List safety considerations associated with chemical usage



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.2

Learning Objectives, cont'd.

SNOW AND ICE CONTROL MATERIALS

3. Identify application methods and rates for anti-icing applications.
4. Identify application methods and rates for de-icing applications.
5. Explain how TxDOT minimizes the effect of chemicals on the environment.



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.3



SNOW AND ICE CONTROL
MATERIALS



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.4

Exercise 6.1

TxDOT Snow and Ice Control Materials



Individual assignment:

1. Identify the granular chemicals TxDOT uses.
2. Identify the liquid chemicals TxDOT uses.
3. Abrasives are used for: _____.

Be prepared to discuss your answers (2 minutes).



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.5

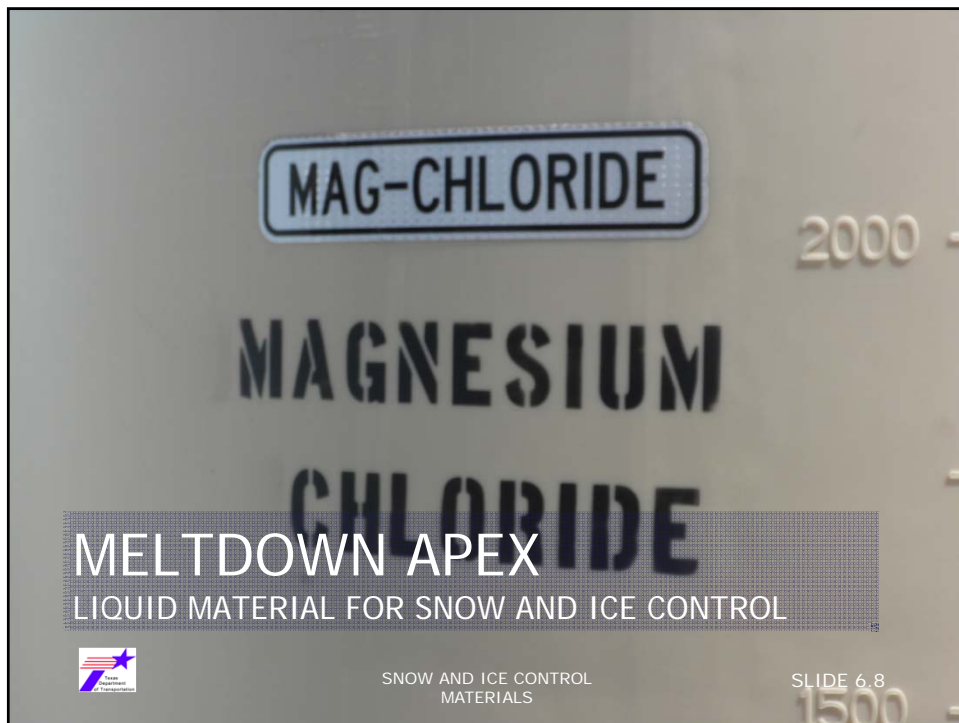
ROAD SALT

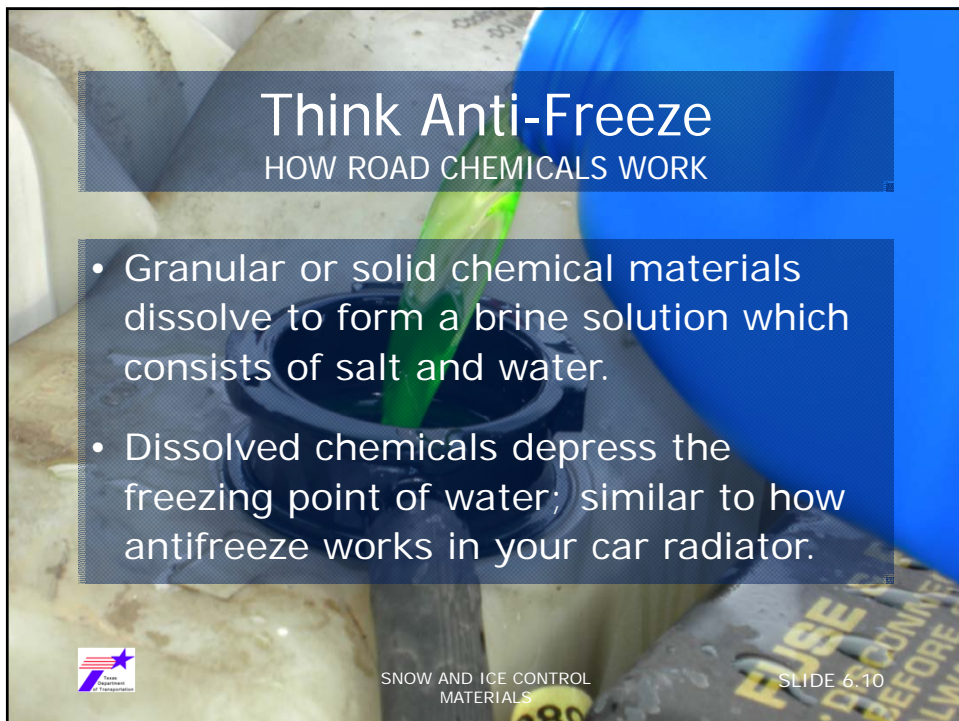
GRANULAR MATERIAL FOR SNOW AND ICE CONTROL



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.6





Prevent the Bond

HOW ROAD CHEMICALS WORK

- The goal is to prevent the bond between snow/ice and the pavement surface (anti-icing) or to destroy the bond (de-icing).
- The concentration of the brine and the temperature of the pavement are the key variables determining whether and how fast the chemical will act.



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.11

Melting Ice is Reactive

HOW ROAD CHEMICALS WORK

- Chemicals are applied to prevent or break the bond between ice and snow to the road surface.
- We don't use chemicals to "burn off" or remove the snow.
- We remove snow & ice with the plow – we make it *easier* to remove with the chemicals.



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.12

Let Chemicals Work for You

HOW ROAD CHEMICALS WORK



YOU DO THE WORK
←




→
CHEMICALS DO THE WORK




SNOW AND ICE CONTROL MATERIALS

SLIDE 6.13



SNOW AND ICE CONTROL

SAFETY CONSIDERATIONS



SNOW AND ICE CONTROL MATERIALS

SLIDE 6.14

Health and Safety Issues


HOW ROAD CHEMICALS WORK

- Eye Irritant
- Skin Irritant
- Breathing Irritant
 - Dust Inhalation
 - Mist Inhalation
- Best Practices
 - Good Personal Hygiene
 - Personal Protective Equipment



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.15



ENVIROTECH
SERVICES, INC.

MATERIAL SAFETY DATA SHEET

SECTION I: PRODUCT, COMPANY AND SHIPPER IDENTIFICATION

Product Name: **MeltDown® 20 Granular Deicer**
 Chemical Name: *Complex Chloride—Sodium Chloride, Potassium Chloride, Magnesium Chloride, Calcium Chloride with corrosion inhibition*
 Manufacturer: *Redmond Minerals, Inc. (801) 423-1622*
PO Box 219
Redmond, UT 84652

Sales/Distributor: *EnviroTech Services, Inc. (970) 346-3900*
910 54th Avenue, Suite 230
Greeley, CO 80634

Chemtec: *(800) 424-9300*

SECTION II: COMPOSITION / INFORMATION ON INGREDIENTS

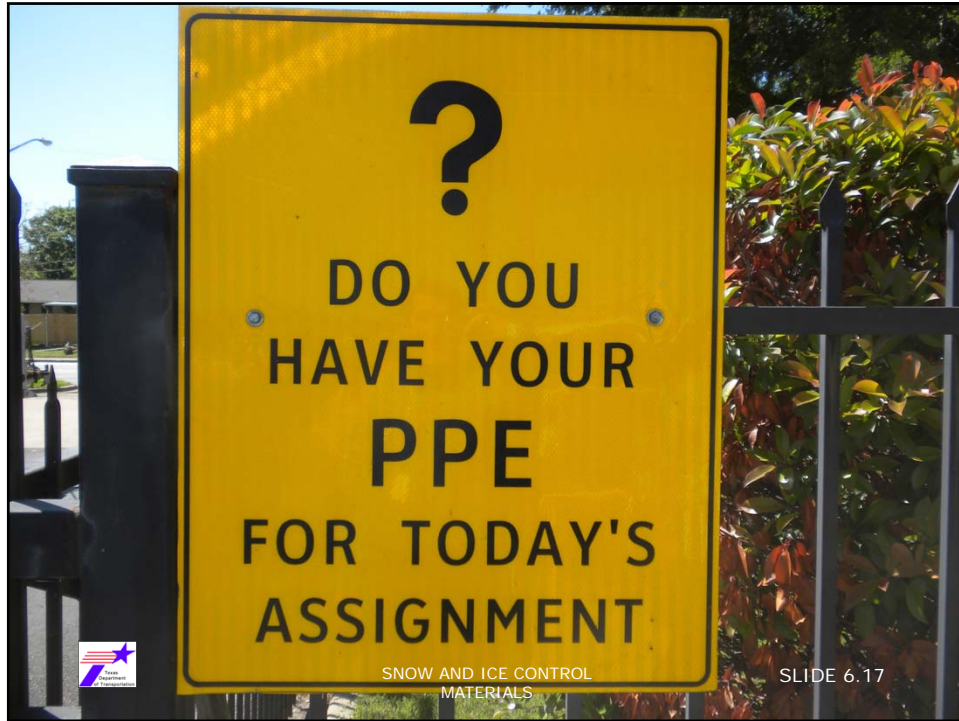
Ingredients	CAS Number	Percent
Sodium Chloride	7647-14-5	90 - 98
Magnesium Chloride	7791-18-6	0.06 - 0.20
Potassium Chloride	7447-40-7	0.03 - 0.20
Calcium Chloride	10043-52-4	0.30 - 1.40
Corrosion Inhibitor	None Exists	Proprietary

SECTION III: HAZARDS IDENTIFICATION

Emergency Overview: *This MSDS has been compiled as a response to customer requests*

MSDS

SLIDE 6.16





Anti-icing is Proactive
BEST MANAGEMENT PRACTICES

- Anti-icing involves applying “chemistry”, typically in liquid form, before the storm starts

 SNOW AND ICE CONTROL MATERIALS SLIDE 6.19



Anti-Icing
HOW IT WORKS

- Anti-icing is designed to prevent snow and ice from bonding to the road (pavement) and to prevent the formation of frost.
- This makes it [much] easier to remove snow and ice.

 SNOW AND ICE CONTROL MATERIALS SLIDE 8.20

VIDEO 6.1 (02:12) Anti-Icing Operations



CREDIT

“Winter Operations Training Series”

Iowa Department of Transportation

Used with permission.



R
6.1
[6.23]



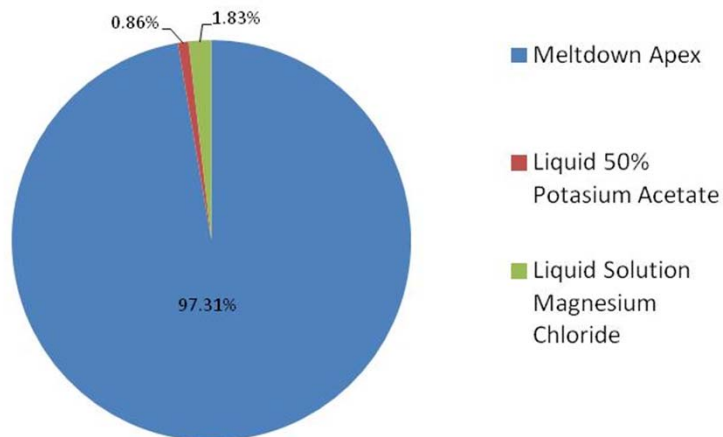
SNOW AND ICE CONTROL MATERIALS

SLIDE 6.21

Anti-Icing Chemicals USAGE AT TXDOT

Percentage Chemical Purchased

Annual Average Quantity, 2007-2011



SNOW AND ICE CONTROL MATERIALS

SLIDE 6.22

TxDOT Application Rates

LIQUID SPRAY APPLICATIONS

Product	Material	Unit	Rate (Unit/Lmi)	Cost (\$/Unit)	Comments
Road Salt	NaCl	gal	60	\$0.066	Anti-icing (Brine)
Meltdown Apex	MgCl ₂	gal	20	\$1.68	Anti-icing (Brine)
Meltdown Apex	MgCl ₂	gal	40	\$1.68	De-icing (Brine)

NOTE: See your supervisor for application rates in your area!



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.23

Not Always Recommended

ANTI-ICING OPERATIONS

- Liquid anti-icing material (magnesium chloride) should not be applied when the pavement surface is warm (above freezing)
- This can cause slick pavement
- Do not apply material too heavily
- For the first application or after a prolonged dry spell, apply liquids at half the rate
- See your Supervisor for accepted practice in your District



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.24

TxDOT Application Rates ANTI-ICING

- Local experience is key
- Ask your supervisor about application rates for your District



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.25



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.26



SNOW AND ICE CONTROL MATERIALS
DE-ICING



SNOW AND ICE CONTROL MATERIALS

SLIDE 6.27



De-Icing is Reactive
BEST MANAGEMENT PRACTICES

- De-icing involves applying “chemistry” to the road *after* a storm starts.
- In this situation, the snow and ice are already bonded to the pavement surface.



SNOW AND ICE CONTROL MATERIALS4

SLIDE 6.28



De-Icing HOW IT WORKS


- De-icing seeks to break the bond between the pavement and accumulated snow and ice.
- More resources (labor, equipment, materials) and time are required to break the bond, melt snow and ice, and achieve the LOS.



SNOW AND ICE CONTROL MATERIALS

SLIDE 6.29

VIDEO 6.2 (03:06) De-Icing Operations




CREDIT


“Winter Operations Training Series”


Iowa Department of Transportation

Used with permission.



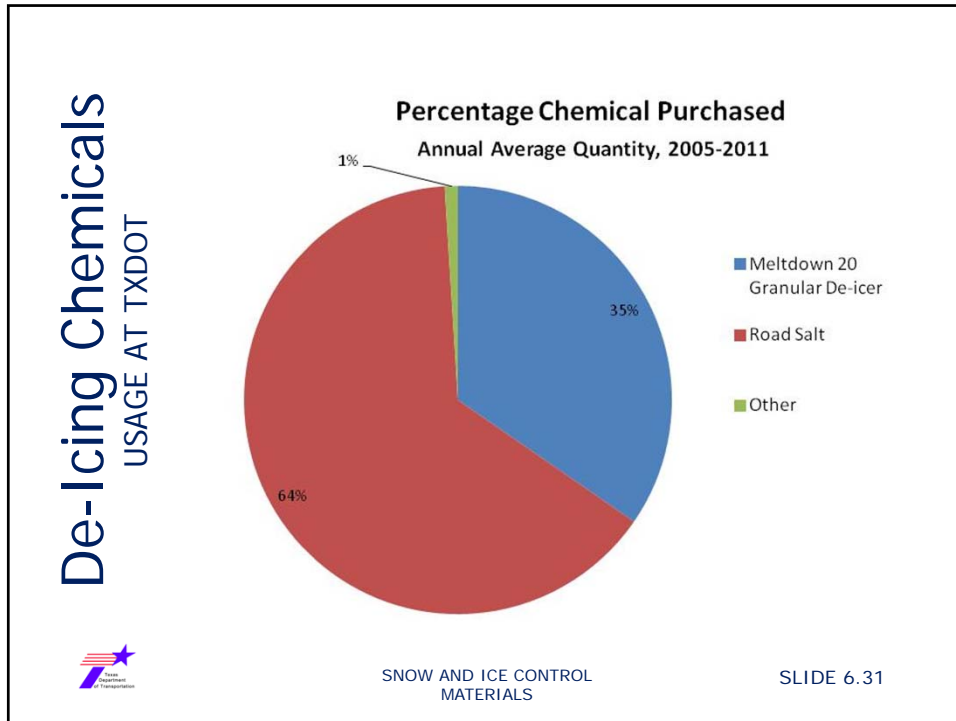
"Anti-Icing & Deicing" 30:19
"Winter Weather Resources" 35:00





SNOW AND ICE CONTROL MATERIALS

SLIDE 6.30



TxDOT Application Rates

GRANULAR SPREADER APPLICATIONS

Product	Material	Unit	Rate (Unit/Lmi)	Cost (\$/Unit)	Comments
Road Salt	NaCl	lb	300	\$0.033	De-icing (Granular)
Meltdown 20	NaCl + additives	lb	200	\$0.23	De-icing (Granular)

NOTE: See your supervisor for application rates in your area!

SNOW AND ICE CONTROL MATERIALS

SLIDE 6.32

TxDOT Application Rates DE-ICING

- Local experience is key
- Ask your supervisor about application rates for your District



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.33



SNOW AND ICE CONTROL
MATERIALS


SLIDE 6.34



Chemical Impacts

CHEMICALS... THE ENVIRONMENT

- Infrastructure Impacts
 - Structures (bridges, buildings)
 - Roadway pavement and structure
 - Vehicles and equipment
- Environmental Impacts
 - Soil
 - Animals
 - Vegetation
 - Water
 - Air
 - Human health

 SNOW AND ICE CONTROL MATERIALS SLIDE 6.36

Operational Issues

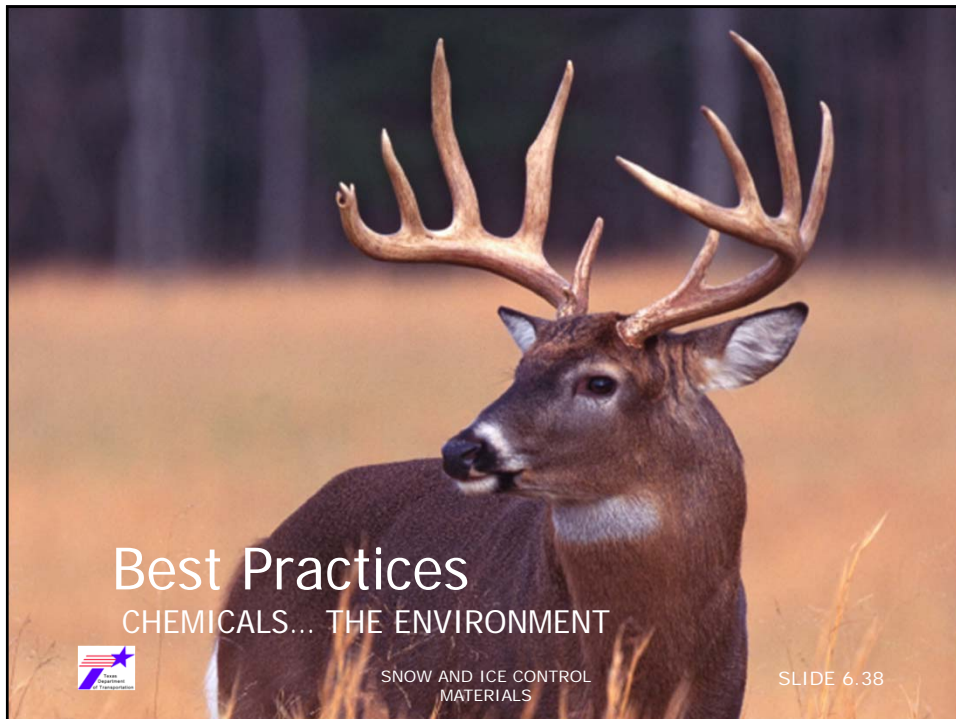
CHEMICALS... THE ENVIRONMENT

- Traffic is necessary to “slush” the road
- Effectiveness drops with dilution and temperature
- Requires thorough cleaning of:
 - Equipment after each storm event
 - Structures after the winter season
- Environmental concerns may result:
 - Excessive chemical usage
 - Improper chemical storage



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.37



Best Practices

CHEMICALS... THE ENVIRONMENT



SNOW AND ICE CONTROL
MATERIALS

SLIDE 6.38



Summary and Review

1. Common TxDOT snow and ice control materials
2. Chemical safety
3. Anti-icing... liquid spray application
4. De-icing... granular application
5. Chemicals and the environment



Exercise 6.1

TxDOT Snow and Ice Control Materials



Individual assignment:

1. Identify the granular chemicals TxDOT uses.
2. Identify the liquid chemicals TxDOT uses.
3. Abrasives are used for: _____.

*Be prepared to discuss your answers
(2 minutes).*



VIDEO 6.1. ANTI-ICING OPERATIONS (02:12)

SCRIPT

As we discussed earlier, anti-icing is a road maintenance strategy that tries to keep the bond between ice and pavement surface from forming.

An anti-icing technique that is proven effective is the spreading of brine on the roadway before or at the very beginning of a storm.

By applying brine prior to a precipitation event, it adheres to the surface of the roadway and is ready to go to work when the rain or snow begins to fall. This speeds up the entire melting process and also makes roadways easier to plow. Even if the forecast precipitation does not fall, most of the salt will remain on the roadway ready to go to work when the next precipitation event occurs.

Brine application rates can range from 25 to 60 gallons per lane mile depending on conditions. Your supervisor will tell you what rates should be applied.

When applying brine, always be on the alert for rapidly declining pavement temperatures and rising winds. Be especially cautious when it looks like pavement temperatures will fall below 20 degrees and winds exceed 15 mph.

The keys to applying brine as an anti-icer are accurate weather forecasts, knowing the pavement temperatures, and understanding the de-icing chemicals you are using.

Carried out successfully, anti-icing procedures can provide a higher level of service to the traveling public and reduce total chemical use.

Anti-icing techniques are also being used to treat frost. When frost is predicted, brine applied in the afternoon is effective to prevent frost if there is no intervening precipitation.

However there are a few storms when any single strategy is adequate. You will find that it will not be unusual to start fighting a storm with anti-icing procedures, switch to de-icing, and before the storm ends, go back to using liquid chemicals.

Your supervisor is in charge of managing these transitions.

Page intentionally left blank.

VIDEO 6.2. DE-ICING OPERATIONS (03:06)

SCRIPT

De-icing and anti-icing chemicals like sodium chloride work by lowering the freezing point of water. The actual freeze point of a solution is governed by the concentration of salt in that solution.

It is this freezing point depression characteristic that makes de-icing chemicals so useful and why sodium chloride and calcium chloride are called freeze point depressants because they depress the freezing point temperature of water.

Anti-freeze in your vehicle is also a freeze point depressant. As we all know, water freezes at 32 degrees Fahrenheit. Straight anti-freeze freezes at 2 degrees. However, when you mix 50 percent anti-freeze with 50 percent water, the freeze point temperature of the mixture is lowered to minus 35 degrees.

Like anti-freeze, deicers are less effective when too little or too much is used.

When a solid deicer like salt is applied to an ice covered pavement, it must first dissolve and become a solution before melting can occur. The moisture can come from pre-wetting the salt or from moisture on the highway.

Calcium chloride, as we have learned, can draw moisture from the air to begin the melting process.

However, too much moisture can rapidly slow or halt the melting point process. Dilution of the solution quickly reduces melting power.

Dilution of the solution always takes place as melting occurs or additional precipitation falls. Whether it be in the form of rain or snow, dilution of solution may always be considered when applying dry and liquid de-icing chemicals.

When applying salt, the idea is to concentrate much of the chemical over the middle of the roadway so that as it begins the melting process, the melting liquid moves away from the crest of the roadway towards the outside.

It is important to keep as much of the material on the roadway as possible. Traveling too fast or having the spinner moving too fast can result in more material on the shoulders and in the ditch than on the roadway. Low spinner speed is recommended to concentrate materials on the highway.

The only exception is when treating intersections, use a higher spinner speed to spread material across the entire intersection.

Refer to the calibration chart for truck speed and auger speed for proper application rates.

As you have learned, the amount of salt that should be applied per lane mile can vary considerably depending on many conditions: pavement temperature, weather temperatures are rising or falling, the amount of traffic, the type of precipitation forecast, and the roadway characteristics. Whether it is a shaded cut along a grove of trees or a curve, your supervisor will let you know what rate to apply or offer you advice depending on the conditions.

Class Exercise – Review Questions
Module 6 – SNOW AND ICE CONTROL MATERIALS

MNT812 Winter Weather Operations Training

1. TxDOT primarily uses which of the following snow and ice control chemicals:
 - A. Salt brine, Road salt, Meltdown Apex, Calcium chloride
 - B. Meltdown 20, Meltdown Apex, Road salt, Salt brine
 - C. Road salt, Potassium acetate, Meltdown 20, Meltdown Apex
 - D. Freeze Guard, Salt brine, Meltdown 20, Road salt

2. Snow and ice control chemicals are known to cause health and safety issues for which of the following:
 - A. Skin
 - B. Eye
 - C. Breathing
 - D. All of the above

3. [True/False] Meltdown Apex can be applied either as a liquid (brine) or in dry granular form.
 - A. True
 - B. False

4. [True/False] For de-icing applications, Meltdown 20 is applied at an initial application rate of 200 pounds per lane mile.
 - A. True
 - B. False

5. [True/False] Road salt can be applied either as a liquid (brine) or in dry granular form.
 - A. True
 - B. False

6. [True/False] You should always see your supervisor to obtain the proper chemical application rate for your particular Maintenance Section.
 - A. True
 - B. False

7. [True/False] Because snow and ice control chemicals are highly corrosive, there is really nothing TxDOT employees can do to minimize their impact on infrastructure or the environment.
 - A. True
 - B. False

MODULE 7

Calibrate a V-Box Spreader



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012

Learning Objectives

Upon completion of this section, the learner will be able to:

1. Explain the basic goal of calibration
2. Read a calibration chart
3. Comprehend the importance of calibrating a granular material spreader in order to “hit the target rate” when applying snow and ice chemicals



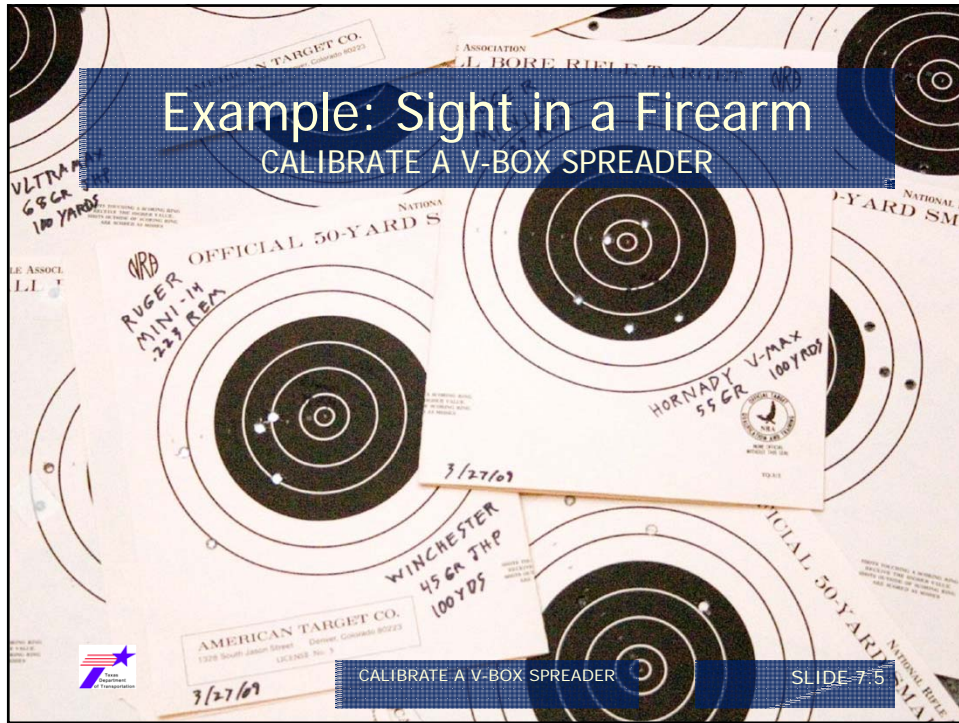


The Goal of Calibration

CALIBRATE A V-BOX SPREADER

- Calibration is to confirm that the V-box operational settings used to deliver salt or MD20 are reliable...
- “The amount of material applied corresponds to the target application rate”





TxDOT Application Rates

GRANULAR SPREADER APPLICATIONS

Product	Material	Unit	Rate (Unit/Lmi)	Cost (\$/Unit)	Comments
Road Salt	NaCl	lb	300	\$0.033	De-icing (Granular)
Meltdown 20	NaCl + additives	lb	200	\$0.23	De-icing (Granular)

NOTE: See your supervisor for application rates in your area!



Several Factors Affect Calibration

CALIBRATE A V-BOX SPREADER

Factors that are SET

- Type of V-box
 - Hydraulic system performance
 - Operating condition
- Type of chemical
 - Road salt
 - Meltdown 20
- Condition of stockpile
 - Particle size
 - Moisture content

Factors you ADJUST

- Feed gate opening
 - Height above conveyor
- Material feed rate
 - Conveyor
- Forward ground speed
 - Travel speed
- Spread pattern width
 - Spinner rotation speed
 - Flap (baffle) setting

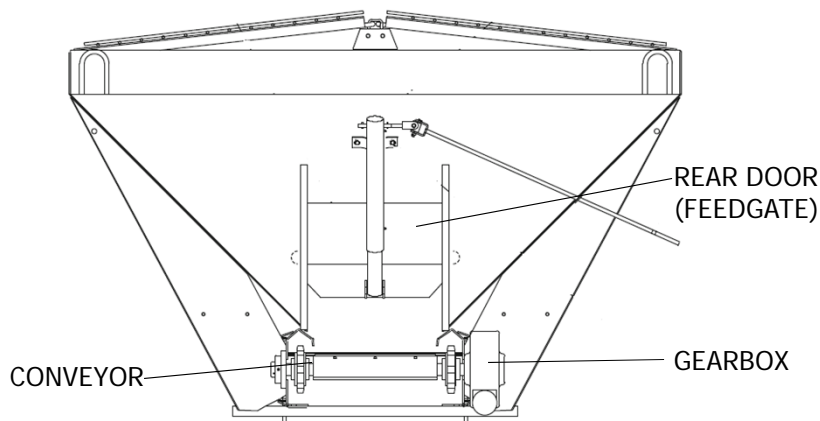


CALIBRATE A V-BOX SPREADER

SLIDE 7.7

Where Calibration Happens

CALIBRATE A V-BOX SPREADER



CALIBRATE A V-BOX SPREADER

SLIDE 7.8











V-BOX SAFETY



CAUTION
Use care when mounting or dismounting.
IF DEFACED - ORDER PART NO. 0001498

CAUTION

1. Keep all guards/shields in place.
2. Make certain everyone is clear of machine before starting engine or operation.
3. Keep hands, feet and clothing away from power driven parts.
4. Disengage PTO, shut off hydraulic valve and set parking brake before leaving operator's position. Make sure all movement has stopped before servicing or unloading machine.
5. Make sure machine is solidly supported when it is being mounted, dismantled or stored.
6. Use flashing lights when operating machine.

IF DEFACED - ORDER PART NO. 0001494



DANGER
Moving conveyor/auger
• Disconnect and lockout power before servicing, adjusting or cleaning.
• Keep hands, feet, hair and loose clothing away from moving parts at all times.
• Never remove or modify guards or shields.
Failure to heed will result in death or injury.
IF DEFACED - ORDER PART NO. 0001494



WARNING
Flying debris.
Stay clear and wear eye protection.
Failure to heed will result in serious injury.
IF DEFACED - ORDER PART NO. 0001497



WARNING
Turning spinners throw material. Stay clear and wear eye protection while spinner is turning. Failure to heed will result in serious injury.
IF DEFACED - ORDER PART NO. 0001492



DANGER
Moving conveyor!
• Disconnect and lockout power before servicing, adjusting or cleaning.
• Keep hands, feet, hair and loose clothing away from moving parts at all times.
• Never remove or modify guards or shields.
Failure to heed will result in death or injury.
IF DEFACED - ORDER PART NO. 0001494


DANGER
Keep all guards/shields in place. Moving parts can crush and dismember.
IF DEFACED - ORDER PART NO. 0002310

CALIBRATE A V-BOX SPREADER SLIDE 7.18

V-Box Safety

CALIBRATE A V-BOX SPREADER

- Calibration of a V-box spreader requires the majority of the work to be done in the vicinity of the spinner
- In an effort to minimize the possibility of an accident or injury during the calibration process, the spinner should be removed from the spreader box before the field exercise begins

 CALIBRATE A V-BOX SPREADER SLIDE 7.19



SAFETY: Remove the Spinner
CALIBRATE A V-BOX SPREADER

 CALIBRATE A V-BOX SPREADER SLIDE 7.20

Calibration Method

CALIBRATE A V-BOX SPREADER

1. Warm up truck
2. Place load of material in V-box
3. Mark the conveyor shaft
4. Rev truck engine to 2000 RPM
5. Count number of shaft revolutions per minute
6. Collect material for one revolution
7. Do the math (calibration chart)



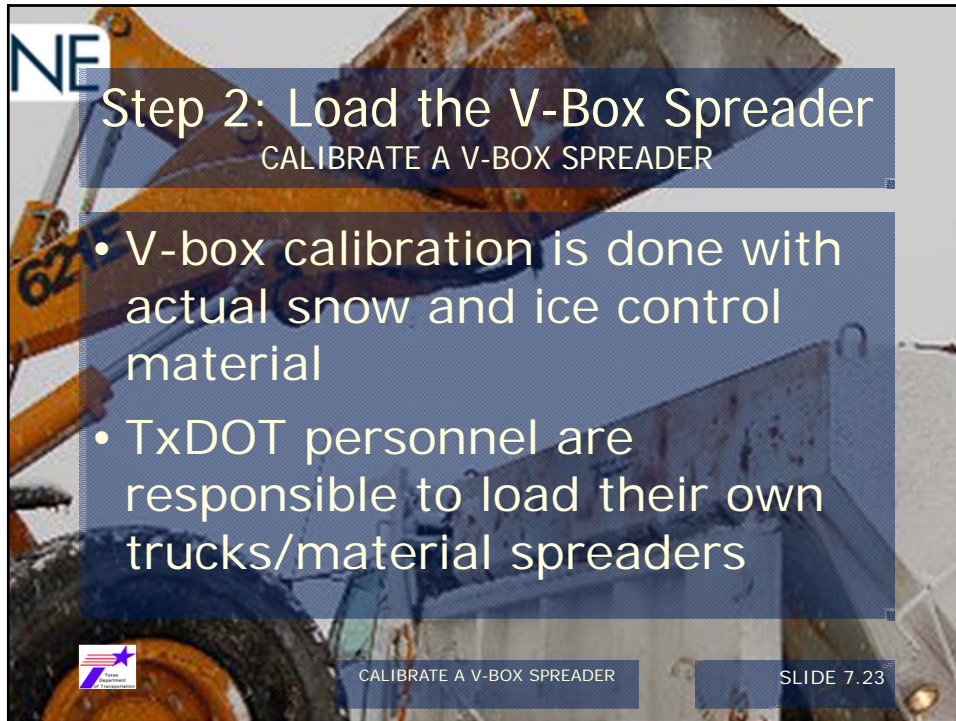
CALIBRATE A V-BOX SPREADER

SLIDE 7.21



CALIBRATE A V-BOX SPREADER


SLIDE 7.22



Step 2: Load the V-Box Spreader


CALIBRATE A V-BOX SPREADER

- V-box calibration is done with actual snow and ice control material
- TxDOT personnel are responsible to load their own trucks/material spreaders


 CALIBRATE A V-BOX SPREADER SLIDE 7.23


VIDEO 7.1 (00:44)


Loading Material into a V-Box Spreader



CREDIT
Tyler District
Texas Department of Transportation





 CALIBRATE A V-BOX SPREADER SLIDE 7.24





Step 7: Do the Math

CALIBRATE A V-BOX SPREADER

- Use the calibration chart
- Multiply shaft RPM (rev/min) from **Column A** by discharge per revolution (lb/rev) from **Column B** to get discharge rate in pounds per minute (lb/min) from **Column C**.



CALIBRATE A V-BOX SPREADER

SLIDE 7.29

Salt Institute Calibration Chart

CALIBRATE A V-BOX SPREADER

Agency: _____
 Location: _____
 Truck No.: _____ Spreader No.: _____
 Date: _____ By: _____

Control Setting	GATE OPENING (HOPPER TYPE SPREADERS)			POUNDS DISCHARGED PER MILE									
	A	B	C	MINUTES TO TRAVEL ONE MILE									
	Shaft RPM (Loaded)	Discharge Per Revolution (Pounds)	Discharge Rate (Lbs/Min)	5 mph x 12.00	10 mph x 6.00	15 mph x 4.00	20 mph x 3.00	25 mph x 2.40	30 mph x 2.00	35 mph x 1.71	40 mph x 1.50	45 mph x 1.33	
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													



CALIBRATE A V-BOX SPREADER

SLIDE 7.30

Calibration Chart Legend

CALIBRATE A V-BOX SPREADER

- **Column A:** Conveyor shaft revolutions per minute (RPM or rev/min, loaded)
- **Column B:** Pounds of material discharged per revolution (lb/rev)
- **Column C:** Material discharge rate in pounds per minute (lb/min)



CALIBRATE A V-BOX SPREADER

SLIDE 7.31

VIDEO 7.2 (02:17) Calibrate a V-Box Spreader

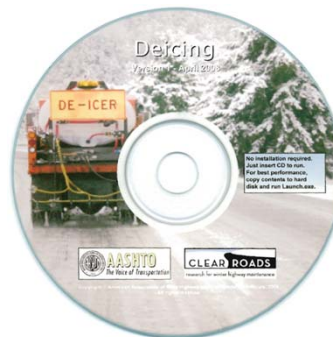


CREDIT

“Deicing”

AASHTO Winter
Roadway Maintenance
Computer-Based
Training

Used with permission.



CALIBRATE A V-BOX SPREADER

SLIDE 7.32

Calibration Settings

CALIBRATE A V-BOX SPREADER

- For the purposes of this field exercise, we will count the number of shaft revolutions per minute for the conveyor speed and gate opening that are normally used for the selected material in the host maintenance section/district.



CALIBRATE A V-BOX SPREADER

SLIDE 7.33

FIELD Exercise 7.1

Calibrate a V-Box Spreader



- Refer to handout for detailed calibration procedure



CALIBRATE A V-BOX SPREADER

R_{7.3}
[7.27]

SLIDE 7.34

Complete the Calibration Chart

CALIBRATE A V-BOX SPREADER

Agency: Texas Dept. of Transportation
 Location: LBB District Office
 Truck No.: 4856-F Spreader No.: 4856-F
 Date: 06/28/2012 By: W.D. Lawson

GATE OPENING (HOPPER TYPE SPREADERS)			POUNDS DISCHARGED PER MILE											
Control Setting	A Shaft RPM (Loaded)	B Discharge Per Revolution (Pounds)	C Discharge Rate (Lbs/Min)	MINUTES TO TRAVEL ONE MILE										
				5 mph x 12.00	10 mph x 6.00	15 mph x 4.00	20 mph x 3.00	25 mph x 2.40	30 mph x 2.00	35 mph x 1.71	40 mph x 1.50	45 mph x 1.33		
1														
2														
3														
4	30	7.0	210	2520	1260	840	630	504	420	359	315	279		
5														
6	←READ	←READ	←CALC				←CALC							
7														
8														
9														
10														



CALIBRATE A V-BOX SPREADER

SLIDE 7.35



CALIBRATE A V-BOX SPREADER

WHY CALIBRATION IS IMPORTANT



CALIBRATE A V-BOX SPREADER

SLIDE 7.36

Why Calibrate? CALIBRATE A V-BOX SPREADER

- Calibration helps confirm that the V-box operational settings used to deliver salt or MD20 are reliable...
 - Less chemical use... *efficiency*
 - Lower cost... *economy*
 - Reduced impact... *environment*



CALIBRATE A V-BOX SPREADER

SLIDE 7.37

VIDEO 7.3 (01:10) Salt Application Rate Comparison

CREDIT

“Winter Operations Training Series”

Iowa Department of
Transportation

Used with permission.



CALIBRATE A V-BOX SPREADER

SLIDE 7.38

Thoroughly Clean After Use

INSPECT AND MAINTAIN V-BOX SPREADER

- Remove remaining snow and ice control material from spreader box
- Carefully, completely, and thoroughly clean and wash the V-box spreader
- Thoroughly oil the conveyor chain system and apply an anti-corrosion protective sealer




CALIBRATE A V-BOX SPREADER

SLIDE 7.39




CALIBRATE A V-BOX SPREADER

SLIDE 7.40




Summary and Review


1. Explain the basic goal of calibration
2. Read a calibration chart
3. Comprehend the importance of calibrating

 CALIBRATE A V-BOX SPREADER SLIDE 7.42

FIELD Exercise 7.1
Calibrate a V-Box Spreader



- Refer to handout for detailed calibration procedure



CALIBRATE A V-BOX SPREADER

R_{7.3}
[7.27]

SLIDE 7.34

VIDEO 7.1. LOADING MATERIAL INTO A V-BOX SPREADER (00:44)

SCRIPT

The front end loader is another type of equipment used for winter weather operations.

Whether the snow and ice control material is road salt or Meltdown20, or an abrasive such as ice chatt, the material first has to be loaded into the V-Box.

At TxDOT, the truck operator not only operates the V-Box, but also is responsible to load the V-Box. Under winter conditions, this requires care and caution.

With the truck properly loaded and checked, the operator may proceed with de-icing operations.

VIDEO 7.2.CALIBRATE A V-BOX SPREADER (02:17)

SCRIPT

Since no 2 spreaders are exactly alike, each one must be calibrated before winter. The salt institute has an easy calibration method. First, some salt is placed in the spreader to put weight on the auger or conveyor. Next, the end of the auger or conveyor shaft is marked. Now, the number of complete turns the shaft makes in one minute at each setting of the auger or conveyor control are counted. This figure is recorded.

With a V-Box, the gate opening must be recorded because the calibration will only be correct for only that particular size opening. A sample calibration at one control setting will help explain how to calibrate.

At setting 4 for example, the shaft might make 5 revolutions. With a piece of canvas or other suitable material or container, the salt discharged by just one complete turn of the shaft is collected.

Let's assume that 50 pounds of salt is discharged in one turn of the shaft, this figure will not change no matter how fast or slow the shaft turns. To find out how much salt is discharged per minute, the number of pounds is multiplied by the number of turns per minute. At setting 4, it's 5 times 50, 250 pounds.

If we know how much salt is discharged per minute and how many minutes it takes to go one mile, it is easy to determine the salt discharge per one mile.

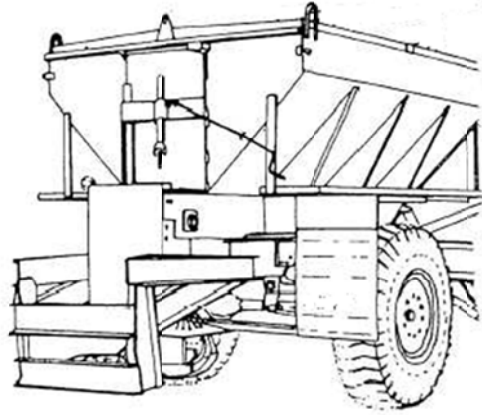
Charts are available that translate miles per hour into minutes required to travel one mile. For example, it takes 2 minutes to go one mile if the speed is 30 mph. That's 2 minutes worth of salt or 2 times 250, 500 pounds per mile.

The calibration card should be placed in the truck and kept there and a duplicate should be filed in the office.

LEARNING EXERCISE 7.1
Calibrate a V-Box Spreader
Winter Weather Operations Training

Equipment Needed for this Exercise:

1. Dump truck (6 CY or 10 CY capacity) with V-box spreader
2. Low-profile (flat) scale with 150-pound capacity for weighing granular material
3. Granular material collection device (bucket, container, tarp or other suitable vessel)
4. Chalk, pen or other suitable marker for marking the end of the conveyor shaft
5. Stop watch or watch with second hand
6. Calibration form, pencil, eraser, and calculator



V-BOX SAFETY

- Read all installation, safety and maintenance instructions completely before operating this equipment.
 - Keep all personnel clear of moving parts while equipment is being operated.
 - While operating this equipment, use common sense, use caution, be alert and be safety-conscious.
-

Learning Objectives

Upon completion of this field exercise, the learner will be able to:

- 1.) Calibrate a V-Box spreader
- 2.) Comprehend the importance of calibrating a granular material spreader in order to “hit the target rate” when applying snow and ice chemicals

Introduction

When you compare the relatively insignificant cost of spreader calibration to the benefits that result from this activity, it's easy to see why annual calibration is one of the most cost-effective

ways to optimize your maintenance section's usage of snow and ice control materials. Along with the correct application technique, proper calibration is the first step towards reduced chemical use, greater efficiency, and increased cost effectiveness.

Regardless of the type of spreader being used, it is extremely important to calibrate the system to ensure that the desired quantity of material is actually being applied to the road. In this field exercise, we will look at getting the "right amount" of material on the road by ensuring that your spreader has been properly calibrated.

Spreader Calibration Procedure

Calibration of spreaders is simply calculating the number of pounds of material discharged per mile at various spreader control settings and truck speeds. This is accomplished by first counting the number of conveyor shaft revolutions per minute, measuring the material discharged in one revolution, then multiplying the two to obtain the discharge rate, and finally, multiplying the discharge rate by the minutes it takes to travel one mile.

Keep in mind that different materials will spread at different rates at the same setting, so spreaders must be calibrated with the material that will be used. If your maintenance section uses more than one type of snow and ice control material, a calibration must be performed for each material.

With hopper-type spreaders, specific gate openings must be calibrated. The "gate opening" must be measured from the floor of the conveyor to the bottom edge of the gate. Each spreader must be calibrated individually; even the same models can vary widely at the same setting.

A sample **Calibration Chart** from the Salt Institute is provided (see Page 7.30). The calibration calculations may also be performed on a computer after the input information is obtained in the field; a calibration form is available in Microsoft Excel format. The Maintenance Division has a copy of this spreadsheet.

With reference to the **Calibration Chart**, the following columns define the material discharge rate:

- **Column A:** Conveyor shaft revolutions per minute (RPM or rev/min, loaded)
- **Column B:** Pounds of material discharged per revolution (lb/rev)
- **Column C:** Material discharge rate in pounds per minute (lb/min)

Calibration, then, consists of *measuring* data for Column A and Column B and *calculating* the quantity in Column C. Once Column C is determined, it is possible to calculate the pounds of material delivered at various speeds (the other columns in Figure 1).

Calibration Steps

- 1.) Warm up the truck so that the hydraulic oil is at normal operating temperature with the spreader system running.

- 2.) Place a partial load of material in the V-Box (road salt or Meltdown 20).
- 3.) Mark the shaft end of the conveyor to measure rotation.
- 4.) Rev truck engine to operating RPM (at least 2000 RPM). It would be best to match the RPM that corresponds to the normal speed at which the selected material is distributed on the road.
- 5.) Count the number of shaft revolutions per minute at each spreader control setting, as shown on the **Calibration Chart**. Record your answer.

For the purposes of this field exercise, we will count the number of shaft revolutions per minute for the conveyor speed (auger control setting) and gate opening that are normally used for the selected material in the host maintenance section.

- 6.) Collect material for one revolution of the shaft and weigh. Be sure to deduct the weight of the container.

For greater accuracy you may collect snow and ice control material for several revolutions of the shaft and divide the total weight by the number of turns to get the weight for one revolution. This can be accomplished at idle or at very low engine RPM.

- 7.) Multiply shaft RPM (rev/min) from Column A by discharge per revolution (lb/rev) from Column B to get discharge rate in pounds per minute (lb/min) from Column C. Then, multiply discharge rate (lb/min) by the number of minutes to travel one mile at various truck speeds to get pounds discharged per mile (lb/mile).

Example Problem

Determine weight of material discharged per mile (**lb/mile**) given 30 shaft revolutions per minute (RPM or rev/min) and 7.0 pounds of material discharged per revolution (lb/rev) at a truck speed of 20 miles per hour (mph).

$$\text{Material Discharged/Mile (lb/mile)} = [(30 \text{ rev/min})(7 \text{ lb/rev})(60 \text{ min/hr})] \div (20 \text{ miles/hr})$$

$$\text{Material Discharged/Mile (lb/mile)} = \underline{\underline{630 \text{ lb/mile}}}$$

Comment about Spinner Rotation Speed and Flap Settings

This calibration procedure assumes that all material delivered by the conveyor into the spinner chute will be delivered to one lane of roadway. However, the spinner rotation speed and flap settings can also be adjusted. If the flaps (also called “baffles”) are opened wide and the spinner speed is high, it is possible to spread material to three lanes of roadway. This means that a definitive calibration of the amount of material delivered per lane mile must also account for the flap settings and spinner rotational speed.

CALIBRATION CHART

Agency: _____

Location: _____

Truck No.: _____ Spreader No.: _____

Date: _____ By: _____

GATE OPENING (HOPPER TYPE SPREADERS)				POUNDS DISCHARGED PER MILE								
	A	B	C	MINUTES TO TRAVEL ONE MILE								
Control Setting	Shaft RPM (Loaded)	Discharge Per Revolution (Pounds)	Discharge Rate (Lbs/Min)	5 mph x 12.00	10 mph x 6.00	15 mph x 4.00	20 mph x 3.00	25 mph x 2.40	30 mph x 2.00	35 mph x 1.71	40 mph x 1.50	45 mph x 1.33
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

SOURCE: The Salt Institute

VIDEO 7.3. SALT APPLICATION RATE COMPARRISON (01:10)

SCRIPT

The DOT has a variety of salt and sand spreaders. Most have spinners to spread materials on the roadway.

Proper calibration of chemical application equipment is critical and must be done at least once a year for each mix you will be spreading.

Whenever a spreader is worked on it should also be recalibrated for each mix. Check with your supervisor on the method for calibration.

Refer to the calibrations chart for truck speed and auger speed for proper application rates.

If you apply salt at the rate of 300 lbs per lane mile and it all stays on the roadway, a square foot of pavement may look something like this.

Approximately 3 grains of salt weighing .0047 lbs./sq. ft. at the rate of 100 lbs/lane mi. a square foot of pavement would have this amount of salt, about 1 grain weighing .0015 lbs/sq. ft.

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Class Exercise – Review Questions
Module 7 – CALIBRATE A V-BOX SPREADER

MNT812 Winter Weather Operations Training

1. [True/False] It is best practice for each V-box spreader in your Maintenance Section to be calibrated every year.
 - A. True
 - B. False
2. [True/False] It is not possible to use a V-box spreader that has not been properly calibrated.
 - A. True
 - B. False
3. The primary goal of the V-box spreader calibration process is to:
 - A. Promote safety
 - B. Eliminate waste
 - C. Ensure reliability
 - D. Save money
4. [True/False] Because V-box spreader calibration is done in the maintenance yard in a controlled way, equipment safety considerations do not really apply.
 - A. True
 - B. False
5. [True/False] Reliable V-box spreader calibration means calibrating with the same kind of snow and ice control material that you use on the road in the winter.
 - A. True
 - B. False
6. [True/False] Calibration of the V-box spreader involves all of the following factors:
 - Feed gate opening (height)
 - Material feed rate (conveyor setting)
 - Forward ground speed (truck speed)
 - Spread pattern width (spinner rotation and flap settings)
 - A. True
 - B. False
7. [True/False] A separate calibration chart is required for each feed gate opening.
 - A. True
 - B. False

Continued on next page...

CALIBRATION CHART (US)													
Agency: Texas Department of Transportation													
Location: Southeast Maintenance Section													
Truck No: TRK 4856-F			Spreader No: TRK 4856-F										
Date: 28-Jun-12			By: John Operator										
Gate Opening			1.5 (inches)			DISCHARGE RATE (pounds discharged per mile)							
(Hopper Type Spreaders)													
		A	B	C	TRAVEL SPEED AND COMPUTATION MULTIPLIER ()								
Control Setting	Shaft RPM (Loaded)	Discharge per Revolution (pounds)	Discharge per Minute (lb) (A x B)	Discharge per Minute (lb) (A x B)	5 mph (x 12.00)	10 mph (x 6.00)	15 mph (x 4.00)	20 mph (x 3.00)	25 mph (x 2.40)	30 mph (x 2.00)	35 mph (x 1.71)	40 mph (x 1.50)	45 mph (x 1.33)
1	1.3	18.5	24.1	289	144	96	72	58	48	41	36	32	
2	2.0	18.5	37.0	444	222	148	111	89	74	63	56	49	
3	3.2	18.5	59.2	710	355	237	178	142	118	101	89	79	
4	4.6	18.5	85.1	1,021	511	340	255	204	170	146	128	113	
5	5.8	18.5	107.3	1,288	644	429	322	258	215	183	161	143	
6	6.6	18.5	122.1	1,465	733	488	366	293	244	209	183	162	
7	7.9	18.5	146.2	1,754	877	585	438	351	292	250	219	194	
8	9.1	18.5	168.4	2,020	1,010	673	505	404	337	288	253	224	
9	9.8	18.5	181.3	2,176	1,088	725	544	435	363	310	272	241	
10	11.0	18.5	203.5	2,442	1,221	814	611	488	407	348	305	271	
11	12.5	18.5	231.3	2,775	1,388	925	694	555	463	395	347	308	
THE ACTUAL APPLICATION RATE (POUNDS PER LANE MILE) ON THE HIGHWAY IS THE DISCHARGE RATE DIVIDED BY THE NUMBER OF LANES BEING TREATED													



Use the example TxDOT Calibration Chart (opposite page) to answer the following questions:

8. Winter road conditions on a rural FM Road are such that you can safely drive 15 miles per hour. Your flaps are down so that you only treat one lane per pass. To achieve a target material application rate of 350 pounds per lane mile, set your conveyor on:
 - A. Control setting 3
 - B. Control setting 4
 - C. Control setting 6
 - D. Control setting 7

9. Same as problem 8, but now you treat two lanes per pass, driving your truck down the middle of the road. This requires that you open the spinner flaps some and increase the spinner rotation speed. To achieve a target material application rate of 350 pounds per lane mile, set your conveyor on:
 - A. Control setting 3
 - B. Control setting 6
 - C. Control setting 9
 - D. Control setting 11

10. Winter road conditions on a freeway are such that you can safely drive 20 miles per hour. Your flaps are wide open and your spinner rotational speed is high so that you treat three lanes per pass. To achieve a target material application rate of 200 pounds per lane mile, set your conveyor on:
 - A. Control setting 3
 - B. Control setting 5
 - C. Control setting 7
 - D. Control setting 10

11. [True/False] This particular chart only applies to the spreader/truck combination identified, for the stated gate opening.
 - A. True
 - B. False

12. [True/False] This particular chart would not apply to other trucks or spreaders, or even to this same truck/spreader with a different gate opening. You would have to obtain a different chart.
 - A. True
 - B. False

MODULE 8

Calibrate a Liquid Spray Applicator



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012

Learning Objectives

Upon completion of this section, the learner will be able to:

1. Identify the components and systems associated with liquid spray application
2. Calibrate liquid spray application equipment



Learning Objectives, cont'd

3. Comprehend the importance of calibrating liquid spray application equipment in order to "hit the target rate" when applying snow and ice chemicals



CALIBRATE A LIQUID SPRAY
APPLICATOR

SLIDE 8.3

VIDEO 8.1 (01:41) TxDOT Liquid Spray Operation



CREDIT

Houston District

Texas Department of
Transportation



R
8.1
[8.21]



CALIBRATE A LIQUID SPRAY
APPLICATOR


SLIDE 8.4



The Goal of Calibration
CALIBRATE A LIQUID SPRAY APPLICATOR

- Calibration is to confirm that the liquid spray equipment operational settings used to deliver salt brine or Meltdown Apex are reliable...

“The amount of material applied corresponds to the target application rate”

 CALIBRATE A LIQUID SPRAY APPLICATOR SLIDE 8.6

TxDOT Application Rates

LIQUID SPRAY APPLICATIONS

Product	Material	Unit	Rate (Unit/Lmi)	Cost (\$/Unit)	Comments
Road Salt	NaCl	gal	60	\$0.066	Anti-icing (Brine)
Meltdown Apex	MgCl ₂	gal	20	\$1.68	Anti-icing (Brine)
Meltdown Apex	MgCl ₂	gal	40	\$1.68	De-icing (Brine)

NOTE: See your supervisor for application rates in your area!



CALIBRATE A LIQUID SPRAY
APPLICATOR

SLIDE 8.7

Several Factors Affect Calibration

CALIBRATE A LIQUID SPRAY APPLICATOR

Factors that are SET

- Spray application rig
 - System performance
 - Operating condition
- Type of chemical
 - Salt brine
 - Meltdown Apex
- Application
 - Anti-icing... mostly
- Pavement condition
 - Temperature, moisture

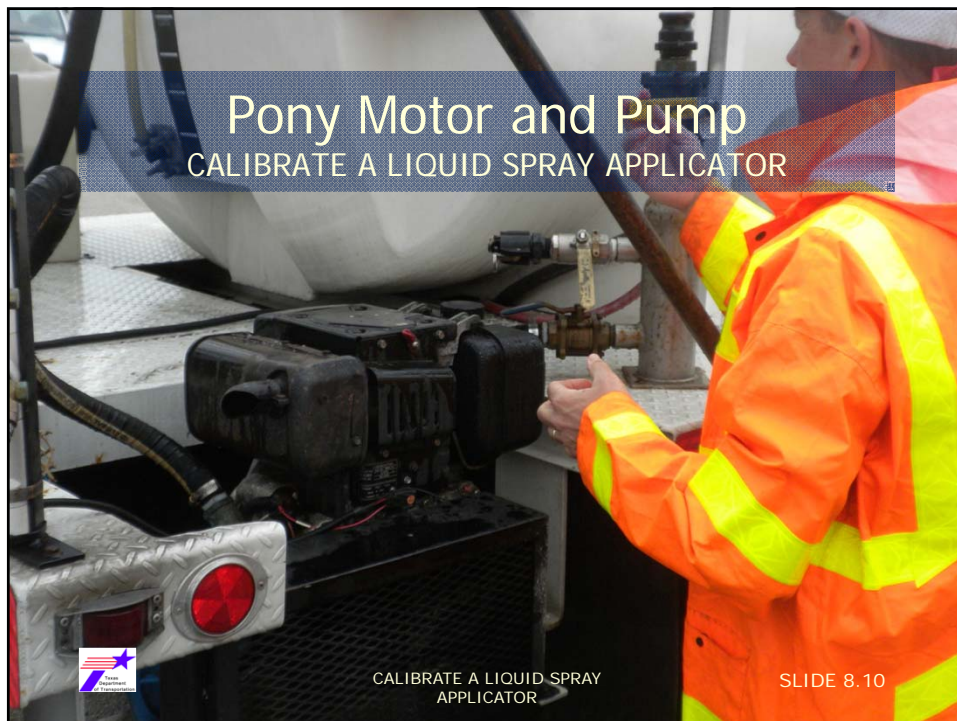
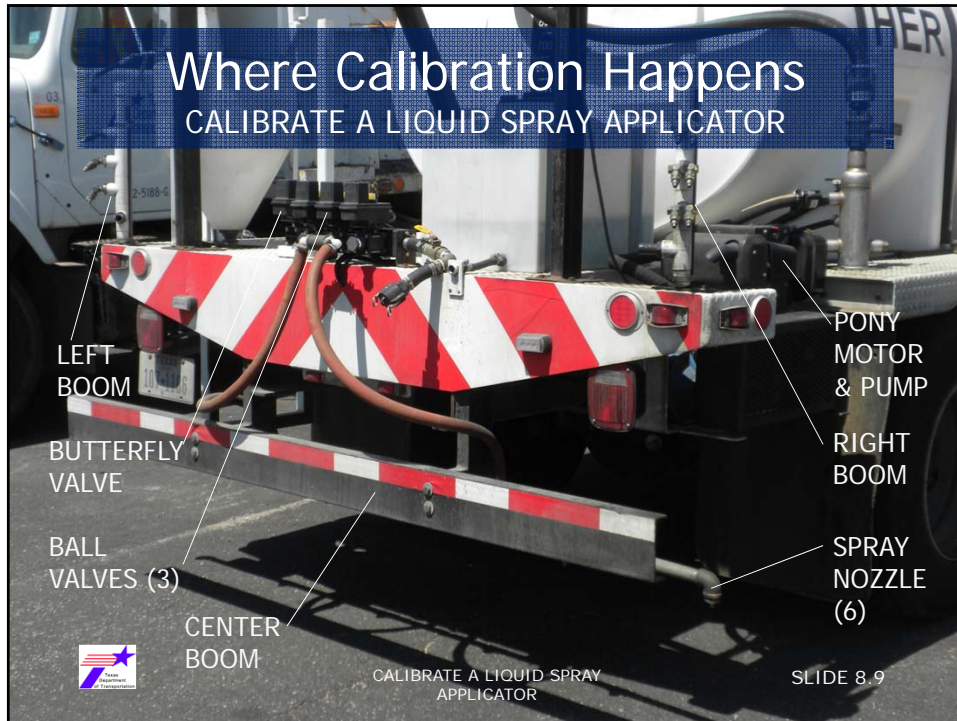
Factors you ADJUST

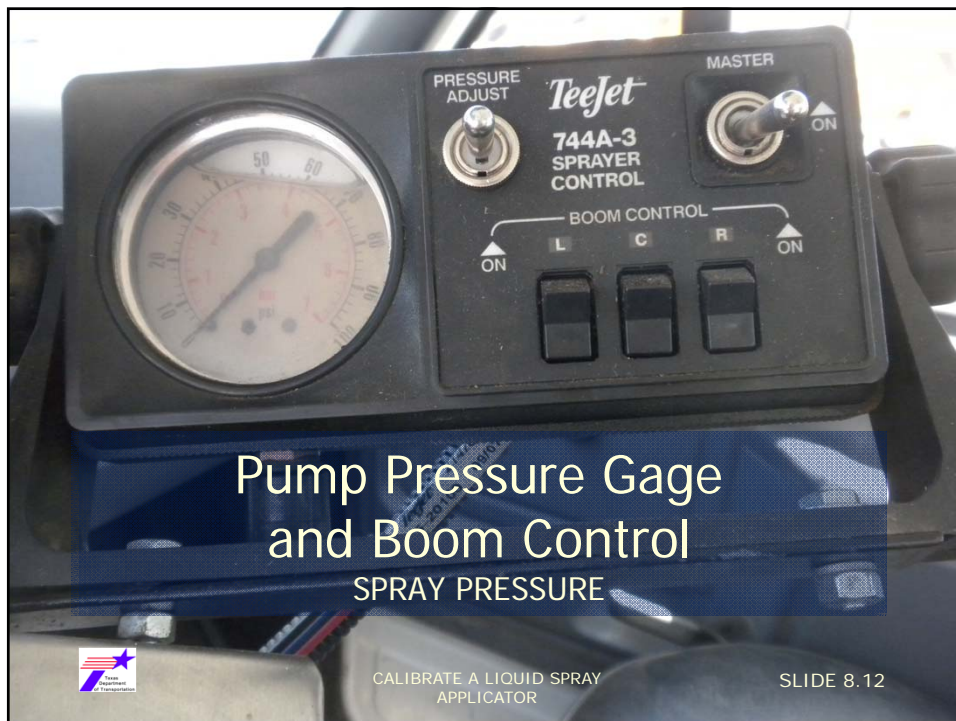
- Spray pressure
 - Keep at 30-40psi
- Flow rate
 - Nozzle size
- Spread pattern
 - Center boom (1 lane)
 - Three booms (3 lanes)
- Forward ground speed
 - Travel speed



CALIBRATE A LIQUID SPRAY
APPLICATOR

SLIDE 8.8





VIDEO 8.2 (06:07) Liquid Spray Rig Controls



CREDIT

Dennis Markwardt
Maintenance Division
Texas Department of
Transportation

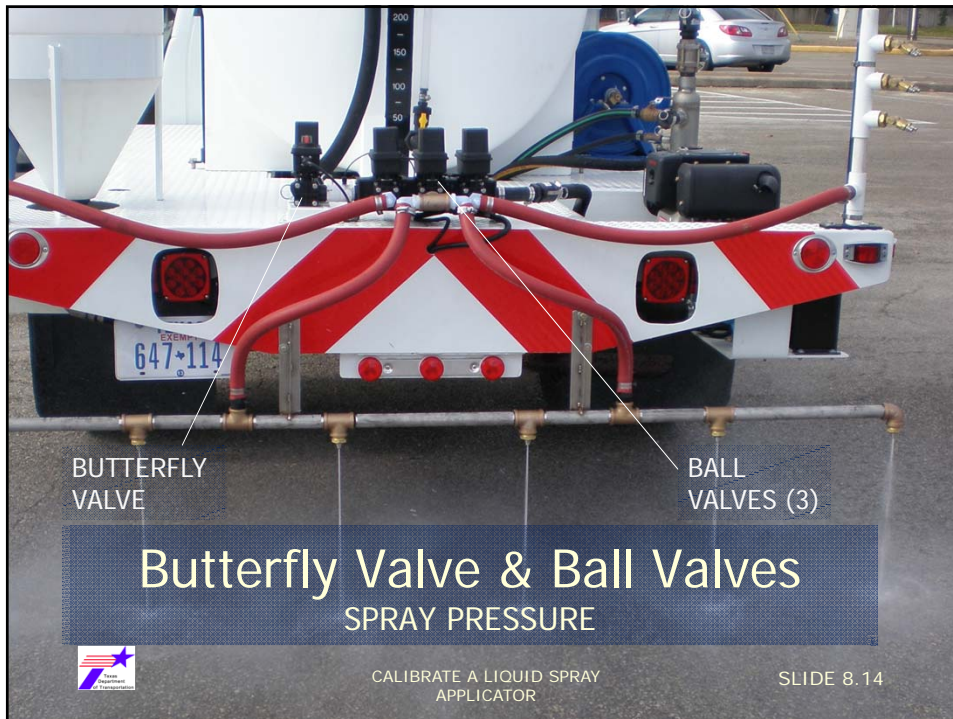


R
8.2
[8.22]



CALIBRATE A LIQUID SPRAY
APPLICATOR

SLIDE 8.13



BUTTERFLY
VALVE

BALL
VALVES (3)

Butterfly Valve & Ball Valves SPRAY PRESSURE



CALIBRATE A LIQUID SPRAY
APPLICATOR

SLIDE 8.14

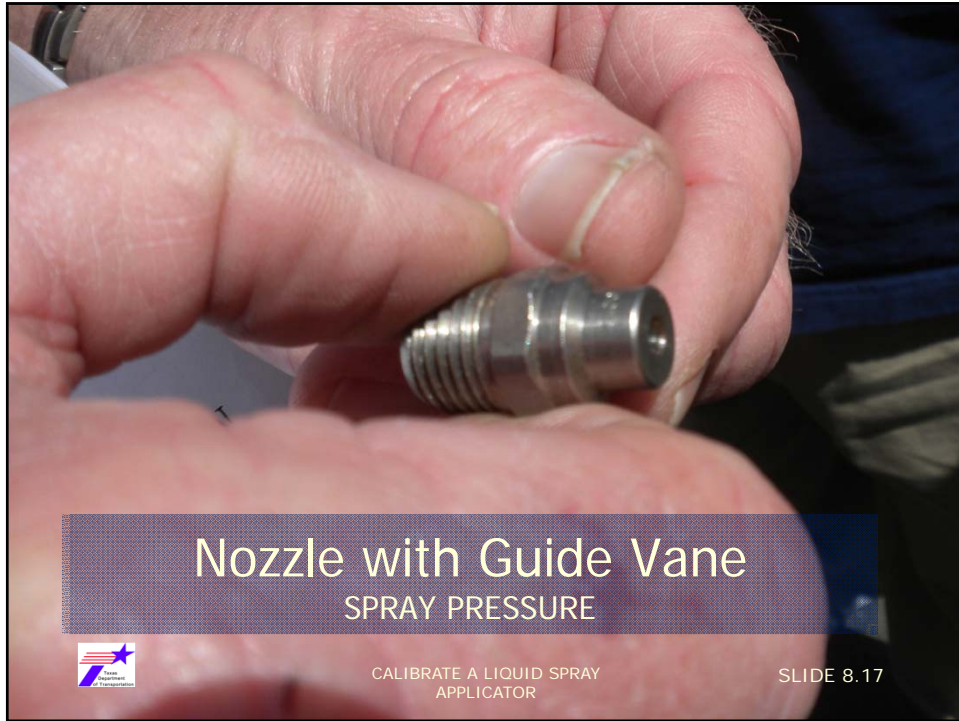


Nozzle with Guide Vane


SPRAY PRESSURE

- To minimize drifting of liquid anti-icing and de-icing agents, solid stream nozzle tips are preferred over fan type nozzle tips
- The guide vane is important in achieving a solid stream








VIDEO 8.3 (03:09)
Proper Spray Nozzles

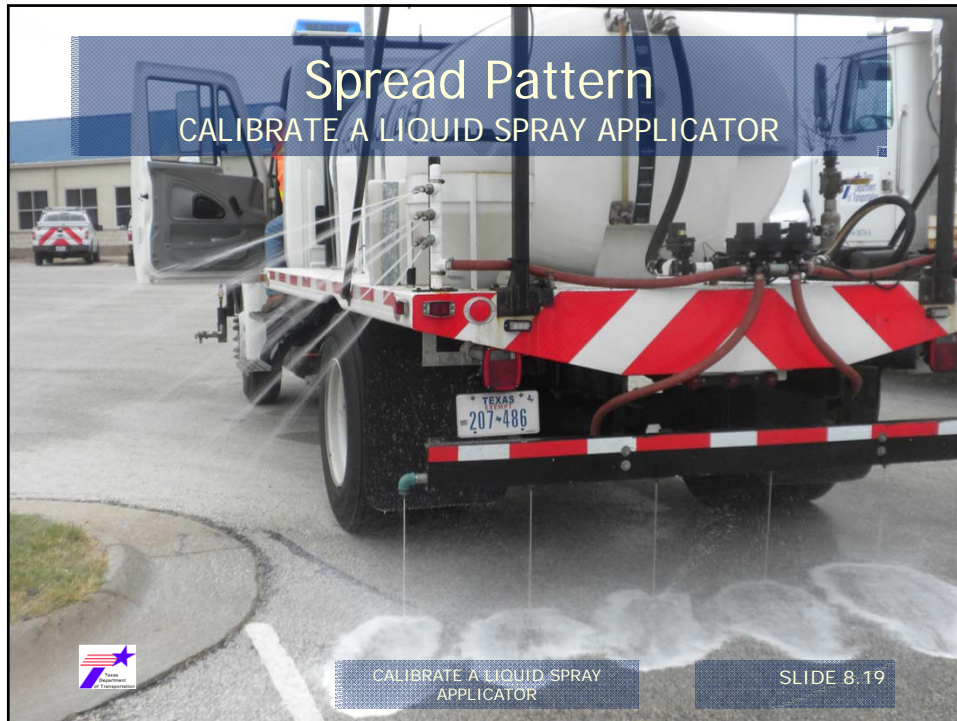


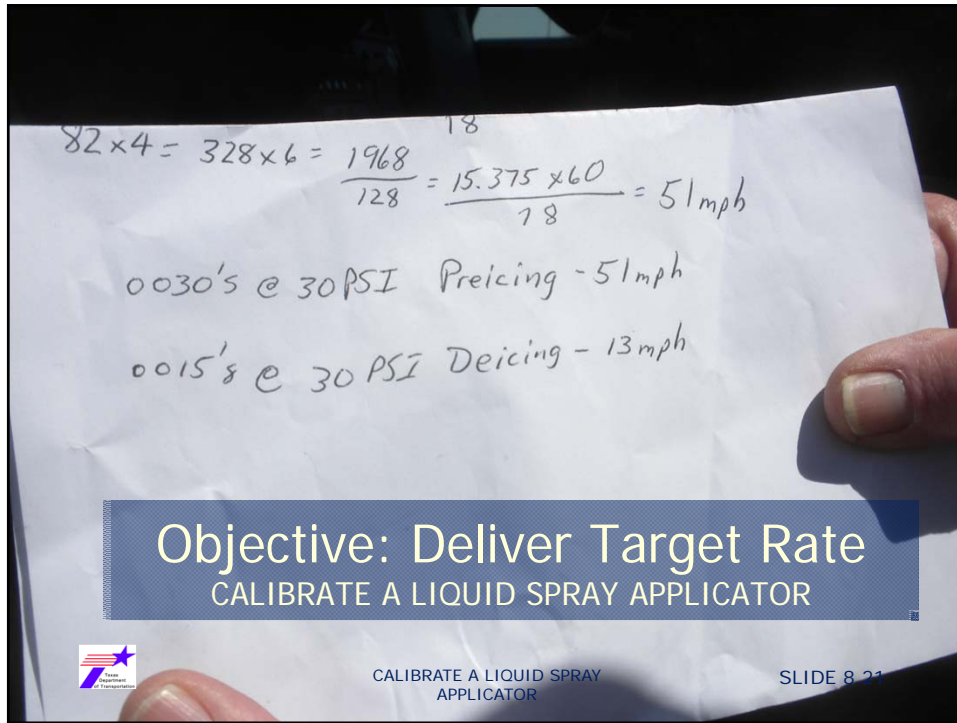
CREDIT
Lubbock District
Texas Department of
Transportation





 CALIBRATE A LIQUID SPRAY
APPLICATOR SLIDE 8.18





Objective: Deliver Target Rate
CALIBRATE A LIQUID SPRAY APPLICATOR

CALIBRATE A LIQUID SPRAY APPLICATOR SLIDE 8.21



CALIBRATE A LIQUID SPRAY APPLICATOR
**HOW TO CALIBRATE A
LIQUID SPRAY APPLICATOR**

CALIBRATE A LIQUID SPRAY APPLICATOR SLIDE 8.22

SPRAYER SAFETY

ENVIROTECH SERVICES, INC.

MATERIAL SAFETY DATA SHEET

SECTION I: PRODUCT, COMPANY AND SHIPPER IDENTIFICATION

Product Name: MeltDown® Apex
 Chemical Name: Magnesium Chloride Solution plus Proprietary Additive
 Manufacturer: EnviroTech Services, Inc.
 910 54th Avenue, Suite 230
 Greeley, CO 80634

Shipper/Distributor: (if different than Manufacturer)
 Chemtrec: (800) 424-9300

SECTION II: COMPOSITION / INFORMATION ON INGREDIENTS

Ingredients	CAS Number	Percent
Magnesium Chloride	7701-18-6	25 - 35
Water	7732-18-5	65 - 75
Shield AP Corrosion Inhibitor	None Exists	Proprietary
Proprietary Additive	None Exists	Proprietary

SECTION III: HAZARDS IDENTIFICATION

Emergency Overview: This MSDS has been compiled as a response to customer requests to address the safe handling of the product.
THIS PRODUCT IS NOT REGULATED UNDER OSHA.
 It does not contain any hazardous components.
CAUTION - MAY CAUSE EYE IRRITATION.

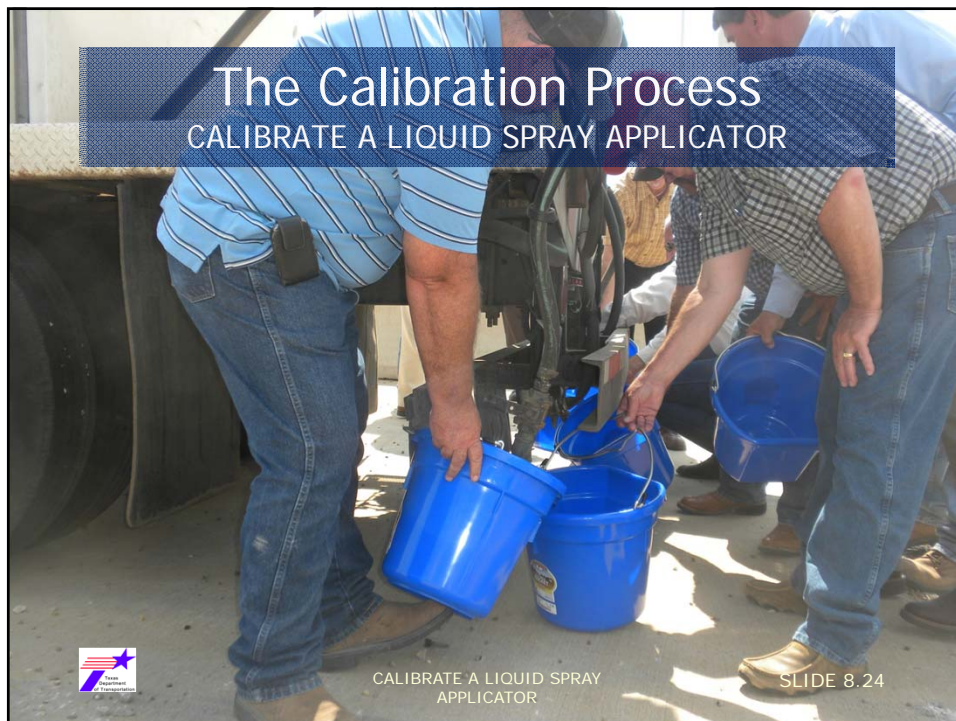
Potential Health Effects

Route(s) Of Entry: Eye, Inhalation, Ingestion, Skin

Effects: Eye: May cause mild irritation.
 Inhalation: May cause respiratory irritation.
 Ingestion: May cause mild irritation.
 Skin: May cause mild irritation.

Non toxic

SLIDE 8.23



Calibration Settings

CALIBRATE A LIQUID SPRAY APPLICATOR

- Calibration should represent the conditions that are normally used for the selected chemical and roadway conditions in the host maintenance Section/District



CALIBRATE A LIQUID SPRAY
APPLICATOR

SLIDE 8.27

FIELD Exercise 8.1

Calibrate a Liquid Spray Applicator



- Refer to handout for detailed calibration procedure
- Handout includes calibration form



CALIBRATE A LIQUID SPRAY
APPLICATOR

R_{8.5}
[8.29]

SLIDE 8.28

Complete the Calibration Chart
CALIBRATE A LIQUID SPRAY APPLICATOR

Deicing Calibration Form

5-7548-8
1-6-11

MPH = $\frac{60 \times \text{GPM}}{\text{GPLM}}$ 60 is a constant

→ 30 PSI

74 x 4 = 296
296 x 6 = 1776
1776 ÷ 128 = 13.87
13.87 x 60 = $\frac{832.5}{18}$

Preicing - 46.25 MPH

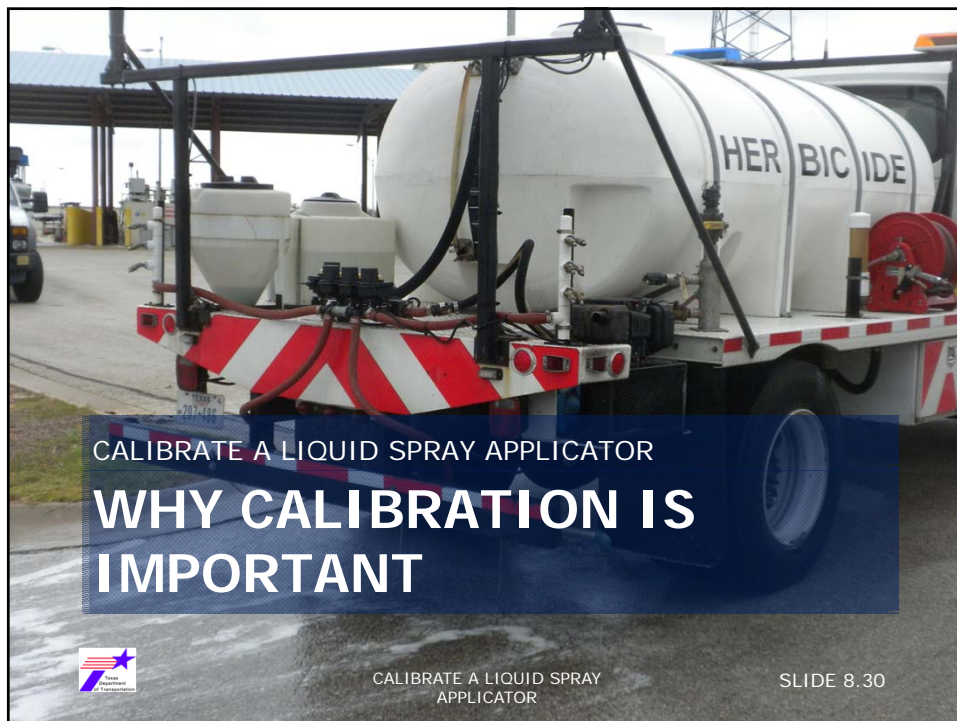
Suburb SE
Reard's Truck

CALIBRATE A LIQUID SPRAY APPLICATOR

SLIDE 8.29

CALIBRATE A LIQUID SPRAY APPLICATOR

WHY CALIBRATION IS IMPORTANT



CALIBRATE A LIQUID SPRAY APPLICATOR

SLIDE 8.30

Why Calibrate?

CALIBRATE A LIQUID SPRAY APPLICATOR

- Calibration helps confirm that the liquid spray system operational settings used to deliver salt brine or Meltdown Apex are reliable...
 - Less chemical use... *efficiency*
 - Lower cost... *economy*
 - Reduced impact... *environment*



CALIBRATE A LIQUID SPRAY
APPLICATOR

SLIDE 8.31

Calibrate Every Season!

CALIBRATE A LIQUID SPRAY APPLICATOR

- Liquid anti-icing and de-icing application equipment should be calibrated at the beginning of every winter season



CALIBRATE A LIQUID SPRAY
APPLICATOR

SLIDE 8.32

Thoroughly Clean After Use

INSPECT AND MAINTAIN LIQUID SPRAY APPLICATOR

- De-icing chemicals are extremely corrosive to the liquid spray application equipment as well as to the truck frame and body
- The entire liquid spray application equipment system (including the tank) should be thoroughly flushed (at least two or three times) with clean water after each use



CALIBRATE A LIQUID SPRAY
APPLICATOR

SLIDE 8.33



CALIBRATE A LIQUID SPRAY
APPLICATOR

SLIDE 8.34




Summary and Review


1. Explain the components and systems associated with liquid spray applicators
2. Calibrate a liquid spray applicator
3. Comprehend the importance of calibrating



FIELD Exercise 8.1
Calibrate a Liquid Spray Applicator



- Refer to handout for detailed calibration procedure



CALIBRATE A LIQUID SPRAY
APPLICATOR

R_{8.5}
[8.29]

SLIDE 8.28

VIDEO 8.1. TXDOT LIQUID SPRAY OPERATION (01:41)

SCRIPT

This video, taken in the Houston District, shows TxDOT liquid spray rigs that have been converted for anti-icing applications.

The process begins with filling the tanks of the liquid spray rigs with anti-icing chemical.

For a heavy traffic operation, it is necessary to plan the application and to communicate the plan. For safety purposes, everyone on the team needs to know his or her role.

Roadway maintenance operators in metropolitan areas often apply anti-icing chemicals in a tandem operation which includes multiple spray rigs, multiple support vehicles, and in some cases, assistance from the highway patrol.

TxDOT mostly uses magnesium chloride, known as Meltdown Apex, as its anti-icing chemical.

The idea behind anti-icing is to place chemical on the road before the storm so that frost or black ice will not form on the roadway surface. This applies especially to bridges, overpasses, ramps, and known trouble spots.

The spray rigs are equipped with three booms and can apply chemical up to three lanes at a time.

Depending on the calibration, anti-icing chemical is applied in traffic, at speeds of about 30 to 45 miles per hour. Safety first! The support vehicles help protect both the spray rig and the traveling public.

VIDEO 8.2. LIQUID SPRAY RIG CONTROLS (06:07)

SCRIPT

Dennis: Alright.

This is the controller for the de-icing boom. You basically have three switches on here, one for each of the different boom sections: left, center, right. You also have a master switch that you can just turn them all on or off at one time.

Dennis: Now, when you are out there spraying say, for example, they are spraying on the center one, and they turn on the left one, your pressure is going to drop.

Bill: Yep.

Dennis: And to adjust that pressure, you just hold that pressure switch up and it will close that butterfly valve and your pressure will get back up. And you know, really what I want people spraying at is at 40 psi.

Bill: Yeah.

Dennis: And that's exactly what those nozzles are set for, say it's a 0030G is set for 3 gallons a minute for 40 psi so we try to always run it at 40 psi. If you turn all three of them on, your pressure will really drop so that butterfly valve you can adjust it to get that pressure back up.

Bill: And do the best you can.

Dennis: Do the best you can. This controls the independent engine in the back (pony motor).

Bill: I see.

Dennis: Okay. Of course, your on and off switch, but this controls the RPM's so if you are not getting enough pressure to run all three of them, you can jack the RPM's up on that motor and get more output on the pump.

Bill: I see. I see.

Dennis: Once you get plenty of output, you leave it alone.

Bill: And by the engine, you are talking to the pony motor back there?

Dennis: Yes sir.

Bill: Gotcha. That is running that pump back there.

Dennis: Yes sir.

Bill: Okay.

Dennis: Now if you are out there spraying in the center lane and you know you are about to turn on another boom section, it's good to go ahead and flip that switch a little earlier and start raising that pressure because that butterfly valve has a slow delay on getting that pressure back up. So it will already start closing when you flip that other switch on, and you don't have as big of a pressure drop that way.

Bill: Gotcha.

Dennis: Guys really have to be paying attention what they are going to be doing with that pressure switch also. And like I said, we try to spray at 40 psi. If this pressure drops to 20 psi, we are not even going to get that close to the right rate of product; so it is really important trying to maintain that pressure. So when it comes to maintaining this truck, that butterfly valve is very important on how that boom is going to work. A lot of people say, I want to run my pump slow or fast; I personally like to run it fairly fast to make sure I have plenty of fluid.

Bill: Yeah.

Dennis: These motors can run all day long with it.

Bill: Yeah. You would like to run it really fast and choke it down on the butterfly valve. Is that what you are saying?

Dennis: Yes sir. I would rather have enough pressure back there and enough fluid that I can operate everything off of this.

Bill: Yeah.

Dennis: And not have to worry about "Oh gosh, I need to jack this down then I need to do this."

Bill: There are only so many knobs that you need to be messing with when you are driving down the road.

Dennis: Yes sir. So when it comes to maintaining this system, whenever they are done spraying mag chloride or brine, I don't care what it is, they need to especially rinse. They really need to rinse these trucks, not just once, not just run some water through it, they need to run water through it 2 or 3 times and make sure that material is cleaned out good.

Bill: Yeah.

Dennis: This we read speed with.

Bill: Okay.

Dennis: And the main reason is because I mean look right now, the speedometer says we are doing 4 mph.

Bill: Right, gotcha.

Dennis: So what we do is we calibrate this calc-an-acre.

Bill: What did you call that?

Dennis: This is a calc-an-acre.

Bill: A calc-an-acre.

Dennis: Yes sir.

Bill: Okay.

Dennis: And all it does for us is read speed. Now farmers can use it to calculate how many acres they sprayed that day and that kind of stuff but when we spray, we vary our boom widths so it can't calculate that for us but we do use it to read accurate speed, and that is our main goal here. You know we tell someone to drive 10 mph and then all of a sudden, they drive 8, there is 20 percent messing up already.

Bill: Right.

Dennis: So it is really important to drive the right speed. We really try to hammer it into these guys to really try to drive that right speed.

Bill: Gotcha.

Dennis: Now on de-icing or anti-icing, you know it says apply 15 to 20 gallons per lane mile. So I try to calibrate these trucks at 18 gallons per lane mile. That way we have a little come and go and still be able to put out the right amount of product without causing us problems or grief.

Bill: So then whether you are spraying mag chloride, which most people are, or whether you are spraying brine, the controls are the same but if you are using only mag chloride you might have a different nozzle configuration back here than if you are using brine because you are using a higher flow rate for the treatment.

Dennis: One thing I try to tell people if you are going to be setting up, whether it be brine or mag chloride, I ask them, "What speed do you want to make that application at?" For example, I have some guys that want to put it at about 45 mph on a pre-treatment. I have other guys that want it at 20 mph. Well to accomplish that, all you really need to do is make sure you get the right nozzles back there. Make sure all the nozzles are the same but make sure the right nozzles are back there so you can make that application at those speeds.

Bill: Right, so if you know your chemical, and you know what rate you are supposed to use, then you select your nozzle. Then you can back in what rate you need (and you know what rate you want), you can kind of match the nozzles to the chemical and the rate; is kind of the way it works.

Dennis: And the speed.

Bill: And the speed.

Dennis: So for example, I had a guy in one district that said, "All I am doing is interstate, 100 percent, I am never on an off ramp or anything, only interstate. Can you set me up at 55 mph so I do not get run over out there while doing a pre-treatment?" Sure, we just put him some bigger nozzles on there so he can put that volume out there and do that speed and do it safely.

VIDEO 8.3. PROPER SPRAY NOZZLES (03:09)

SCRIPT

This video discusses the importance of having the proper nozzles for your liquid spray application rig.

This close-up of the center boom shows the different nozzles and their configuration for an anti-icing application.

Here, Dennis Markwardt of the TxDOT maintenance division is removing one of the nozzles which he suspects does not have a required component, namely, a guide vane.

The idea is to compare nozzles that do not have a guide vane with those that do, so you can see the difference.

The problem is not that this nozzle is improperly sized. The problem is that the nozzle does not have a guide vane, which negatively affects its spray pattern.

Notice that the base opening for the nozzle without a guide vane is clear. You can see right through it.

TxDOT uses stainless steel, solid stream nozzles. The base of the nozzle threads into the spray boom. The orifice, or nozzle opening, is sized to provide a flow rate of 2 gallons per minute at 40psi pressure, which is normal for anti-icing applications using magnesium chloride.

This view shows the two types of nozzles side by side. The base of the one nozzle, which still has its brass adapter, is open. The base of the other nozzle has the small "X" in it. The "X" is the metal guide vane.

The nozzle with the guide vane is the one you want. It is designated "Double O Twenty Gee" or 0020G.

Dennis has assembled a parts catalog for these liquid spray rigs. Your supervisor will have a copy. You can purchase the correct nozzles - with the guide vane - by ordering the nozzles designated "Double O Twenty Gee".

One of the checks for liquid application rigs is to make sure all nozzles are sized correctly. Nozzle size will vary by application, whether you are doing anti-icing, which is typical, or de-icing. Nozzle size also depends on the type of chemical you use, whether it is road salt (termed salt brine) or magnesium chloride.

Whichever your application, all nozzles should be the same size. Again, you want the nozzle with the guide vane.

Dennis is now going to replace one of the nozzles on the right boom, so you can see how the two types of nozzle streams compare.

From a distance, the nozzle streams look alike, but with a close-up view, you can really see the difference in the two nozzle streams.

The nozzle without the guide vane has a wider, more diffuse stream. This wide stream will not carry as well in the wind as you are driving down the road. In contrast, the nozzles with the guide vane have a solid, straight stream. The stream is more pure, or dense, so the liquid will carry farther.

The solid, pure stream is what you want.

VIDEO 8.4. LIQUID SPRAY RIG CALIBRATION (01:45)

SCRIPT

Dennis: Knowing what to look for and at least going out there and calibrating that thing one time a year before going out there is such an important factor. Even though they set these 2 years ago, things happen in 2 years. Like this thing here (referring to the nozzles on one of the side booms).

Bill: Because corrosion happens, among other things.

Dennis: Yeah but for even example here, somebody could have bumped that and shifted it back a little bit and that's why it is not covering out as far. You know, loosen that thing up and move it back in the right place and then reset those nozzles that will cover that other lane better.

Bill: Right.

Dennis: That's the kind of things that we need to look for every year and a lot of people just take it for granted (that things have not changed).

Bill: You look for that every year, the right coverage, the right nozzles, make sure that the RPM's on the pump are going the way they need and that it is properly adjustable; you look for the right kind of stream, not just the right size nozzle but the right kind of stream. The same size nozzles in the whole system, whether you are doing anti-icing or de-icing associated with the kind of application you are going to do and the rate that you are trying to hit. You look for the right kind of valves and that these are functioning right. You make sure your butterfly valve is working properly so that it operates.

Dennis: And then once all that is done, you calibrate it which takes about a minute. Everyone says you need to come calibrate it. Calibrating is easy, you just stick a bucket underneath there and get your gallons per minute and you are done.

Bill: Yeah.

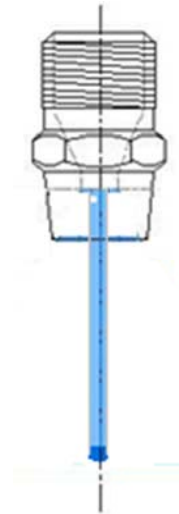
Dennis: Your spray width is, you know, I got a formula there. And your spray width is all set and you just put in how many gallons per minute. You're catching it so it can tell you how fast to drive.

LEARNING EXERCISE 8.1 Calibrate Liquid Spray Application Equipment

Winter Weather Operations Training

Equipment Needed for this Exercise:

1. Liquid spray application unit (rig)
2. Hand tools as needed for repairs, component replacement and calibration
3. Appropriate buckets/containers to catch liquid from one or more nozzles during the calibration process
4. A graduated container that is capable of accurately measuring a volume of liquid up to 1.00 gallon
5. Stop watch or watch with a second hand or function (readout)



LIQUID SPRAY APPLICATION RIG SAFETY

- Read all installation, safety and maintenance instructions completely before operating this equipment.
 - Keep all personnel clear of moving parts while equipment is being operated.
 - While operating this equipment, use common sense, use caution, be alert and be safety-conscious.
-

Learning Objectives

Upon completion of this field exercise, the participant will be able to:

1. Identify basic components and systems associated with liquid spray application equipment
2. Calibrate liquid spray application equipment
3. Comprehend the importance of calibrating liquid spray application equipment in order to “hit the target rate” when applying snow and ice chemicals

Introduction

When you compare the relatively insignificant cost of calibration to the benefits that result from this activity, it is easy to see why calibration is one of the most cost-effective ways to optimize your maintenance section's usage of snow and ice control materials. Along with the correct application technique, proper calibration is the first step towards reduced chemical use, greater efficiency and increased cost effectiveness.

Regardless of the type of equipment being used, it is extremely important to calibrate the system to ensure that the desired quantity of material is actually being applied to the road. In this field exercise, we will look at getting the "right amount" of material on the road by ensuring that your liquid spray application equipment has been properly calibrated.

Liquid Spray Application Equipment

TxDOT uses liquid spray application equipment to spray herbicides during the spring and summer months and to spray liquid snow and ice control chemicals during the winter season. For the purposes of this training, we will limit our discussions to winter weather maintenance operations.

Liquid spray application equipment is used primarily for anti-icing treatments on selected roadways, bridges (overhead structures) and trouble spots. Anti-icing involves applying liquid chemicals in advance of a storm to prevent snow and ice from bonding to the pavement surface and to prevent the formation of frost.

Liquid spray application equipment is also used for deicing in some regions of the state in certain temperature, moisture and pavement conditions. Deicing involves applying chemicals to the road after a storm starts where snow and ice have already bonded to the pavement surface.

TxDOT currently uses two liquid snow and ice control materials. The most commonly-used chemical at the present time is Meltdown Apex which is a magnesium chloride ($MgCl_2$) based product. TxDOT also uses a sodium chloride ($NaCl$) brine solution which is produced by some of the snow and ice districts in the state.

Most of the TxDOT liquid spray application equipment in the state is comprised of herbicide rigs that have been retrofitted or modified for winter maintenance operations. TxDOT is also producing (fabricating) dedicated liquid spray application equipment for winter weather operations at their Camp Hubbard facility in Austin, Texas. They are currently producing self-contained truck-mounted rigs, trailer-mounted rigs and skid-mounted units that can slide into a 6 cubic yard or 10 cubic yard dump truck bed.

Equipment Selection and Maintenance

TxDOT personnel have indicated that the Meltdown Apex ($MgCl_2$) product is extremely corrosive to the liquid spray application equipment as well as to the truck frame and body. For this reason, corrosion resistant components (metals) such as stainless steel and brass

should be selected in the design and fabrication of this type of equipment to minimize the effects of corrosion.

Special attention should be given to components such as the pump, metal piping, fittings and spray nozzles. Metal tanks are no longer being used and have been replaced by poly (polymer) tanks or fiberglass tanks. Spray bars should be located as far back on the truck as possible to minimize chemical spray or drift from getting on the truck frame and body or on the liquid spray application system components.

Electrical and mechanical components such as valves and solenoids should be robust (durable) and capable of functioning in and around a corrosive environment.

To minimize drifting of liquid anti-icing and deicing agents, straight stream spray type nozzle tips are preferred over fan type nozzle tips.

All equipment should be thoroughly cleaned after each use to minimize the effects of the corrosive environment. This would include the truck as well as the liquid spray application equipment.

The entire liquid spray application equipment system (including the tank) should be thoroughly flushed (at least two or three times) with clean water after each use. In other words, all residual chemicals should be thoroughly flushed out of the system after each use.

Calibration of Liquid Spray Application Equipment

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

Calibration of winter weather liquid spray application equipment is a two-part process. The first part is often the most time consuming when compared with the second part (the actual calibration process).

The first part of the process consists of a thorough inspection of the liquid spray unit to verify that each component of the system is fully functional and that the system has been designed, modified, retrofitted and/or fabricated with top quality, fully-compatible corrosion resistant components that work together as a properly designed system to achieve the desired results.

Part 1 - System Inspection

The liquid spray application system should be inspected in advance of the actual calibration (Part 2) to verify that each component of the system is compatible and fully functional. The system inspection may require tools and spare parts, as follows

- 1.) Multimeter for checking voltage, continuity, etc.
- 2.) Wire nuts, electrical connectors, electrical tape and soldering gun to repair or replace electrical connections
- 3.) Petroleum jelly to coat electrical connections as needed
- 4.) Teflon tape or liquid Teflon
- 5.) An adequate supply of common components and replacement parts such as an extra pump, belt, ball valves and spray nozzles.

The system inspection consists of the following:

- Check system design and fabrication to ensure flow rates work from the pump to the ball valves to the nozzles; correct system components as needed.
- Check pump “pony” motor to verify that it has a rated horsepower that is adequate to “drive” the system in terms of flow rate and pressure for the desired vehicle speeds, material application rates and area to be treated.
- Check pump to verify that it is of adequate capacity to “drive” the system in terms of capacity, flow rate and pressure for the desired vehicle speeds, material application rates and area to be treated.
- Check the pump’s rotational speed (RPM) control to ensure it is working properly; in most cases, this pump control can act as an additional pressure control mechanism.
- Inspect electronic ball valves, solenoids and the butterfly valve (pressure regulator) to ensure that they are consistent in terms of design, type and rating.
- Inspect electronic ball valves, solenoids and the butterfly valve (pressure regulator) to ensure that they are fully opening and closing as they should; this may require checking the voltages to each of the valves/solenoids to ensure they are correct and consistent for each valve.
- Inspect the nozzles to verify that they are the correct type and rating in terms of pressure and flow rate.
- All nozzles should be the same (consistent) throughout the center boom and throughout the side booms.
- Check nozzles to verify that a guide vane is present in each nozzle.

- Ensure that the nozzles are directed in a uniform spray pattern across the entire length of the boom.
- Inspect all electrical connections to verify that they are clean, tight and free of corrosion.
- Verify that all piping and fitting configurations are consistent throughout the system to ensure a consistent output at each nozzle and repair any leaks.
- Ensure that all pipe, fittings and component threads associated with pressurized connections are wrapped with Teflon tape or coated with liquid Teflon before each connection is made; pipe dope and Permatex are not suited for this type of application.

Part 2 - Steps to Calibrate a Liquid Spray Applicator

With the liquid spray application system fully functional, calibrate the system as follows:

- 1.) Set system pressure to approximately 40 pounds per square inch (psi) using the butterfly valve (pressure regulator) and the rotational speed (RPM) of the pony motor.
- 2.) Pressure is set from the pony motor first to supply an adequate amount of material; pressure while spraying is set from the butterfly valve which is located in the vicinity of the ball valves, pump and pony motor on the rear of the truck.
- 3.) Make sure all nozzles are consistent so they can be calibrated.
- 4.) Catch fluid out of one or more of the six nozzles on the center boom (rear spray bar) with appropriate buckets/containers.
- 5.) Allow fluid to spray out of the selected nozzle(s) for approximately 15 seconds and then multiply the amount (volume or weight) of fluid in the bucket by 4 to approximate the flow rate for the selected nozzle(s) in gallons per minute (GPM).
- 6.) Determine an average flow rate in gallons per minute (GPM) for all of the nozzles that were tested. Use the **Calculation Form** provided (see Page 8.35).
- 7.) Use the average flow rate in gallons per minute (GPM) to estimate how fast the truck driver should go in miles per hour (MPH) to attain the prescribed material application rate in gallons per lane mile (GPLM).
- 8.) Insert the average flow rate in GPM into the equation below to determine truck speed in MPH.

Equation:

$$\text{MPH} = [60(\text{GPM})] \div \text{GPLM}$$

Equipment Inspection and Maintenance

The following liquid spray application equipment inspections and maintenance activities will maximize equipment performance and minimize down time.

Pre-Storm Activities

Well before a storm strikes, be sure to:

- Complete preventive maintenance checklist
- Adapt herbicide rig to spray liquid snow and ice control chemicals (when applicable)
- Flush tank to prevent contamination
- Service auxiliary motor
- Flush pump for correct operation
- Operate all systems to ensure correct operation
- Check all electrical components for correct operation
- Perform trial run with water to ensure correct operation
- Ensure spare parts are on truck

During the Storm Activities

While using the equipment during the storm:

- Perform occasional walk around to check for any problems (lights, leaks)
- Repair any problem as necessary to ensure correct operation of equipment

Post-Storm Activities

Once the storm is over, be sure to:

- Flush system
- Clean all equipment associated with liquid spray application
- For pump preservation; once pump is no longer used for the season, don't drain and let air in the pump – it will corrode. Keep the pump full of something; use antifreeze.
- Check all equipment for proper operation before next storm
- Service equipment as necessary to prepare for next storm

Pre-icing/De-icing Calibration Form

District _____ Truck Number _____ Date _____

Pre-icing: Pressure _____ Speed _____ GPLM _____

De-icing: Pressure _____ Speed _____ GPLM _____

Calculations:

Useful Formulas:

$$\text{MPH} = \frac{60 \times \text{GPM}}{\text{GPLM}}$$

$$\text{GPLM} = \frac{60 \times \text{GPM}}{\text{MPH}}$$

GPM = gallon per minute from nozzle

GPLM = gallon per lane mile

MPH = miles per hour

Page intentionally left blank.



Class Exercise – Review Questions
Module 8 – CALIBRATE A LIQUID SPRAY APPLICATOR

MNT812 Winter Weather Operations Training

1. [True/False] It is best practice to calibrate each liquid spray application rig in your Maintenance Section every year.
 - A. True
 - B. False
2. [True/False] It is not possible to use a liquid spray application rig that has not been properly calibrated.
 - A. True
 - B. False
3. The primary goal of the liquid spray application rig calibration process is to:
 - A. Promote safety
 - B. Eliminate waste
 - C. Ensure reliability
 - D. Save money
4. [True/False] Because liquid spray application rig calibration is done in the maintenance yard in a controlled way, material safety considerations do not really apply.
 - A. True
 - B. False
5. [True/False] Calibration of the liquid spray application rig should represent normal conditions for your Maintenance Section including the type of chemical, type of application, and typical roadway conditions.
 - A. True
 - B. False
6. Calibration of liquid spray application equipment is a two-part process with the second part being the actual calibration. What is the *first* part of the calibration process?
 - A. Inspect the liquid spray application system to verify the proper components including the pump, butterfly valve, ball valves, nozzle size, and nozzle stream
 - B. Test the system to make sure each component is compatible and fully functional
 - C. Set system pressure to approximately 40 psi by adjusting the speed of the pony motor and the opening of the butterfly valve (pressure regulator)
 - D. All of the above

Continued on next page...

7. Identify the main purpose of component ❶ in the photo below.
- Regulates the system pressure
 - Directs flow to the three different booms
 - Generates flow in the system
 - Discharges flow to the pavement



8. [True/False] The calibration process for the liquid spray application rig is as follows:
- Step 1. Measure the flow volume, in gallons, of one nozzle for one minute
 - Step 2. Multiply by the number of nozzles per lane (6, typical) - GPM
 - Step 3. Identify the target rate for your application - GPLM
 - Step 4. Using the formula, calculate the speed you must drive the spray rig to apply material at the target application rate - MPH
- True
 - False
9. [True/False] The calibration process identified above applies whether you plan to operate all three booms, two booms, or just one. You always calibrate this same way.
- True
 - False
10. [True/False] Different applications (anti-icing, de-icing) and different chemicals (Meltdown Apex, salt brine) each require their own calibration. Just repeat the process for each situation, starting at Step 1.
- True
 - False

MODULE 9

Preparing for Snow/Ice Removal



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012

Learning Objectives

PREPARING FOR SNOW/ICE REMOVAL

Upon completion of this section, the learner will be able to:

1. Describe how responding to a winter storm is part of emergency operations.
2. List personnel preparations needed for winter maintenance operations.



Learning Objectives, cont'd.

PREPARING FOR SNOW/ICE REMOVAL

3. List available sources of weather forecasts and other information.
4. Explain your District's level of service for winter operations.
5. Compare and contrast winter maintenance operations for snow vs. ice.



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.3

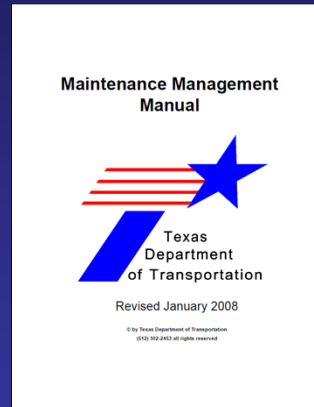


Winter Maintenance as Emergency Response

DISTRICT ORGANIZATIONAL STRUCTURE

- Snow and ice control is categorized as “routine maintenance” under the heading, “Emergency Operations.”

TxDOT Maintenance Management Manual



PREPARING FOR SNOW/ICE
REMOVAL

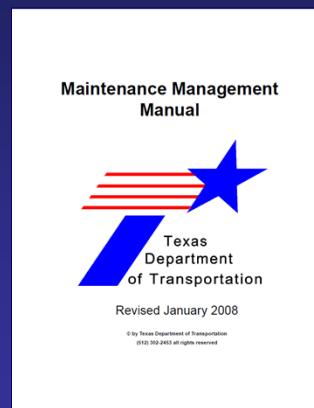
SLIDE 9.5

Why Coordinate?

IMPORTANCE OF COORDINATION

- “Each district must develop and distribute standard operating procedures for emergency preparation, response and recovery. All employees must be trained in the standard operating procedures.”

*-TxDOT
Maintenance Management Manual*



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.6

Exercise 9.1

Importance of Coordination



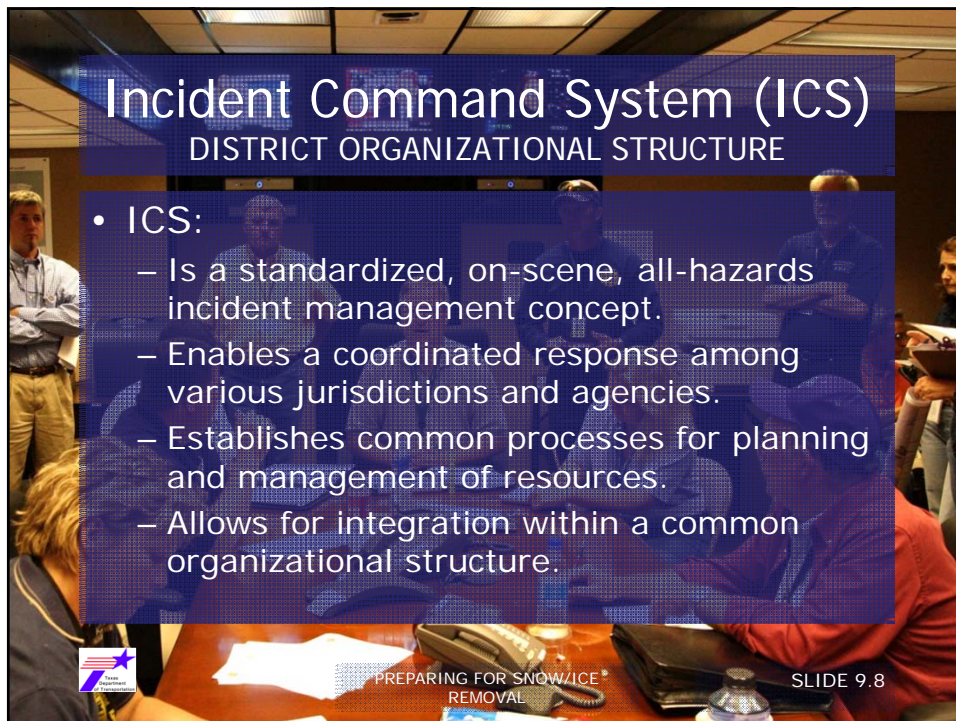
1. Think about why it is important for a District to have an established plan to coordinate winter weather response.
2. Not down some reasons.
3. Discuss these with the persons next to you.

Be prepared to discuss your reasons (3 minutes).



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.7



Incident Command System (ICS)

DISTRICT ORGANIZATIONAL STRUCTURE

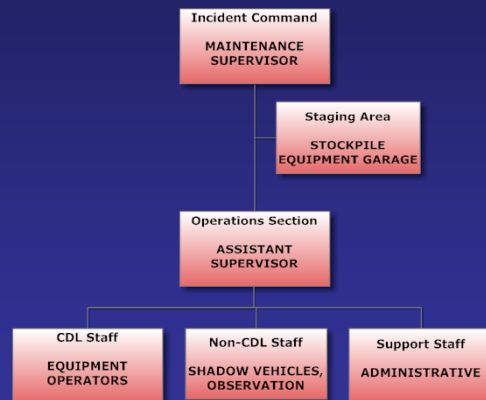
- ICS:
 - Is a standardized, on-scene, all-hazards incident management concept.
 - Enables a coordinated response among various jurisdictions and agencies.
 - Establishes common processes for planning and management of resources.
 - Allows for integration within a common organizational structure.



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.8

ICS Org Chart – Typical Storm DISTRICT ORGANIZATIONAL STRUCTURE

PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.9

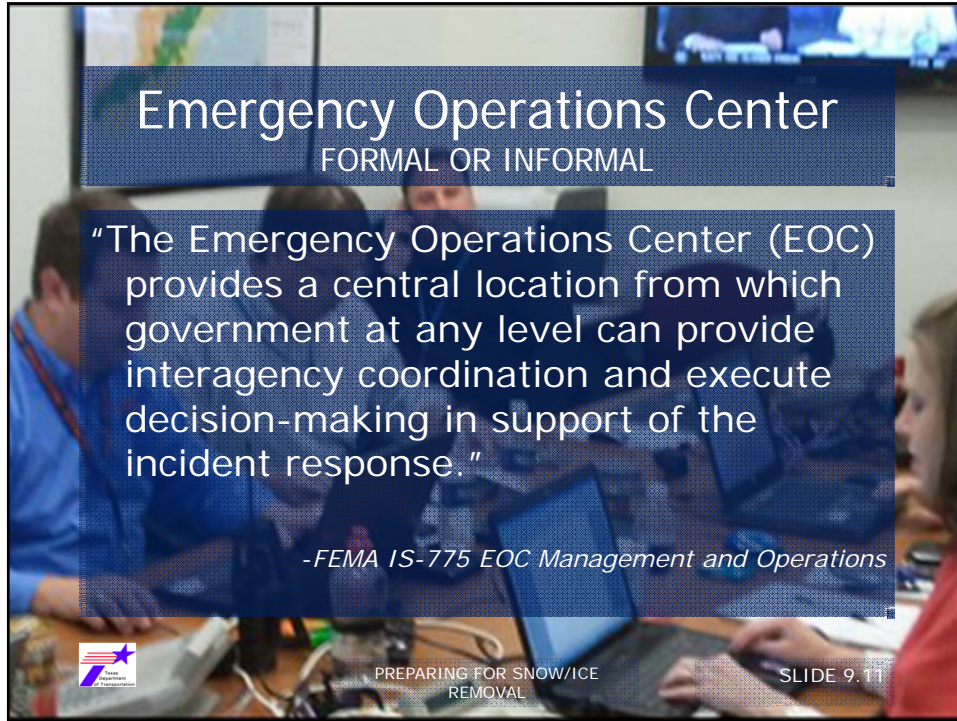
Some Observations

DISTRICT ORGANIZATIONAL STRUCTURE

- The Maintenance Supervisor holds the key operational role
- The severity of the storm drives the level of response
 - Level of formality
 - Extent of response
 - Centralized vs. decentralized

PREPARING FOR SNOW/ICE
REMOVAL


SLIDE 9.10



Emergency Operations Center
FORMAL OR INFORMAL

“The Emergency Operations Center (EOC) provides a central location from which government at any level can provide interagency coordination and execute decision-making in support of the incident response.”

-FEMA IS-775 EOC Management and Operations

 PREPARING FOR SNOW/ICE REMOVAL SLIDE 9.11



BE PREPARED

PREPARING FOR SNOW/ICE REMOVAL
PERSONNEL READINESS

 PREPARING FOR SNOW/ICE REMOVAL SLIDE 9.12


Maintenance Supervisor's Pre-Season Meeting

PERSONNEL READINESS


- Review the District Snow and Ice Control Plan
- Conduct a section-level pre-season meeting with assistants, operators, support personnel and other staff to discuss preparations for the winter season
 - Materials
 - Equipment
 - Personnel

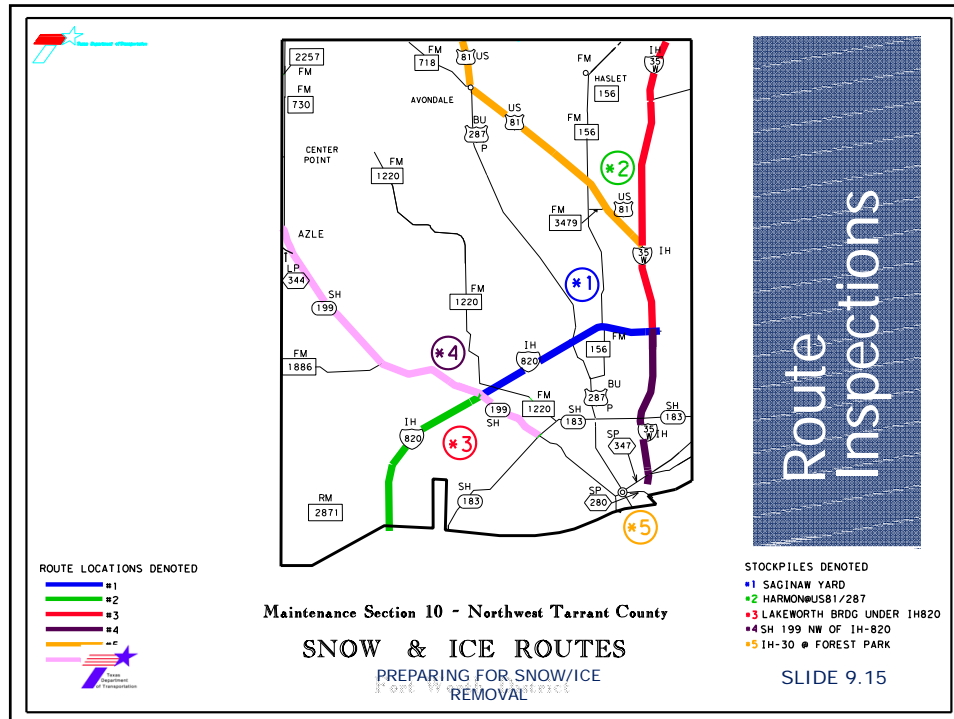
 PREPARING FOR SNOW/ICE REMOVAL SLIDE 9.13

District Snow and Ice Control Plan



**Lubbock District
Snow and Ice Control Plan
FY 2011**

 PREPARING FOR SNOW/ICE REMOVAL SLIDE 9.14



Route Inspections

PERSONNEL READINESS

- Conduct road and field inspections
 - Total infrastructure inspection related to snow and ice control:
 - Roads
 - Drainage
 - Signs
 - Safety Features
 - Note roadside hardware that can be easily damaged by equipment or vehicular accidents (rails, attenuators, etc)



VIDEO 9.1 (00:58) Route Inspection



CREDIT

“Proper Plowing Techniques”

AASHTO Winter Roadway Maintenance Computer-Based Training
Used with permission.



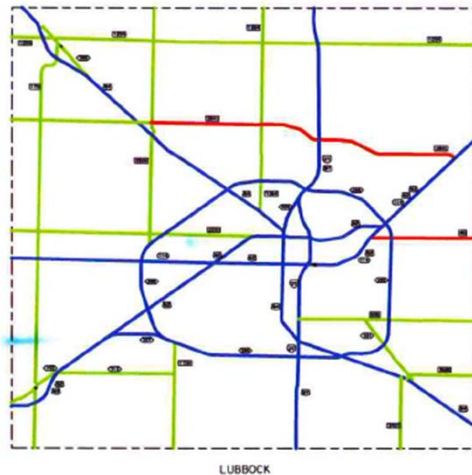
R_{9.1}
[9.29]



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.17

Route Inspection Priorities



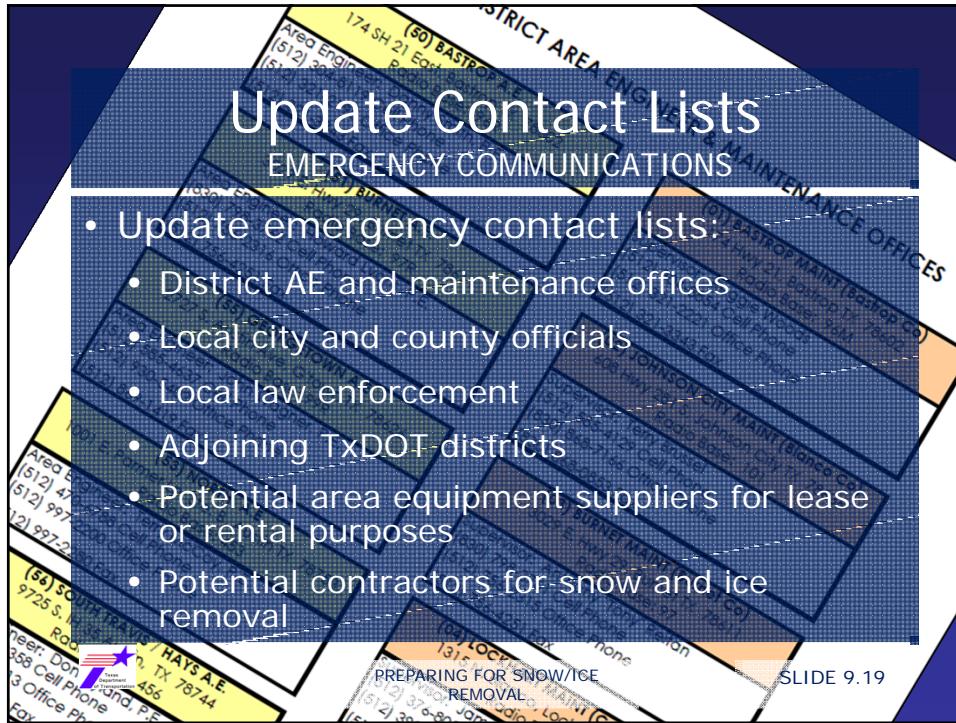
LUBBOCK DISTRICT SNOW & ICE REMOVAL

1st Priority
2nd Priority
3rd Priority



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.18

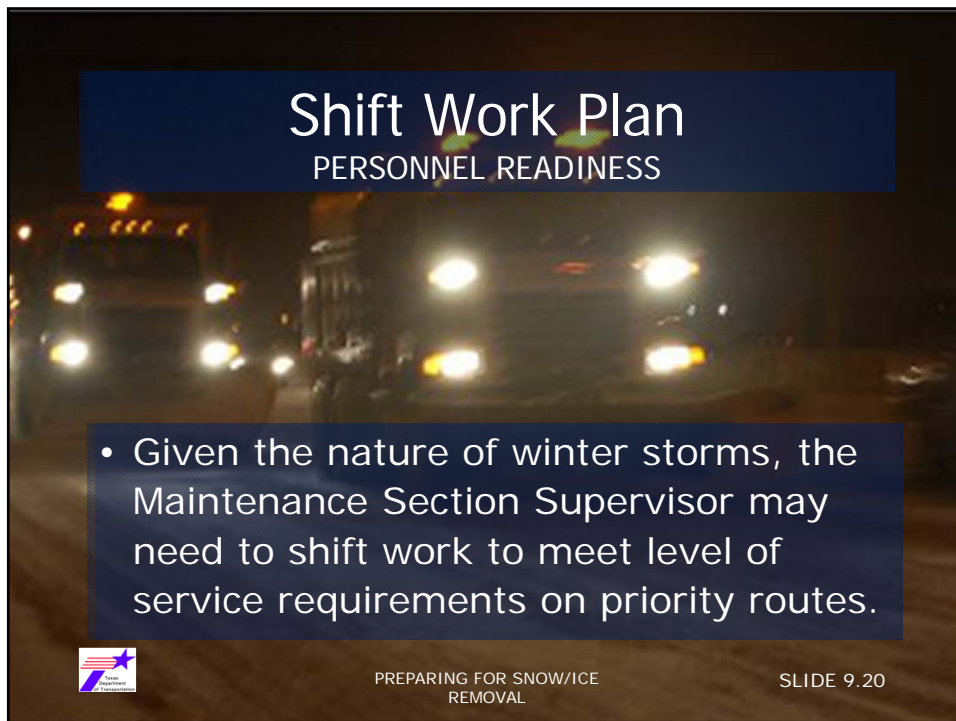


Update Contact Lists

EMERGENCY COMMUNICATIONS

- Update emergency contact lists:
 - District AE and maintenance offices
 - Local city and county officials
 - Local law enforcement
 - Adjoining TxDOT-districts
 - Potential area equipment suppliers for lease or rental purposes
 - Potential contractors for snow and ice removal

SLIDE 9.19



Shift Work Plan

PERSONNEL READINESS

- Given the nature of winter storms, the Maintenance Section Supervisor may need to shift work to meet level of service requirements on priority routes.

SLIDE 9.20

Shift Work Plan

PERSONNEL READINESS

- Your District has a policy on how crews will be set up if shift work becomes necessary during an extended storm event; most districts prefer to utilize two twelve-hour shifts
- As a safety precaution, employees should get a minimum of 8 hours “off the clock” after working a maximum of 16 consecutive hours
- If deemed necessary, the AE may authorize and approve more than 16 hour shifts
- See your Supervisor for policy in your District

PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.21

Working Out of Town

PERSONNEL READINESS

PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.22

Working Out of Town

PERSONNEL READINESS

- It is not uncommon for neighboring Districts to require assistance during a major winter storm event.
- Out-of-town assignments will be made by your supervisor.
- Keep an overnight/travel bag packed and ready to go.



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.23



Defensive Driving

DRIVING ON SNOW/ICE



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.24

VIDEO 9.2 (02:03) Defensive Driving on Snow/Ice



CREDIT

Amarillo District

Dallas District

Texas Department of
Transportation



**The Weather
Channel**

Used with permission.



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.25



Personal Protective Equipment PERSONNEL READINESS



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.26

VIDEO 9.3 (01:48) Winter Weather Clothing



CREDIT

“Winter Operations Training Series”

Iowa Department of Transportation

Used with permission.



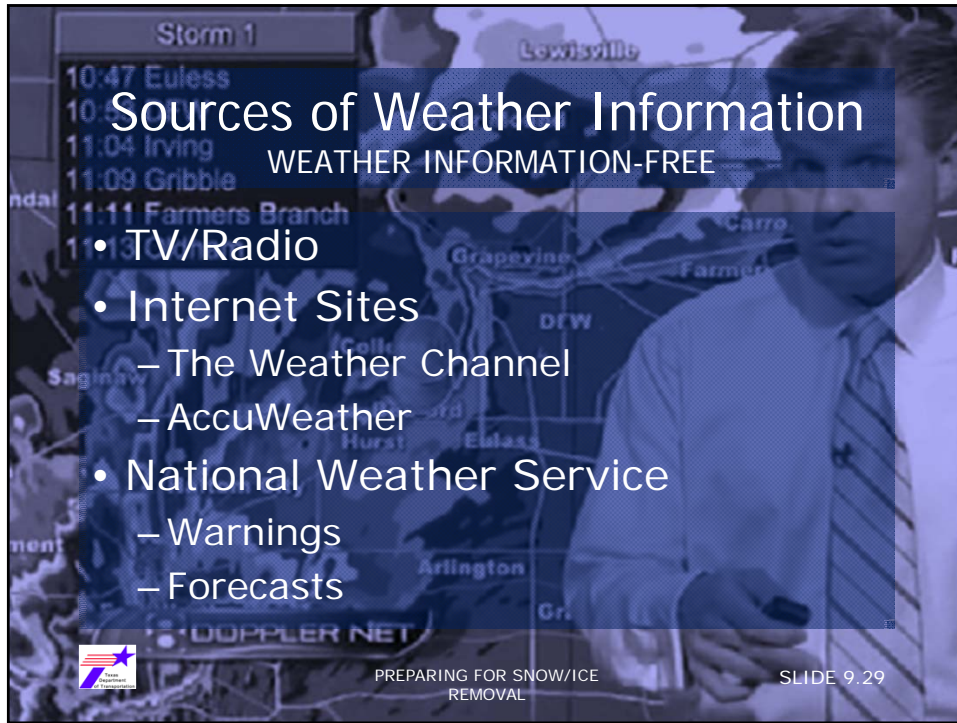
R_{9.3}
[9.31]



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.27

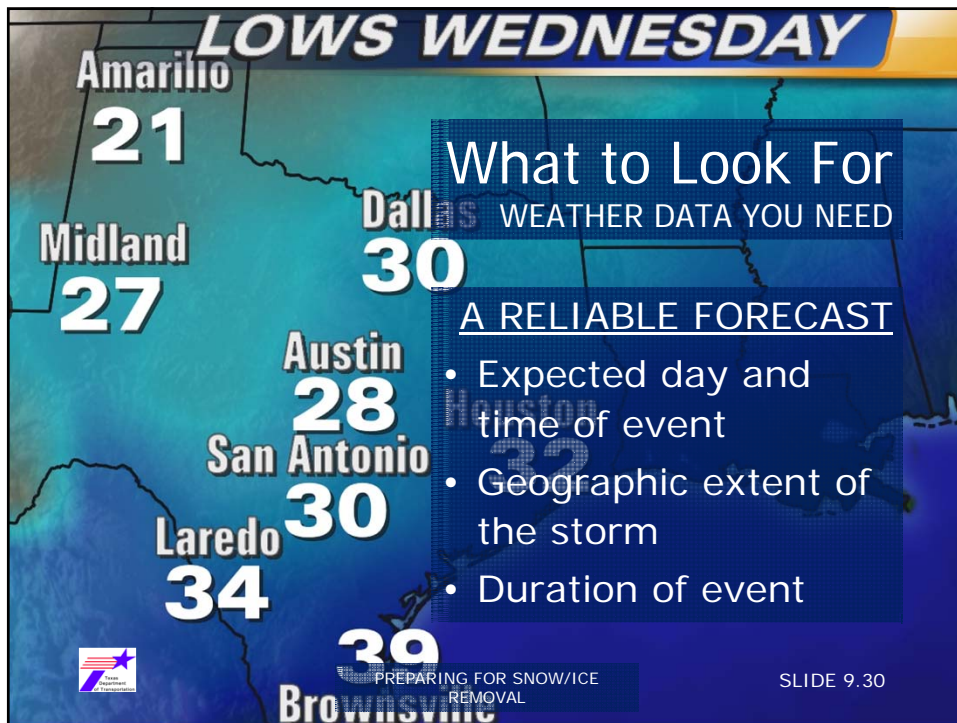




Sources of Weather Information
WEATHER INFORMATION-FREE

- TV/Radio
- Internet Sites
 - The Weather Channel
 - AccuWeather
- National Weather Service
 - Warnings
 - Forecasts

PREPARING FOR SNOW/ICE REMOVAL SLIDE 9.29



LOWS WEDNESDAY

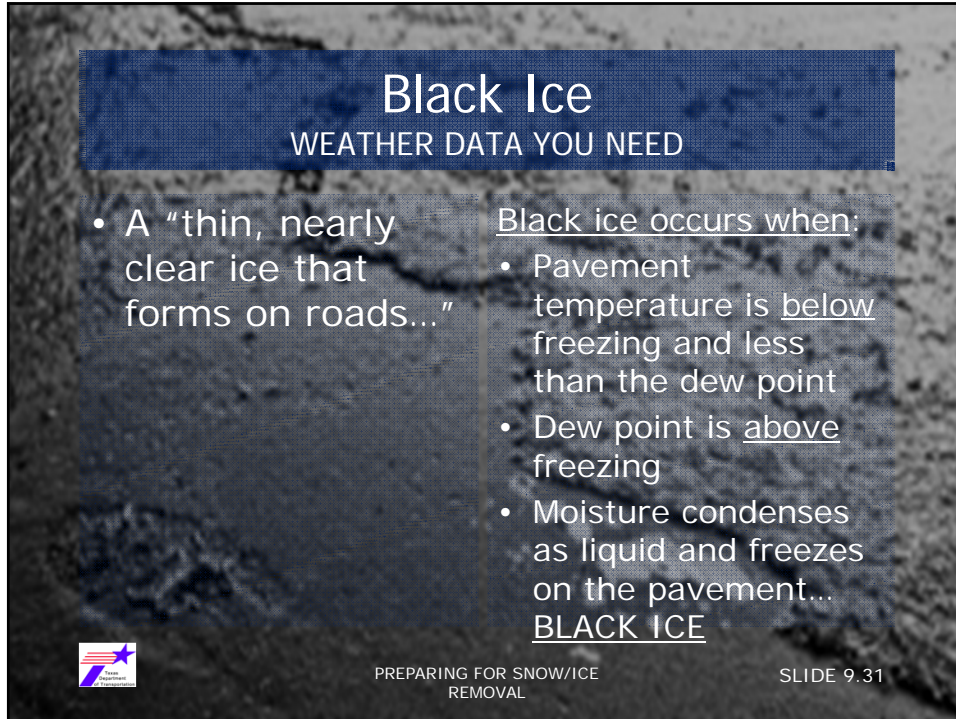
Amarillo	21
Midland	27
Dallas	30
Austin	28
San Antonio	30
Laredo	34
Brownsville	30

What to Look For
WEATHER DATA YOU NEED

A RELIABLE FORECAST

- Expected day and time of event
- Geographic extent of the storm
- Duration of event

PREPARING FOR SNOW/ICE REMOVAL SLIDE 9.30



Black Ice


WEATHER DATA YOU NEED

- A “thin, nearly clear ice that forms on roads...”

Black ice occurs when:

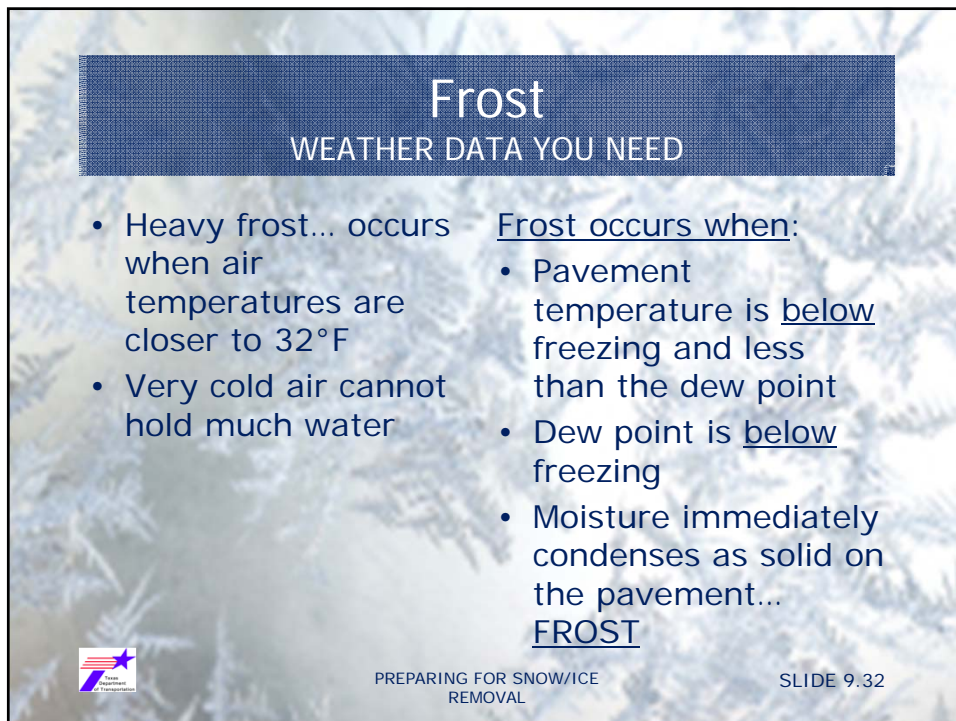
- Pavement temperature is below freezing and less than the dew point
- Dew point is above freezing
- Moisture condenses as liquid and freezes on the pavement...

BLACK ICE



PREPARING FOR SNOW/ICE REMOVAL

SLIDE 9.31



Frost


WEATHER DATA YOU NEED

- Heavy frost... occurs when air temperatures are closer to 32°F
- Very cold air cannot hold much water

Frost occurs when:

- Pavement temperature is below freezing and less than the dew point
- Dew point is below freezing
- Moisture immediately condenses as solid on the pavement...

FROST



PREPARING FOR SNOW/ICE REMOVAL

SLIDE 9.32



PREPARING FOR SNOW/ICE REMOVAL
LEVEL OF SERVICE

 PREPARING FOR SNOW/ICE REMOVAL SLIDE 9.33



Level of Service
WINTER WEATHER OPERATIONS

"The desired, usually achievable condition of pavement surface for a given road... after a typical winter event."

Best Practice: Outcomes-based Approach

 PREPARING FOR SNOW/ICE REMOVAL SLIDE 9.34

Focus on Priority Routes

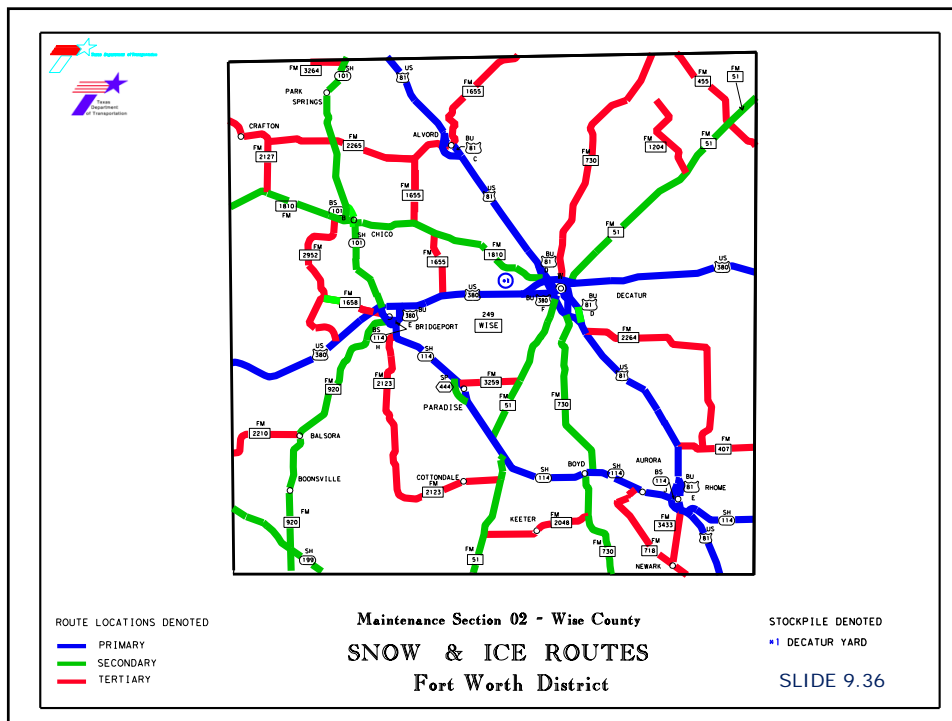
LEVEL OF SERVICE (LOS) ELEMENTS

- LOS is not the same for every road
- Your priority is the section of road you are assigned
- The LOS for a particular road is not necessarily constant throughout



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.35



Focus on the Pavement Surface

LEVEL OF SERVICE (LOS) ELEMENTS

- The pavement surface is where LOS is achieved and measured
- The road condition relates to driver safety and satisfaction
- Your Supervisor will explain what is expected for your particular road
 - Pavement surface conditions vary
 - Range from “Dry” to “Thick Ice Covered”



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.37



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.38

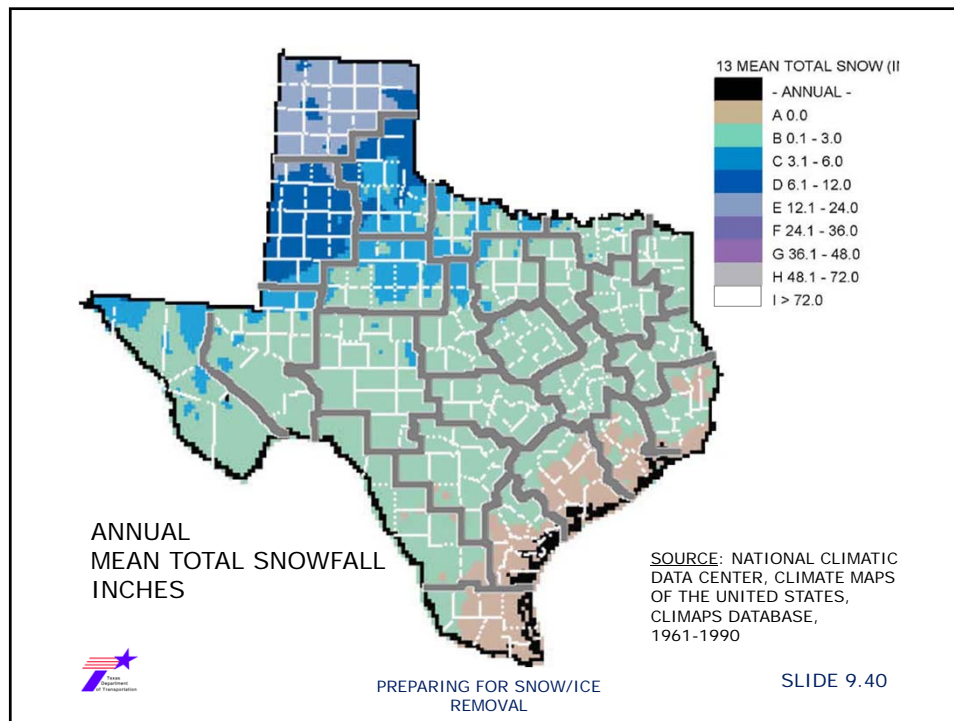
Typical Winter Storm LEVEL OF SERVICE (LOS) ELEMENTS

- Your District Snow and Ice Control Operations Plan is based on “typical” climate for your area
- “Typical” varies by geographic region
- Consider average winter weather over the past 5 years



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.39



Desirable, Usually Achievable

LEVEL OF SERVICE (LOS) ELEMENTS

- LOS is the target maintenance threshold
- Your Supervisor will clearly explain what is expected
- Extreme weather, and other factors beyond your control, will change what can be achieved



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.41



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.42

A Reasonable Goal

EXAMPLE LEVEL OF SERVICE LANGUAGE

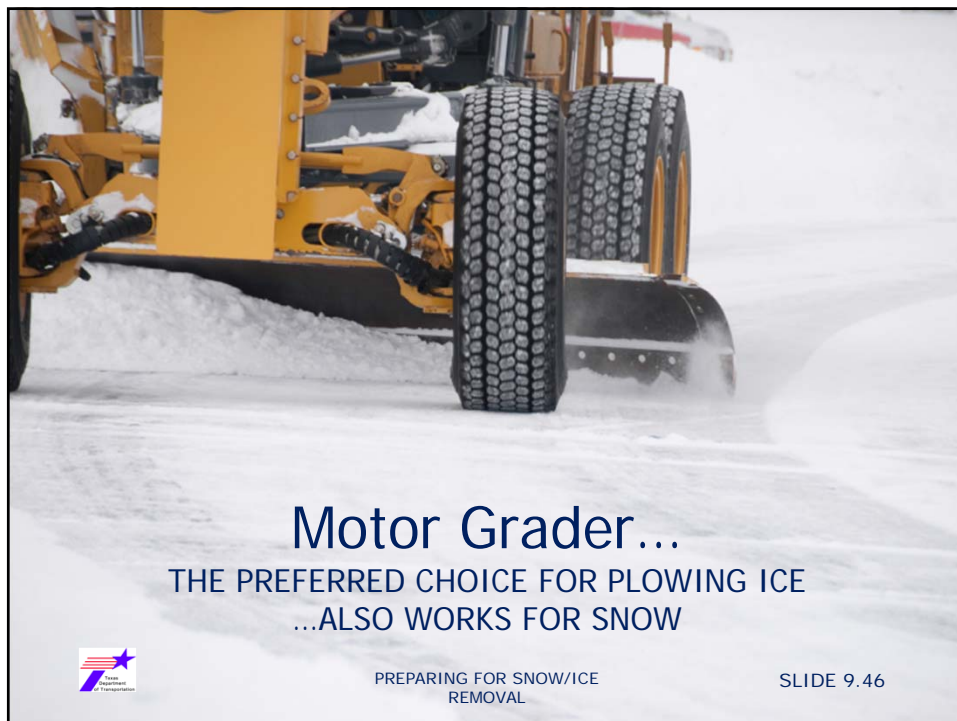
“Winter operations under typical storm conditions for Priority 2 routes (mid-volume US Highways, per plan) will keep roads open and passable for passenger vehicles, with effort focused on bridges, overpasses, steep inclines, and known trouble spots.”

PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.43

PREPARING FOR SNOW/ICE
REMOVAL

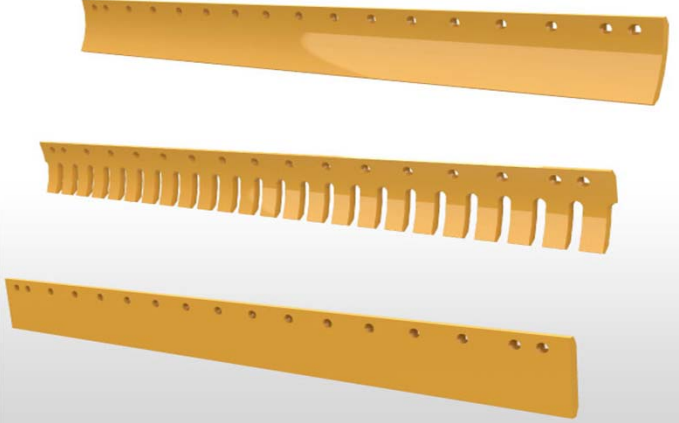
SLIDE 9.44



NOT RECOMMENDED


Standard Duty Motor Grader Blade

MECHANICAL REMOVAL OF ICE



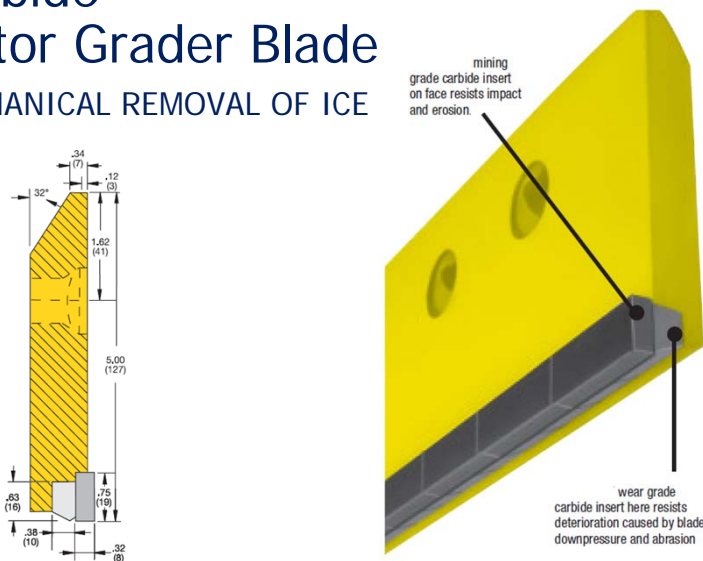
PREPARING FOR SNOW/ICE REMOVAL

SLIDE 9.47




Carbide Motor Grader Blade

MECHANICAL REMOVAL OF ICE



PREPARING FOR SNOW/ICE REMOVAL

SLIDE 9.48

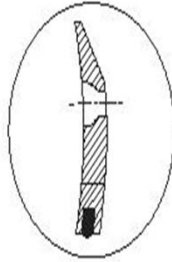


mining grade carbide insert on face resists impact and erosion.

wear grade carbide insert here resists deterioration caused by blade downpressure and abrasion

Curved Serrated Motor Grader Blade

MECHANICAL REMOVAL OF ICE



CURVED CARBIDE TIPPED SERRATED GRADER BLADE

- Thickness 3/4", Width 5-1/4", Lengths 2', 3' and 4'.
- Width of teeth 1" (5 per foot).
- Hole Sizes Available to accommodate 5/8" and 3/4" plow bolts.
- Carbide Inserts available in curved blade sections only.



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.49

VIDEO 9.4 (00:18) Plowing Ice with a Motor Grader

CREDIT

"Proper Plowing Techniques"


AASHTO Winter
Roadway Maintenance
Computer-Based
Training

Used with permission.



PREPARING FOR SNOW/ICE
REMOVAL

SLIDE 9.50



Summary and Review

1. Winter maintenance is part of emergency operations
2. Winter maintenance operations require careful preparation
3. It is good practice to monitor the weather
4. Level of service (LOS) means how well you clear the road surface
5. Motor graders can plow both ice and snow

PREPARING FOR SNOW/ICE REMOVAL

SLIDE 9.52

The slide has a dark blue background. On the left side, there is a white icon of a motor grader. To the right of the icon is the title 'Summary and Review' in white. Below the title is a numbered list of five points. At the bottom of the slide, there is a small Texas Department of Transportation logo on the left, the text 'PREPARING FOR SNOW/ICE REMOVAL' in the center, and 'SLIDE 9.52' on the right.

Exercise 9.1 Importance of Coordination



1. Think about why it is important for a District to have an established plan to coordinate winter weather response.
2. Jot down some reasons.
3. Discuss these with the persons next to you.

*Be prepared to discuss your reasons
(3 minutes).*



VIDEO 9.1. ROUTE INSPECTION (00:58)

SCRIPT

Each driver should travel his snow route in advance of the winter season to familiarize himself with the route and learn if hazards or obstructions are present which will affect plowing.

Become very familiar with the route you are responsible for. The way to do this effectively is to drive the route one or more times *prior to* any snowfall on the ground.

This video identifies several natural features to watch for, such as hills and curves, bumps, shaded areas, fences, and the like.

Also pay special attention to obstacles such as bridge expansion joints, low-hanging wires, concrete curbs, and any other kind of obstruction or hazard along your plow route.

It may be difficult or dangerous to jot these locations down while driving, so bring someone along with you during your dry run to take notes. For safe operation you will want to memorize these locations.

VIDEO 9.2. DEFENSIVE DRIVING ON SNOW/ICE (02:03)

SCRIPT

There's no doubt about it, winter weather makes for hazardous driving conditions! This video from the TxDOT Amarillo district shows snow plows operating in heavy traffic on Interstate 40.

We all know that when the weather outside is bad, the best place to be is inside! But despite warnings and encouragement to stay home, some of the travelling public will be out on the road.

When you have to drive on snow and ice, keep safety first, and drive defensively both to protect others and yourself. Practice these winter weather driving tips:

1. Make sure your vehicle is winter weather ready. Carefully performing your pre-trip inspection will go a long way toward ensuring your safety.
2. Experienced snow and ice drivers tell us to decrease speed and to allow extra room for turning and stopping. Brake gently, and accelerate gently, so as not to lose control.
3. Retain visibility. Make sure others can see you, and keep your visibility as good as possible.
4. Always know your own location, monitor road conditions, and communicate updates to your co-workers and your supervisor.

Even when you have done all you know to do, things can happen. The following film clip first aired on the Weather Channel. The video speaks for itself.

Be safe!

VIDEO 9.3. WINTER WEATHER CLOTHING (01:48)

SCRIPT

Selecting your snow plowing wardrobe may seem like a trivial issue, and it may be until you get caught out that first time in a howling snow storm with equipment problems. It is then, the clothing you are wearing becomes a vital issue.

It has been said that when selecting clothing to wear, plan for the normal but be prepared for the unusual. Experienced operators will tell you that you will usually face the unusual when plowing snow.

Start every shift with clean, dry skin and carefully chosen clean clothing. Cotton t-shirts and underwear are your best choice next to your skin. Over that wear 2 piece style long underwear, either thermal material or wool.

On your feet, wear cotton or polypropylene socks as the first layer. Polypropylene is the best choice because it wicks moisture away from your skin; cotton tends to hold moisture. A good choice for a second layer is wool socks. Do not wear stretch socks because they tend to cut off blood circulation, and it is good circulation that keeps your feet warm. As for trousers, jeans are a good choice. Suspenders are better than a belt because they allow for more air circulation.

When you pick out shirts, think in terms of layers because loose fitting layers of clothing trap air to keep you warm. Over your undershirt, a heavy flannel shirt is a good choice. Pick out shirts with long tails so they do not worked up and leave bare skin exposed when you get in and out of the truck. A heavy sweatshirt with or without hood, makes a great third layer.

VIDEO 9.4. PLOWING ICE WITH A MOTOR GRADER (00:18)

SCRIPT

Motor graders can be equipped with an ice blade or V-Plow.

These powerful machines are operated at speeds much lower than regular truck mounted plows, generally just 5 to 10 miles per hour.

Class Exercise – Review Questions

Module 9 – PREPARING FOR SNOW/ICE REMOVAL

MNT812 Winter Weather Operations Training

1. Responding to a winter storm is part of emergency operations at TxDOT because:
 - A. Winter storms constitute a state of emergency
 - B. Operating equipment in winter weather can be very hazardous
 - C. Winter storm response often occurs outside of normal business hours
 - D. All of the above
2. [True/False] No matter the size of the storm, for your Maintenance Section, the Maintenance Supervisor holds the key operational role in the Incident Command System.
 - A. True
 - B. False
3. Some of the preparations needed for winter maintenance operations include:
 - A. Be ready for shift work and working out of town
 - B. Inspect and become familiar with your plow route
 - C. Make sure you have adequate winter weather clothing
 - D. All of the above
4. [True/False] TxDOT policy on defensive driving during major winter storms is that it is better and safer for operations personnel to stay at home, safe and warm, and to keep roadway maintenance equipment off the road and in the garage, protected from damage.
 - A. True
 - B. False
5. [True/False] During the winter storm season, it is the job of your Supervisor to keep an eye on the weather. That is one thing you do not have to worry about.
 - A. True
 - B. False
6. [True/False] The important thing about level of service is, your Supervisor will explain the outcome he expects you to achieve for your assigned section of road.
 - A. True
 - B. False
7. [True/False] Snow plows and motor graders are equally effective at plowing both snow and ice.
 - A. True
 - B. False

MODULE 10

Snow Plowing Techniques



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012

Learning Objectives

Upon completion of this section, the learner will be able to:

1. List safety considerations associated with plowing snow and ice
2. Demonstrate basic knowledge of snow plowing techniques
3. Identify plowing situations which require operator judgment







Exercise 10.1 Snow Plowing Safety Considerations



In groups of 3 to 4 persons:

1. Identify the top three safety situations you think you will encounter when plowing snow or ice. Which one concerns you most?
2. Jot down your ideas.

Be prepared to discuss your answers (5 minutes).



SNOW PLOWING TECHNIQUES

SLIDE 10.6

VIDEO 10.1 (00:35) Snow Plow Safety



CREDIT

“A Dangerous Game...”

WWTV

Cadillac/Traverse City, MI

In the public domain.



R_{10.1}
[10.53]



SNOW PLOWING TECHNIQUES

SLIDE 10.7

Plowing Safety Checklist

- Plowing Safety Checklist**
- Use a three-point stance to enter and exit the vehicle.
 - There should be no loose items in the cab.
 - Position yourself in the seat so you can comfortably reach all controls.
 - Adjust mirrors for maximum visibility.
 - Fasten seat belt.
 - Verify that your two-way radio is operational.
 - Verify that your warning lights are on before you leave the garage.
 - Test drive vehicle and all attached equipment.
 - Position hands on steering wheel at 9:00 and 3:00 o'clock; do not wrap thumbs around wheel.
 - Take wide turns as needed to accommodate length and width of plow-equipped vehicle.
 - Drive defensively! Don't assume motorists will drive properly.
 - Memorize location of obstacles along your route.
 - Scan ahead 12-15 seconds; expect the unexpected.
 - Drive at safe and effective operating speed for the equipment you're operating.
 - Scan around your vehicle at all times.
 - Give an ample warning to pass on the right.
 - Position where you know surface conditions.
 - Do not pass on a surface where you have a poor view of distance to stop.
 - Plus, be sure

R_{10.2}
[10.55]

SNOW PLOWING TECHNIQUES

SLIDE 10.8

FLINK Manual

SAFE PROCEDURES FOR SNOW PLOWING

1. **DO NOT** exceed appropriate speeds for equipment and conditions.
2. Use all available safety warning devices. **EXAMPLES:** Slow moving vehicle flashing lights, hazard lights.
3. Be alert for drivers coming from behind.
4. Wear protective clothing. **EXAMPLES:** Warm gloves or mittens, thermal-type underwear, water and wind resistance outer coat, head and ear covering, two pair of socks, and warm boots.
5. Know the symptoms of over exposure to cold or frostbite.
6. Carry emergency equipment. **EXAMPLES:** Flares or reflectors, first aid kit, fire extinguisher, flashlight, etc.....
7. Carry emergency equipment. **EXAMPLES:** Bridge expansion joints, pavement expansion joints, headwalls of culverts, cattle guards, sign guards, guardrails, high shoulders, raised pavement markers, curbs, islands, fire hydrants, railroad crossings, mailboxes, holes repaired in roads, manhole covers, and catch basins.
8. If possible, travel snow route in advance to inspect and learn if hazards and/or obstructions are present.
9. **NOTE:** The snow plow trip mechanism may not always protect the plow and truck when impacting some obstructions, especially at high rates of speed. **ALWAYS USE EXTREME CAUTION WHEN PLOWING!**

CAUTION: To prevent damage to plow or vehicle, flag and identify any obstructions that are hard to locate in the snow.

SNOW PLOWING TECHNIQUES

R_{10.3}
[10.57]

SLIDE 10.9

HENKE Manual

GENERAL SAFETY INSTRUCTIONS AND PRECAUTIONS

A careful operator is the best operator. Safety is of primary importance and should be to the owner/operator. Most accidents can be avoided by being aware of your surroundings and observing certain precautions. The first section of this manual includes a list of safety messages before assembling, operating or servicing this implement. This equipment should be used only by those persons who have read the manual, who are responsible and trained, and who know how to use it responsibly.

The Safety Alert Symbol combined with a Signal Word, as seen below, is used throughout the manual and on decals which are attached to the equipment. The Safety Alert Symbol means: "ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!" The Symbol and Signal Word are intended to warn the owner/operator of impending hazards and the degree of possible injury faced when operating this equipment.

SAFETY

Practice all usual and customary safe working precautions and above all—remember safety is up to YOU. Only YOU can prevent serious injury or death from unsafe practices.

! DANGER Indicates an imminently hazardous situation that, if not avoided, WILL result in DEATH OR VERY SERIOUS INJURY.

! WARNING Indicates an imminently hazardous situation that, if not avoided, COULD result in DEATH OR SERIOUS INJURY.

! CAUTION Indicates an imminently hazardous situation that, if not avoided, MAY result in MINOR or moderate injury or damage to property, or damage to the machine, attachments or the environment.


R_{10.4}
[10.61]

SLIDE 10.10

MONROE Manual

SAFETY INSTRUCTIONS

- Read all installation, safety and maintenance instructions completely before operating this equipment.
- Keep all personnel clear of moving parts while equipment is being operated.
- Do not operate a plow in need of maintenance! Repair immediately!
- While operating this equipment use common sense, use caution, be alert and be safety-conscious.



R_{10.5}
[10.77]

SNOW PLOWING TECHNIQUES

SLIDE 10.11

Equipment Safety

EQUIPMENT FOR SNOW AND ICE CONTROL






SNOW PLOWING TECHNIQUES

SLIDE 10.12



Exercise 10.2


Snow Plowing Techniques



In groups of 3 to 4 persons:

1. Identify three snow/ice plowing situations you typically encounter in your area. Do you know what you need to know?
2. Jot down your ideas.

Be prepared to discuss your answers (5 minutes).

 SNOW PLOWING TECHNIQUES SLIDE 10.14

VIDEO 10.2 (01:08) Are You Ready?



CREDIT

“Winter Operations Training Series”

Iowa Department of Transportation

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SNOW PLOWING TECHNIQUES

SLIDE 10.15

Advice from the Pros...

ARE YOU READY FOR THE CHALLENGE?

- We preach to our guys to be ready for a call at any time when operations personnel are “on call”
- Crewmembers should also watch the weather closely when they are “on call” so they can anticipate the call before it comes



SNOW PLOWING TECHNIQUES

SLIDE 10.16

VIDEO 10.3 (01:57) Know Your Route



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SNOW PLOWING TECHNIQUES

SLIDE 10.17

Advice from the Pros...

KNOW YOUR ROUTE

- Each driver should travel their snow route in advance of the winter season to familiarize themselves with the route and learn if hazards or obstructions are present.



SNOW PLOWING TECHNIQUES

SLIDE 10.18

Advice from the Pros...

KNOW YOUR ROUTE

- Be aware of obstructions along your route:
 - Bridge expansion joints
 - Railroad crossings
 - Headwalls of culverts
 - Manhole covers
 - Soft shoulders

... to name a few



SNOW PLOWING TECHNIQUES

SLIDE 10.19

Advice from the Pros...

KNOW YOUR ROUTE

- To prevent damage to plow or vehicle, flag and identify any obstructions that are hard to locate in the snow
- Be alert for any kind of obstruction or hazard along your plow route



SNOW PLOWING TECHNIQUES

SLIDE 10.20

VIDEO 10.4 (00:30) Plowing Speed



CREDIT

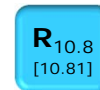
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SNOW PLOWING TECHNIQUES



SLIDE 10.21

Advice from the Pros...


PLOWING SPEED

- 25 mph is a good target speed for plowing
- The plow will start to “skip” over the snow at higher plow speeds and cause a “rub board” effect
- Traffic can lose control of their vehicle on these rub boards



SNOW PLOWING TECHNIQUES

SLIDE 10.22



PLOWING SPEED
Advice from the Pros...

**SPEED
LIMIT
25**

SNOW PLOWING TECHNIQUES SLIDE 10.23

Advice from the Pros...
PLOWING SPEED

- Allowable plow speed depends on the type of snow that you are plowing
- One can plow faster on wet, slushy snow
- The Flink Snow Plow Manual has a chart about plowing speed safety

SNOW PLOWING TECHNIQUES SLIDE 10.24

VIDEO 10.5 (01:24) Plowing in Traffic

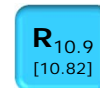


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SNOW PLOWING TECHNIQUES

SLIDE 10.25

Advice from the Pros...

PLOWING IN TRAFFIC: TURNING AROUND

- Turn around in a town section if at all possible; can't utilize an unpaved ditch or median
- Can sometimes utilize a driveway or intersection to turn around
- Watch for traffic when turning around!!!



SNOW PLOWING TECHNIQUES

SLIDE 10.26

VIDEO 10.6 (01:10) Plow Truck Handling



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R10.10
[10.83]



SNOW PLOWING TECHNIQUES

SLIDE 10.27

VIDEO 10.7 (00:45) Visibility



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R10.11
[10.84]



SNOW PLOWING TECHNIQUES

SLIDE 10.28

Advice from the Pros...

VISIBILITY

- One of the biggest problems associated with winter maintenance is the progressive buildup of snow, ice and dirt on the truck, plow and spreader
- Lights and windshields become covered with snow, ice and dirt
- Keep windshields clear and periodically clean your lights so traffic can see you and you can see what you are doing



SNOW PLOWING TECHNIQUES

SLIDE 10.29

VIDEO 10.8 (01:13)

Handling Fatigue and Stress

CREDIT

“Winter Operations Training Series”

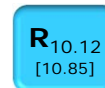
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SNOW PLOWING TECHNIQUES

SLIDE 10.30



Advice from the Pros...

HANDLING FATIGUE AND STRESS

- We stress to operators that it is their responsibility to inform their supervisor when they are fatigued
- Maintenance personnel in the more rural sections don't have enough people to run shifts; crewmembers occasionally have to work "over the limit" to finish out a storm



SNOW PLOWING TECHNIQUES

SLIDE 10.31

VIDEO 10.9 (01:58)

Plowing Two-Lane Roads



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SNOW PLOWING TECHNIQUES

R10.13
[10.86]

SLIDE 10.32

Advice from the Pros...

PLOWING TWO-LANE ROADS

- When plowing two-lane, two-way roads, stay in your own lane
- Position the left side of the plow near the center of the road, but don't extend the moldboard into the path of oncoming traffic



SNOW PLOWING TECHNIQUES

SLIDE 10.33

Advice from the Pros...

PLOWING TWO-LANE ROADS

- Try to uncover the centerline on the first pass, pushing snow to the right
- If conditions are such that you can't see the centerline, use the edge of the road as your guide
- Follow your District's policy regarding scraping off RPMs (or plowing around RPMs)



SNOW PLOWING TECHNIQUES

SLIDE 10.34

Advice from the Pros...

PLOWING TWO-LANE ROADS

- Depending on the priority level of the roadway, you may need to perform a second pass in each lane to push snow farther to the right
- Watch for unpaved shoulders; you can usually sense when the front tire goes off the paved surface



SNOW PLOWING TECHNIQUES

SLIDE 10.35

Advice from the Pros...

MOTOR GRADERS AND KICK-OFF WINGS

- Kickoff wings on motor graders are used to help get the snow off the roadway edges and shoulders
- The problem occurs when the snow melts and the water infiltrates into the base and subgrade materials resulting in pavement deterioration



SNOW PLOWING TECHNIQUES

SLIDE 10.36

Advice from the Pros...

PLOWING TWO-LANE ROADS

- After reaching the end of your route, find a safe place to turn around
- On the return trip, position the plow to catch snow remaining near the center of the road; push the snow to the right.



SNOW PLOWING TECHNIQUES

SLIDE 10.37

VIDEO 10.10 (01:57) Plowing Multiple-Lane Roads

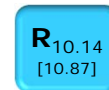


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SNOW PLOWING TECHNIQUES

SLIDE 10.38

Advice from the Pros...

PLOWING MULTI-LANE ROADS

- When plowing alone and not in tandem with another operator, if there is a median wide enough to hold the plowed snow, plow the right-hand lane to the right first



SNOW PLOWING TECHNIQUES

SLIDE 10.39

Advice from the Pros...

PLOWING MULTI-LANE ROADS

- Then in the second pass, plow the left-hand lane to the left, pushing the snow toward the median
- During the second pass, be sure to catch the snow near the middle of the road that was left behind by the first pass



SNOW PLOWING TECHNIQUES

SLIDE 10.40

Advice from the Pros...

PLOWING MULTI-LANE ROADS

- If plowing two lanes in tandem with another operator and a wide median is available to hold the snow, the lead truck should plow the right lane pushing the snow to the right



SNOW PLOWING TECHNIQUES

SLIDE 10.41

Advice from the Pros...

PLOWING MULTI-LANE ROADS

- The second truck should plow to the left, pushing the snow toward the median and catching the snow left behind by the first plow
- If there isn't a wide median available, all the snow must be pushed to the right



SNOW PLOWING TECHNIQUES

SLIDE 10.42

Advice from the Pros...

PLOWING MULTI-LANE ROADS

- Whether you clear the road yourself in two passes or you are plowing in tandem, plow the left lane to the right first, then plow the right-hand lane
- Repeat for the other side of the highway



SNOW PLOWING TECHNIQUES

SLIDE 10.43

Advice from the Pros...

PLOWING MULTI-LANE ROADS

- When plowing in tandem, the front plow will be in the left-most lane and push snow to the right
- The next plow follows closely behind (approximately 100 feet) in the next lane over, with its plow overlapping the first plow width by 2 feet, again pushing the snow to the right



SNOW PLOWING TECHNIQUES

SLIDE 10.44

Advice from the Pros...

PLOWING MULTI-LANE ROADS

- The tandem technique accommodates any number of lanes with an equal number of plows a safe distance apart from one another
- The snow from all lanes is pushed off to the right shoulder or beyond in one pass of the plow train



SNOW PLOWING TECHNIQUES

SLIDE 10.45

VIDEO 10.11 (00:57)

Blade Wear & Replacement



CREDIT

Rocky Andrews

Amarillo District

Texas Department of
Transportation



R_{10.15}
[10.88]



SNOW PLOWING TECHNIQUES

SLIDE 10.46

Advice from the Pros...

BLADE WEAR

- Keep a close watch on your blade while plowing
- Under harsh wear conditions – wet slushy snow, high speed, abrasive road surface – check every mile
- Under milder conditions, blade checks can be less frequent
- Always find a safe place to stop



SNOW PLOWING TECHNIQUES

SLIDE 10.47

Advice from the Pros...

BLADE REPLACEMENT

- Keep the right tools on your truck or motor grader to tighten any loose plow bolts
- Whether or not you use blades with carbide inserts, if less than 1½ inch (two fingers) of the blade remains, it's generally time to replace the blade



SNOW PLOWING TECHNIQUES

SLIDE 10.48



Advice from the Pros...

BLADE WEAR

- Blades “burn up” more quickly when plowing wetter snow since there is no crust on pavement surface to create a buffer between the blade and the pavement surface
- Higher plowing speeds will also increase the rate of plow blade wear



Advice from the Pros...

BLADE WEAR

- It is better and more typical to change plow blades in the shop
- Motor grader blades are often changed in the field (not as mobile as a plow truck)
- Snow plow blades last longer when they are doubled up; plow bolts don't tend to loosen as much



SNOW PLOWING TECHNIQUES

SLIDE 10.51

Advice from the Pros...

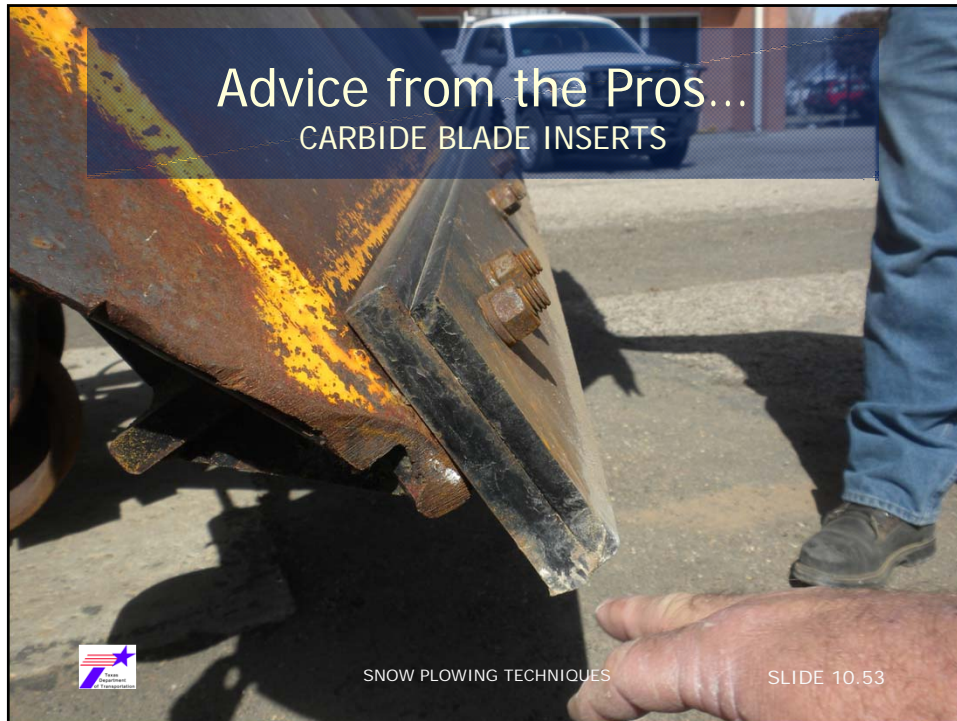
CARBIDE BLADE INSERTS

- Many Districts use carbide inserts in their snow plow blades
- Carbide, which is tougher than mild steel, helps the blade last longer
- Place carbide blade next to moldboard




SNOW PLOWING TECHNIQUES

SLIDE 10.52



Advice from the Pros...
BLADE ATTACK ANGLE

- In order to minimize wear while still maintaining an effective cutting edge, it is important to properly angle your plow blade
- The recommended attack angle is approximately 65° from horizontal

 SNOW PLOWING TECHNIQUES SLIDE 10.54

Advice from the Pros...

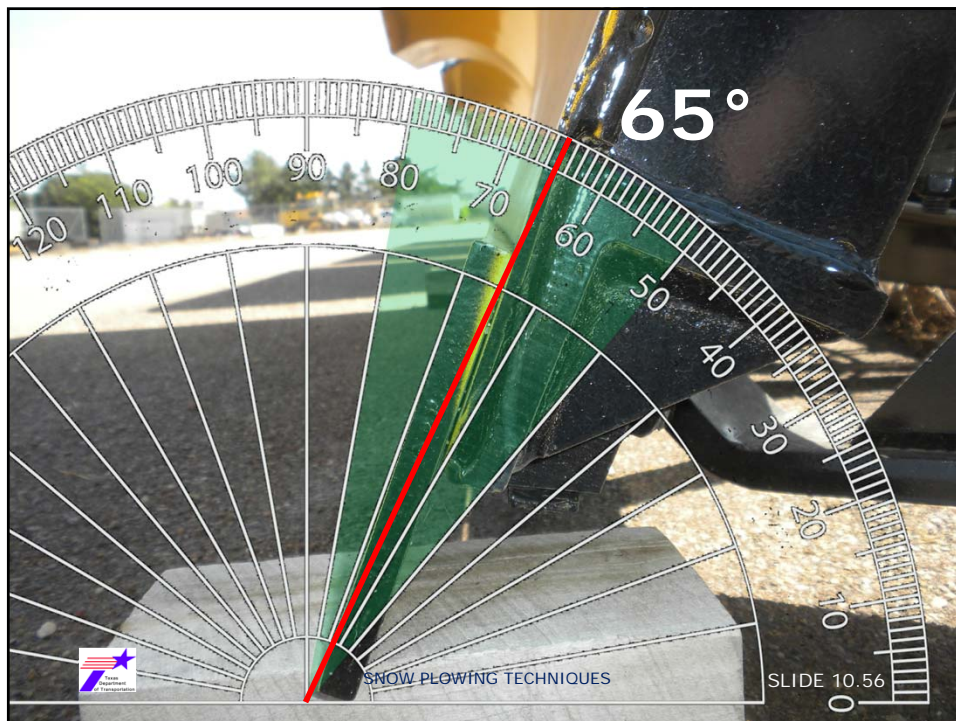
BLADE ATTACK ANGLE

- As long as you tilt the blade within 15° of this recommended angle, your blade should last longer
- Blade angles outside of this range may cause increased vibration which in turn is likely to cause more rapid wear



SNOW PLOWING TECHNIQUES

SLIDE 10.55



Advice from the Pros...

RAISE BLADE IF NOT PLOWING SNOW

- No matter what type of roadway you are plowing, if the road has been cleared of snow and ice, raise your plow!
- Otherwise, you will be wearing down the blade unnecessarily



SNOW PLOWING TECHNIQUES

SLIDE 10.57

VIDEO 10.12 (00:50) Plowing Ramps



CREDIT

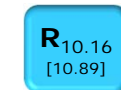
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SNOW PLOWING TECHNIQUES



SLIDE 10.58

Advice from the Pros...

PLOWING RAMPS

- When plowing relatively level ramps, start as far to the side of the ramp as possible and push the snow in the opposite direction



SNOW PLOWING TECHNIQUES

SLIDE 10.59

Advice from the Pros...

PLOWING RAMPS

- Each pass pushes the snow farther to the side until the ramp is clear
- Each pass should overlap the prior pass so no windrows remain
- It is very risky to try to back up or down a ramp... traffic may approach



SNOW PLOWING TECHNIQUES

SLIDE 10.60

Advice from the Pros... PLOWING SUPERELEVATED RAMPS

- When plowing superelevated ramps, move snow from the high side to the low side
- If you need to angle the blade left to accomplish this, be sure to change the angle back to the right when exiting the ramp



SNOW PLOWING TECHNIQUES

SLIDE 10.61

VIDEO 10.13 (00:43) Plowing Intersections



CREDIT

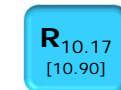
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SNOW PLOWING TECHNIQUES



SLIDE 10.62

Advice from the Pros...

PLOWING INTERSECTIONS

- The priority given to intersections varies among Districts
- For rural Districts, intersections are often priority 1 routes
- For metropolitan Districts, intersections may be part of post-storm cleanup



SNOW PLOWING TECHNIQUES

SLIDE 10.63

Advice from the Pros...

PLOWING INTERSECTIONS

- When plowing intersections, keep the plow blade straight until you are through the intersection, then angle the blade to the right
- This way windrows will be smaller in the intersection



SNOW PLOWING TECHNIQUES

SLIDE 10.64

Advice from the Pros...

PLOWING INTERSECTIONS

- Depending on the number of lanes, plowing an intersection may require several passes
- Multiple passes can be achieved by angling the blade to the right and turning right at the intersection



SNOW PLOWING TECHNIQUES

SLIDE 10.65

Advice from the Pros...

PLOWING INTERSECTIONS

- Repeat the plowing process in all four directions then make a couple of passes through the intersection
- Backing up in an intersection is not recommended; motorists behind you will not be expecting this



SNOW PLOWING TECHNIQUES

SLIDE 10.66

VIDEO 10.14 (02:03) Plowing Bridges

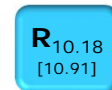


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SNOW PLOWING TECHNIQUES

SLIDE 10.67

Advice from the Pros...

BRIDGE ABUTMENTS AND EXPANSION JOINTS

- When approaching a bridge abutment or expansion joint, it is crucial that your blade not be angled in the same direction as the abutment or joint



SNOW PLOWING TECHNIQUES

SLIDE 10.68

Advice from the Pros...

BRIDGE ABUTMENTS AND EXPANSION JOINTS

- If blade orientation is parallel to the expansion joint, the blade may fall into the joint, likely causing considerable damage to the plow and vehicle
- You could be injured and/or lose control of the vehicle



SNOW PLOWING TECHNIQUES

SLIDE 10.69

Advice from the Pros...

PLOWING OPEN-RAIL BRIDGES

- If no road, railroad, pedestrian crossing, boat traffic or environmentally sensitive area (such as a stream) exists below the bridge, it may be safe to angle the blade to the right and funnel the snow through the railing and over the side of the bridge



SNOW PLOWING TECHNIQUES

SLIDE 10.70

Advice from the Pros...

PLOWING OPEN-RAIL BRIDGES

- If plowing an open-rail bridge and there is a road, railroad, pedestrian crossing, boat traffic or environmentally sensitive area below the bridge, slow down considerably



SNOW PLOWING TECHNIQUES

SLIDE 10.71

Advice from the Pros...

PLOWING OPEN-RAIL BRIDGES

- Plow the snow straight, or nearly straight ahead until you reach the far side of the bridge
- This technique ensures that snow doesn't accumulate along the rail or go over the rail onto an individual or property below



SNOW PLOWING TECHNIQUES

SLIDE 10.72

Advice from the Pros...

PLOWING SOLID-RAIL BRIDGES

- Avoid plowing snow against the solid rail of a bridge
- If you push snow up along a bridge rail or divider, the snow can act as a ramp that vehicles can accidentally roll up on and turn over



SNOW PLOWING TECHNIQUES

SLIDE 10.73

Advice from the Pros...

BRIDGE SUPERSTRUCTURE

- Be very careful that your plow does not collide with structural members of a truss bridge or a bridge railing; this is particularly important if you have a wing attached.



SNOW PLOWING TECHNIQUES

SLIDE 10.74

Advice from the Pros...

PASSING AN ONCOMING PLOW

- If another plow is on a two-lane bridge coming toward you, remember that the width of that plow combined with yours may exceed the space between the bridge railings



SNOW PLOWING TECHNIQUES

SLIDE 10.75

Advice from the Pros...

PASSING AN ONCOMING PLOW

- In this case, wait until the oncoming plow exits the bridge before you enter the bridge
- On very narrow bridges, you may also need to wait for cars to clear the bridge as well



SNOW PLOWING TECHNIQUES

SLIDE 10.76

Advice from the Pros...

MELT AND REFREEZE

- Accumulated snow along the bridge rail can melt and run across the bridge surface, then refreeze
- Therefore, during post-storm cleanup operations, clean as much snow from the bridge rails as possible



SNOW PLOWING TECHNIQUES

SLIDE 10.77

Advice from the Pros...

MELT AND REFREEZE

- On superelevated ramps or bridges, remove as much snow away from the high side as possible to prevent runoff and refreeze



SNOW PLOWING TECHNIQUES

SLIDE 10.78

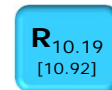
VIDEO 10.15 (00:32) Snow Plow Trip Mechanism



CREDIT

**“Snow Removal
Techniques,
Plowing Tips from
the Pros”**

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SNOW PLOWING TECHNIQUES

SLIDE 10.79



VIDEO 10.16 (00:38) Railroad Crossings

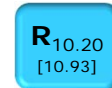


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Iowa Department of Transportation

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SNOW PLOWING TECHNIQUES

SLIDE 10.81

Advice from the Pros... RAILROAD CROSSINGS

- Motor graders have hit railroad tracks in the past
- Have not had a problem with snow plows



SNOW PLOWING TECHNIQUES

SLIDE 10.82

Advice from the Pros...

RAILROAD CROSSINGS

- As you approach a railway crossing, slow down and raise the plow blade
- Angling the blade is not sufficient; the blade could drop between the pavement and the rail, likely causing considerable damage to the plow, your vehicle and/or the rail crossing



SNOW PLOWING TECHNIQUES

SLIDE 10.83

Advice from the Pros...

RAILROAD CROSSINGS

- You could also be injured and/or lose control of your vehicle



SNOW PLOWING TECHNIQUES

SLIDE 10.84

VIDEO 10.17 (00:47) Ready to Hit the Road

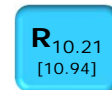


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SNOW PLOWING TECHNIQUES

SLIDE 10.85



VIDEO 10.18 (00:47) Don't Crowd the Plow



CREDIT

**Maintenance
Division**

Texas Department of
Transportation



R_{10.22}
[10.95]



SNOW PLOWING TECHNIQUES

SLIDE 10.87



SNOW PLOWING TECHNIQUES
**SNOW PLOWING
SITUATIONS WHERE
JUDGMENT IS NEEDED**



SNOW PLOWING TECHNIQUES

SLIDE 10.88



Exercise 10.3 Operator Judgment



In groups of 3 to 4 persons:

1. Identify snow/ice plowing situations where the correct approach is not clear. How should you handle this?
2. Jot down your ideas.

Be prepared to discuss your answers (5 minutes).



Some Judgment Situations

SNOW PLOWING TECHNIQUES

- Plowing in construction zones
- Plowing in school zones
- Vehicles stranded in the traffic lane
- Damage to delineators, RPMs
- Barrier separated lanes (e.g., HOV)
- Working outside your home area
- How to handle snow drifts



SNOW PLOWING TECHNIQUES

SLIDE 10.91



Summary and Review

1. Safety considerations associated with plowing snow and ice
2. Basic snow plowing techniques
3. Plowing situations which require operator judgment



SNOW PLOWING TECHNIQUES

SLIDE 10.92

Exercise 10.1

Snow Plowing Safety Considerations



In groups of 3 to 4 persons:

1. Identify the top three safety situations you think you will encounter when plowing snow or ice. Which one concerns you most?
2. Jot down your ideas.

*Be prepared to discuss your answers
(5 minutes).*



Exercise 10.2 Snow Plowing Techniques



In groups of 3 to 4 persons:

1. Identify three snow/ice plowing situations you typically encounter in your area. Do you know what you need to know?
2. Jot down your ideas.

Be prepared to discuss your answers (5 minutes).



Exercise 10.3 Operator Judgment



In groups of 3 to 4 persons:

1. Identify snow/ice plowing situations where the correct approach is not clear. How should you handle this?
2. Jot down your ideas.

Be prepared to discuss your answers (5 minutes).



VIDEO 10.1. SNOW PLOW SAFETY (00:35)

SCRIPT

Another dangerous game kids play is to tunnel in snow banks near the road.

A few years ago one boy... (snow plow spray)

Page intentionally left blank.

PLOWING SAFETY CHECKLIST

Plowing Safety Checklist

- Use a three-point stance to enter and exit the vehicle.
- There should be no loose items in the cab.
- Position yourself in the seat so you can comfortably reach all controls.
- Adjust mirrors for maximum visibility.
- Fasten seat belt.
- Verify that your two-way radio is operational.
- Verify that your warning lights are on before you leave the garage.
- Test drive vehicle and all attached equipment.
- Position hands on steering wheel at 9:00 and 3:00 o'clock; do not wrap thumbs around wheel.
- Take wide turns as needed to accommodate length and width of plow-equipped vehicle.
- Drive defensively! Don't assume motorists will drive properly.
- Memorize location of obstacles along your route.
- Scan ahead 12-15 seconds; expect the unexpected.
- Drive at safe and effective operating speed for the equipment you're operating.
- Keep a safe zone around your vehicle at all times.
- Watch for vehicles attempting to pass on the right.
- When pulling over, do so in safe location where you know surface will be firm and your vehicle will not present a hazard to motorists.
- Keep plenty of distance between you and car ahead so you have plenty of distance to stop.
- Check mirrors every 3-5 seconds.
- Use extreme caution when shifting to the left. Look for oncoming traffic. Plus, be sure no one is trying to pass on the left.
- When approaching a wide oncoming vehicle, such as another plow, cover brake; stop if necessary.
- Become familiar with opposing force of snow so you know how much to over-steer.
- Don't run plow along the curb.

- At night, be wary of tired or impaired motorists or pedestrians.
- Do not plow snow off an overpass if there is a road, structure, traveled waterway, pedestrian walkway, etc. below.
- Watch for pedestrians in crosswalks, on sidewalks, in driveways, etc.
- Watch for children at play.
- Investigate tall accumulations and drifts before plowing through them.
- Always travel in same direction as traffic.
- Never make a U-turn in the middle of a median. Use safe turn-around locations.
- When backing, you must know what is behind you. Get out and check if necessary.
- Don't assume motorists will heed your backup alarm and flashers.
- Always be alert for emergency vehicles; slow and pull over as they approach.
- Take breaks as needed. Eat nutritious snacks and drink plenty of fluids.
- Perform a check of your equipment and clean lights and reflectors when you pull over.
- Keep warning lights on when pulled over.
- You are responsible for the safe operation of your equipment at all times. No excuses!
- If you come upon an accident with injuries, radio for help; render aid only per your supervisor's instructions.
- If you come upon a stranded vehicle, assist only as necessary to clear roadway.

Source: "Plowing Safety Checklist," Documents, **Equipment Maintenance CD**, Version 1, AASHTO Clear Roads Computer Based Training, July 2007.

FLINK SNOW PLOW MANUAL (JUNE 2001)

READ THE FOLLOWING
IT MAY PERTAIN TO YOU!!!!



EXCESSIVE SPEED COULD MAKE YOUR SNOW PLOW INTO A TIME
!!!!BOMB!!!!

SENSIBLE SPEEDS MAKE PLOWING SAFER!!!!

Alterations to this snowplow or using it for purposes other than which it was designed, could create serious safety hazards and possible injury to personnel, or could cause damage to the truck or plow.

! WARNING



STOP ENGINE AND SET PARKING BRAKE BEFORE ADJUSTING CASTERS, PLOW, OR CONNECTING OR DISCONNECTING PLOW FROM PUSH FRAME

211248

! WARNING

Lift Plow Before Backing

015277

FSP SNOW PLOW

SAFE PROCEDURES FOR SNOW REMOVAL

1. **DO NOT** exceed appropriate speeds for equipment and conditions.
2. Use all available safety warning devices. **EXAMPLES:** Slow moving vehicle signs, flashing lights, hazard lights.
3. Be alert for any kind of obstruction.
4. Be wary of drivers coming from behind.
5. Wear protective clothing. **EXAMPLES:** Warm gloves or mittens, thermal-type underwear, water and wind resistance outer coat, head and ear covering, two pair of socks, and warm boots.
6. Know the symptoms of over exposure to cold or frostbite.
7. Carry a container of hot liquid. (Not Alcohol)
8. Carry emergency equipment. **EXAMPLES:** Flares or reflectors, first aid kit, fire extinguisher, flashlight, etc.....
9. If possible, travel snow route in advance to inspect and learn if hazards and/or obstructions are present. **EXAMPLES:** Bridge expansion joints, pavement expansion joints, headwalls of culverts, cattle guards, sign posts, guardrails, high shoulders, raised pavement markers, curbs, islands, fire hydrants, railroad crossings, mailboxes, holes repaired in roads, manhole covers, and catch basins.

NOTE: The snow plow trip mechanism may not always protect the plow and truck when impacting some obstructions, especially at high rates of speed. **ALWAYS USE EXTREME CAUTION WHEN PLOWING!**

CAUTION: To prevent damage to plow or vehicle, flag and identify any obstructions that are hard to locate in the snow.

WARNING: Always wear seat belt when plowing snow. Hitting an obstruction could cause loss of vehicle control, resulting in possible serious injury to the operator. **ONLY** the driver should be in vehicle when plowing.

WARNING: Driver should never plow with head out of the vehicle window. Sudden stops or object protruding from snow could cause severe head or neck injury.

GENERAL INSTRUCTION

1. The first step in organizing a snow removal policy, is to prepare a map or blueprint of the area and implement a snow fighting program.
2. Before a snow fall every area to be plowed should be inspected for hazards and obstructions.
3. Note all "Trapped Areas" in which snow would have to be carried away. This is necessary where piled snow will limit vision or access.
4. Indicate priorities on map for clearing procedures.

FSP SNOW PLOW

PLOWING DIFFERENT SNOW CONDITIONS

1. Suggested procedure: **PLOW WITH THE STORM.**
2. Suggested procedure: Plow snowfall with entire blade, a full cut of snow will enable driver to control vehicle. This will allow equal distribution across moldboard face, and vehicle will track without pulling.
3. Suggested procedure: Wet deep snow may be plowed with full blade width, if snow becomes too heavy for moldboard to discharge a 3/4 to 1/2 blade width might help to discharge snow effectively. **Experience and knowledge** are the best guides to snow removal.
4. Suggested procedure: When plowing deep snow, be sure to keep vehicle plowing and in a lower gear. As moldboard clears path of snow, the weight of the snow can quickly accumulate.
5. Suggested procedure: Hard-packed or icy snow; Raise running gear so cutting edge comes in contact with road surface. In this situation, use lowest gear to obtain maximum power to the cutting edge. Angling blade is more effective in this procedure. Also this procedure prevents plow from riding over snow.

NOTE: This Winter condition can cause a plow truck to slide across roadway.

6. Suggested **MAXIMUM snow plowing speed of 20 m.p.h.** under ideal plowing conditions, assuming driver is familiar with area and roadway being plowed. We recommend reduced speed and extreme caution when conditions become hazardous, poor visibility, and (or) unfamiliar areas to driver.

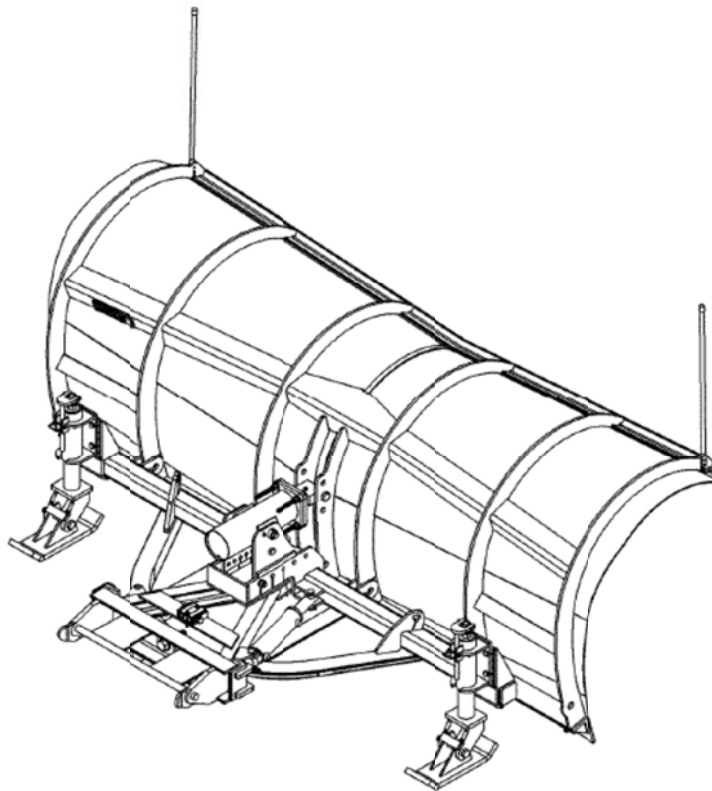
SEASON MAINTENANCE

1. Inspect snow plow and push frame before starting shift, during shift (between each run), and after shift. If parts are worn or damaged replace as soon as possible, waiting could cause further damage. Weld any damaged areas to prevent total breakage.
2. Grease all fittings before shift, making sure fitting is taking lubrication. Then during shift check and lubricate. Give special attention to caster wheel assemblies, making sure wheel bearings are well lubricated, but not breaking seals.
3. Periodically grease cannon spring arm weld assembly between snowfalls. This will depend on usage of unit. (See page-5- on greasing illustration).
4. Periodically check swivel bar for excessive slack in between "A" frame and swivel bar. Tighten swivel bar bolt and nut, until slack is drawn up between swivel bar and "A" frame.
5. All plow and salt trucks should receive a preliminary wash/rinse after each use and a thorough cleaning as soon as storm will allow.
6. Make sure vehicles and equipment have been inspected, and fueled ready to go.

HENKE SNOW PLOW MANUAL (OCT 2011)

HENKE REVERSIBLE I-PLOW INVERTED CIRCLE

HENKE MODEL: Reversible EXP10 & EXP11, EST-IC, TX DOT11
For TEXAS DOT Medium to Heavy Duty Trucks



SERIAL NUMBER: _____

PARTS BOOK AND INSTALLATION MANUAL
VERSION 2.0, OCTOBER 2011



HENKE MANUFACTURING CORPORATION

MANUFACTURERS OF SNOW REMOVAL EQUIPMENT FOR 80 YEARS
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WEBSITE ADDRESS : WWW.HENKEMFG.COM EMAIL: PARTS@HENKEMFG.COM

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SAFETY SECTION

Safety Section 1-1

SAFETY

GENERAL SAFETY INSTRUCTIONS AND PRACTICES

A careful operator is the best operator. Safety is of primary importance to the manufacturer and should be to the owner/operator. Most accidents can be avoided by being aware of your equipment, your surroundings, and observing certain precautions. The first section of this manual includes a list of Safety Messages that, if followed, will help protect the operator and bystanders from injury or death. Read and understand these Safety Messages before assembling, operating or servicing this Implement. This equipment should only be operated by those persons who have read the manual, who are responsible and trained, and who know how to do so responsibly.



The Safety Alert Symbol combined with a Signal Word, as seen below, is used throughout this manual and on decals which are attached to the equipment. The Safety Alert Symbol means: "ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!" The Symbol and Signal Word are intended to warn the owner/operator of impending hazards and the degree of possible injury faced when operating this equipment.

Practice all usual and customary safe working precautions and above all--remember safety is up to YOU. Only YOU can prevent serious injury or death from unsafe practices.



Indicates an imminently hazardous situation that, if not avoided, WILL result in DEATH OR VERY SERIOUS INJURY.



Indicates an imminently hazardous situation that, if not avoided, COULD result in DEATH OR SERIOUS INJURY.



Indicates an imminently hazardous situation that, if not avoided, MAY result in MINOR INJURY.



Identifies special instructions or procedures that, if not strictly observed, could result in damage to, or destruction of the machine, attachments or the environment.

NOTE: *Identifies points of particular interest for more efficient and convenient operation or repair.* (SG-1)

READ, UNDERSTAND, and FOLLOW the following Safety Messages. Serious injury or death may occur unless care is taken to follow the warnings and instructions stated in the Safety Messages. Always use good common sense to avoid hazards. (SG-2)



SAFETY

WARNING

Repeated or substantial breathing of hazardous dusts, including crystalline silica, could cause fatal or serious respiratory disease including silicosis. Concrete, masonry, many types of rock, and various other materials contain silica sand. California lists respirable crystalline silica as a substance known to cause cancer. Operation of this equipment under certain conditions may generate airborne dust particles that could contain crystalline silica. In those conditions, personal protective equipment including an appropriate respirator must be used. If excessive dust is generated, a dust collection or suppression system should also be used during operation. (SG-41)



PELIGRO

Si no lee ingles, pida ayuda a alguien que si lo lea para que le traduzca las medidas de seguridad. (SG-3)

¡ LEA EL INSTRUCTIVO!



DANGER

Never operate the Snow Plow until you have read and completely understand this Manual, the Truck or Power units Operator's Manual, and each of the Safety Messages found in these Manuals and those affixed to the Snow Plow, Truck, or Power units and its components. Learn how to stop the power unit engine suddenly in an emergency. Never allow inexperienced or untrained personnel to operate the Truck or Power unit and Snow Plow without supervision. Make sure the operator has fully read and understood the manuals prior to operation. (SPNG-4)



In addition to the design and configuration of this Snow Plow, including Safety Signs and Safety Equipment, hazard control and accident prevention are dependent upon the awareness, concern, prudence, and proper training of personnel involved in the operation, transport, maintenance, and storage of the machine. Refer also to Safety Messages and operation instruction in each of the appropriate sections of the Truck or Power unit Manuals. Pay close attention to the Safety Signs affixed to the Snow Plow. (SNPG-5)

PARTS INFORMATION

HENKE Snow Plows use balanced and matched system components for plows, carriers, and other components. These parts are made and tested to HENKE specifications. Non-genuine or "will fit" parts do not consistently meet these specifications. The use of non-genuine or "will fit" parts may reduce Snow Plow performance, void HENKE warranties, and present a safety hazard. Use genuine HENKE parts for economy and safety. (SNPG-6)

SEE YOUR HENKE DEALER

WARNING

Always maintain the safety signs in good readable condition. If the safety signs are missing, damaged, or unreadable, obtain and install replacement safety signs immediately. (SG-5)

SAFETY

DANGER

All Safety Shields, Guards and other Protective Safety devices should be used and maintained in good working condition. All safety devices should be inspected carefully at least daily for missing or broken components. **NEVER REMOVE PROTECTIVE SHIELDS AND GUARDS! NEVER MODIFY OR CUT PROTECTIVE SHIELDS OR GUARDS!** When shields or guards are removed to access areas for maintenance, they must be replaced and be in good condition before operating. Missing, broken, or worn shields, guards, and other protective devices must be replaced at once and prior to operation to reduce the possibility of injury. (SNPD-02)

WARNING

The Snow Plow power unit should be equipped with a fire extinguisher, rated for all fires, in an accessible and visible area. The fire extinguisher should be inspected routinely by a certified inspector for operational use and replaced as needed. Never obstruct access to the fire extinguisher. (SNPD-6)

OPERATOR SAFETY INSTRUCTIONS AND PRACTICES

DANGER

NEVER use drugs or alcohol immediately before or while driving or operating the Snow Plow. Drugs and alcohol will affect an operator's alertness and coordination and therefore affect the operator's ability to operate the Equipment safely. Before operating the Equipment, an operator on prescription or over-the-counter medication must consult a medical professional regarding any side effects of the medication that would hinder their ability to operate the Equipment safely. **NEVER** knowingly allow anyone to operate this Equipment when their alertness or coordination is impaired. Serious injury or death to the operator or others could result if the operator is under the influence of drugs or alcohol. (SNPD-3)

WARNING

Always wear OSHA approved Personal Protective Equipment (PPE) while operating, servicing, repairing, and/or cleaning the Equipment. PPE is designed to provide bodily protection during such activities.

Personal Protective Equipment includes:

- Protective Eye Wear
- Steel Toed Safety Footwear
- Gloves
- Hearing Protection
- Close Fitted Clothing
- Hard Hat-When working around a raised hopper.
- Respirator-Depending on conditions and material being swept or cleaned.

Specialized protective equipment may be required if dangerous or hazardous material is being moved by the plow. (SNPD-4)

SAFETY

CAUTION

Prolonged operation of the Snow Plow may cause operator boredom and/or fatigue affecting the safe operation of the Snow Plow and Truck or Power unit. It is recommended that the operator take scheduled work breaks to help prevent these potentially impaired operating conditions. If possible, completely shut down the Equipment, exit the cab and move around stretching your arms and legs. Never operate the Equipment in a fatigued or bored mental state that impairs proper and safe Equipment operation. (SNPD-5)

CAUTION

PROLONGED EXPOSURE TO LOUD NOISE MAY CAUSE PERMANENT HEARING LOSS! Equipment operation can often be noisy enough to cause permanent hearing loss. We recommend that you always wear hearing protection if the noise in the Operator's position exceeds 80db. Noise over 85db over an extended period of time will cause severe hearing loss. Noise over 90db adjacent to the Operator over an extended period of time will cause permanent or total hearing loss. **Note:** *Hearing loss from loud noise [from sweepers, chain saws, radios, and other such sources close to the ear] is cumulative over a lifetime without hope of natural recovery.* (SNPD-6)



CAUTION

Prolonged operation of the Equipment in cold weather may cause operator hypothermia affecting the safe operation of the Snow Plow and Truck or Power unit. It is recommended that the operator wear appropriate clothing take scheduled work breaks to help prevent these potentially impaired operating conditions. If possible, completely shut down the Equipment, exit the cab and warm the body in a properly heated area. Never operate the Equipment in a fatigued or impaired mental state that effects the proper and safe Equipment operation. (SNPD-8)

WARNING

Use both hands for support when getting on and off the truck or power unit. Use handles and steps on the equipment for support when boarding. Never use the Truck or Snow Plow control levers for support when boarding the equipment. (SNPO-01)

WARNING

Use available truck or power unit handles and steps to exit the operator's station. Make sure you have solid footing before stepping down. Be careful of your step and use extra caution when mud, ice, snow, or other matter has accumulated on the steps or handrails. Never rush to exit or jump off the truck or power unit. (SNPO-02)

DANGER

Do not attempt to mount the Truck or Power Unit while the machine is moving. Never attempt to mount a runaway Snow Plow. Serious injury or death may occur from being run over by a moving Truck, Power Unit, or Snow Plow. (SNPO-03)

DANGER

BEFORE leaving the operator's seat, always engage the parking brake and/or set the Truck's or Power Unit's transmission in the park position, stop the engine, remove the key, and wait for all moving parts to stop. Never dismount a Truck or Power Unit that is moving or while the engines are running. Operate the equipment controls from the Operator's seat only. (SNPO-04)

SAFETY

WARNING

Always wear a seat belt while driving the equipment during operation and transport. Serious injury or even death could result from falling from the operator's station or from being involved in a collision. (SNPO-05)

DANGER

Start the engines only when seated and belted in the operator's seat. Operate the equipment controls only while properly seated with the seat belt secured around you. Inadvertent movement of the power unit or attachment components may cause serious injury or death to the operator and passersby. Read the truck or Power Unit operator's manuals for proper starting instructions. (SNPO-06)

DANGER

Do not operate, or perform maintenance to, the Equipment while wearing loose fitting clothing. Entanglement of loose clothing with the rotating elements can result in serious injury or death. Stay clear of all rotating elements at all times. (SNPO-7)

DANGER

Operate only in conditions where you have clear visibility of the area in daylight or with adequate artificial lighting. Never operate in darkness or foggy conditions where you cannot clearly see at least 50 feet in front and to the sides of the equipment. Make sure that you can clearly see and identify passersby, steep slopes, ditches, drop-offs, overhead obstructions, power lines, oversized debris and foreign objects. If you are unable to see these types of items, discontinue operation until visibility improves. (SNPO-8)

WARNING

When transporting the Snow Plow between locations, follow all local traffic laws and regulations. (SNPO-10)

WARNING

Operate at a speed that allows you to safely operate and control the Truck and Snow Plow. Safe plowing speed depends on street condition and the type and amount of debris being moved. Slow down for corners, curbs, parked cars, protruding signs and other obstacles. Use slow traveling speeds when operating on or near steep slopes, ditches, drop-offs, overhead obstructions, power lines, or when debris and foreign objects are to be avoided. (SNPO-13)

WARNING

Do not operate the Equipment if excessive vibration or noise exists. Shut down the equipment and the Truck or Power Unit engine. Inspect the Equipment to determine the source of the vibration or noise. If parts are loose, damaged, or missing, replace them immediately. Do not operate the Equipment until all necessary repairs have been performed. To reduce the possibility of property damage, serious injury, or even death, never operate the Equipment with missing or damaged components. (SNPO-16)

WARNING

Never attempt to plow debris that is too large for the Snow Plow (oversized objects such as broken limbs and discarded tires). Such objects may damage the snow plow components and cause serious mechanical damage to the equipment. If possible, carefully place such objects out of the Snow Plow and traffic path until properly removed by another means. (SNPO-17)

SAFETY

WARNING

Unplowed snow, piled ice and debris, and snow drifts left behind the equipment might pose a driving hazard to vehicle traffic colliding with the debris or losing traction on the material. It is recommended to post warning signs alerting driver's of the equipment operation presence and the need to reduce vehicle speed. If such hazards are left behind following the Snow Plows passage, the area should be plowed a second time and any remaining hazards removed by an alternative method. (SNPO-19)

DANGER

Do not allow the Snow Plow to come in contact with potentially dangerous and/or hazardous material. Such hazards may include, but are not exclusively limited to, the following:

- Fire Hazards- Fuel spills, burning material,
- Chemical Hazards- Chemical spills, discarded chemical containers, batteries,
- Biological Hazards- Decaying Carcasses, BioMedical Waste,
- Radioactive Hazards-Radioactive Waste, Radioactive Material,
- Carcinogenic Materials-Asbestos,
- Corrosive Materials-Batteries, Acids and Bases.

In most areas, these types of material require special handling requirements for safe and proper disposal and should not be plowed by the Snow Plow, nor can they be disposed of in a general landfill site like most swept waste. Contact the appropriate authority for the collection and disposal requirements of such dangerous and/or hazardous material. (SNPO-25)

DANGER

Always wear required OSHA approved Personal Protective Equipment (PPE) when coming in contact with and removing potentially dangerous and hazardous material that has collected on the Snow Plow equipment or which is obstructing one or more components. Pay close attention to dangerous and hazardous material including, but not exclusively limited to, chemicals, decaying carcasses and sharp objects. (SNPO-26)

WARNING

Verbal communication near a Truck or Power Unit and Snow Plow is difficult and dangerous. Operating instructions and directions should be made prior to starting the equipment. Unclear and misunderstood communication may lead to operator and bystander injury or death and equipment damage. If communication by the operator is necessary, completely shutdown and exit the equipment. Never allow anyone to approach the equipment while in operation. (SNPO-28)

DANGER

Never allow children to play on, under, or around the Truck or Power Unit nor allow children to operate equipment controls. Children can slip or fall off the equipment and be injured or killed. Children can cause the equipment components to shift or fall crushing themselves or others. (SNPO-29)

WARNING

Allow passengers only in situations where their presence is involved in the operation (operator training, supervision, maintenance inspection). Never carry passengers whose presence distracts from the safe operation or transport of the equipment. Passengers must be seated securely and belted in the cab's passenger seat. Never allow any person to ride on any other location of the Truck, Power Unit or Snow Plow during operation or transport. (SNPO-30)

SAFETY

WARNING

Extreme caution should be used by the operator when operating near passersby. Stop snow plowing if a passersby comes within 25 feet of the plow to prevent possible passerby injury or death from being struck by the equipment or from a thrown object. (SNPO-31)

CAUTION

Under certain conditions, the Snow Plow is capable of propelling objects up to 75 feet. Be extremely careful when plowing at higher speeds and hitting large dense objects, such as rocks, chunks of frozen ice, metal objects, broken glass, or other solid objects that might become propelled and cause bodily injury to passersby or damage to property such as windows and vehicles. (SNPO-32)

WARNING

Make sure that no bystander, animal or obstruction such as a vehicle, building, or street sign are within the width of the Snow Plow. The design of the Snow Plow may impair the operator vision when operating. Use extreme caution to ensure that the Snow Plow is not driven into the path of pedestrian or vehicle traffic. Serious injury or death and property damage could result from running into, being crushed by, or run over by a Snow Plow. (SNPO-33)

DANGER

Make sure no bystanders or animals are within 25 feet of the equipment basket when dumping contents from or cleaning the Snow Basket. Bucket contents, which may exceed several thousand pounds, could fall and crush a bystander or an animal resulting in possible injury or death. (SNPO-34)

DANGER

Use extreme caution when operating the Equipment in traffic. To alert motorists of the Equipment's presence, use all equipped warning signals to alert motorists and pedestrians of the equipment's presence and relatively slow speed. Serious injury or death and property damage may occur if a vehicle collides with this Equipment. (SNPS-3)

WARNING

Before starting a snow plowing operation, make sure all the warning signal lights are connected, visible and working. Routinely inspect the equipment's headlights, brake lights, backup lights, and turn signal lights for operational condition. Immediately repair non-functioning lighting. Always follow all local traffic regulations while operating the Snow Plow. (SNPS-4)

WARNING

Always turn on all safety lights and flashers when you operate the Snow Plow. (SNPS-5)

DANGER

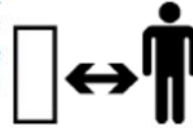
Be particularly careful in transport. The Implement has raised and moved the center of gravity to the front of the Power Unit increasing the possibility of overturn and tipping forward. Turn curves or go up slopes only at low speed and using a gradual turning angle. Go up slopes with the Implement located uphill. Slow down on rough or uneven surfaces. (SPU-2)

SAFETY

CONNECTING OR DISCONNECTING IMPLEMENT SAFETY INSTRUCTIONS AND PRACTICES

WARNING

Do not stand or allow bystander or coworkers between the attachment and the truck or power unit while installing or disconnecting the attachment. Keep hands and body clear of the attachment and the attachment mounts. Serious injury or death can result from a person being crushed between the attachment and truck or power unit. (SNPC-01)



WARNING

Reset the tripped snow plow edge by raising the snow plow off the ground. DO NOT attempt to reset the trip edge by hand. The trip edge is spring loaded and sudden and unexpected movement can occur resulting in serious injuries. Keep hands and feet away from the trip edge. If the trip edge does not reset, stop plowing and have the snow plow repaired before resuming snow plowing. (SNPO-12)

WARNING

Make sure the implement is properly attached to the Power Unit and the retaining pins securely lock the implement into position. Improper mounting of the Implement onto the Power Unit can result in the Implement falling causing serious injury. (SNPC-02)

WARNING

The operator of the equipment must be trained in the operation and safe use of this machine. The operator must read and completely understand the operator's manuals of the Snow Plow, Truck or Power unit manufacturers. New operators should be trained in an open area clear of obstructions before operating on public roadways. If operation of the entire Snow Plow unit (Truck or Power unit) is not completely understood, consult your authorized sales representative for a detailed explanation. Never allow an untrained or unqualified driver to operate the Snow Plow. (SNPD-1)

CAUTION

The Snow Plow driver must meet the requirements and possess a Motor Vehicle License as determined by the state in which the Snow Plow is operated if used on public roadways. Contact your local State Department of Public Safety office for special licensing requirements to operate the Snow Plow in your area. (SNPD-2)

SAFETY

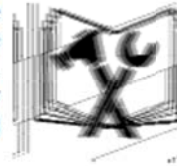
MAINTENANCE AND SERVICE SAFETY INSTRUCTIONS AND PRACTICES

WARNING

Perform service, repairs and lubrication according to the maintenance section. Ensure the unit is properly lubricated as specified in the lubrication schedule and all bolts and nuts are properly torqued. Failure to properly service, repair and maintain this implement in good operating condition could cause component failure and possible serious injury or even death. (SG-35)

WARNING

Periodically inspect all moving parts for wear and replace when necessary with authorized service parts. Look for loose fasteners, worn or broken parts, and leaky or loose fittings. Make sure all pins are properly secured. Serious injury may occur from not maintaining this equipment in good working order. (SNPM-01)



WARNING

Inspect the entire Snow Plow before each use. Accidents may occur or damage to the equipment may result if the Snow Plow is not maintained in good mechanical working order.

- Check for loose bolts, worn or broken parts, pinched hydraulic hoses, and leaky or loose fittings.
- Make sure all pins are secure and safety pin equipped.
- Make sure replacement parts are the correct size and properly installed.
- Make sure all fluid levels are full and replenish as necessary.
- Make sure fuel, oil, and coolant caps are replaced and tightened.
- Check tire condition for tread wear and tire pressure at the rated PSI.
- Make sure that all safety shields and guards are attached and in good condition.
- Make sure all scheduled maintenance is up to date. (SNPM-02)

WARNING

Do not modify or alter this Snow Plow. Do not permit anyone to modify or alter this equipment, any of its components or any Snow Plow function. Modification can result in equipment failure and cause serious injuries to the operator, coworkers, or bystanders. (SNPM-03)

WARNING

Use extreme care when climbing onto the equipment to perform repairs, maintenance, and cleaning. Use proper stands and ladders to access areas that cannot be reached from ground level. Slipping and falling off the equipment can cause serious injury or death. (SNPM-04)

WARNING

Never attempt to repair, lubricate, adjust, clean, remove obstructions or perform any other type of service to any component while the Snow Plow is in motion or while the engine is running. Completely shut down the engine and wait for all motion to come to a complete stop before servicing the Snow Plow. (SNPM-05)

SAFETY



Never leave the Snow Plow unattended while the plow is in the raised position. Accidental operation of the lifting lever or a hydraulic failure may cause a sudden drop of the unit which could result in injury or death by crushing. If the plow must be raised for inspection or service, securely block up and support the Plow to prevent it falling. (SNPM-05)



Never crawl under the Snow Plow or any raised component unless it is properly blocked up and support to prevent it from falling. Accidental operation of a lifting lever or hydraulic failure may cause a sudden drop of the unit with injury or death by crushing. (SNPM-07)



Use proper protective equipment including gloves, safety eye wear, arm protection when handling plow blades and components during replacement, adjustment, and maintenance. Plow edges and components can become sharp and have burrs that could inflict puncture and cuts to the hands, arms, and/or eyes if proper protective equipment is not worn. (SNPM-08)



Replace bent, cracked, or broken plow blade with a new blade. Never attempt to straighten or weld on plow blades because this will likely crack or otherwise damage the blade with subsequent failure and possible serious injury from broken blade being ejected from plow. (SNPM-10)



Escaping pressurized hydraulic oil generated by hydraulic pumps has the potential to inflict serious injury and possible death. Never attempt to repair a pump or hose or tighten a connection while the system is pressurized. Always shut down the engine and relieve hydraulic oil pressure before performing any repairs to the hydraulic system. (SNPM-11)



Hydraulic pressure must be relieved from the hydraulic circuit prior to doing any maintenance or repair work and when the Snow Plow is parked at the end of the day. Place the Snow Plow(s) on the ground or securely blocked up. Turn off the Truck engine then engage the hydraulic remote cylinders several times to relieve hydraulic pressure prior to performing any maintenance or repair work. (SNPM-12)



Never remove debris from or unclog jams in the plow or lifting components until the engine have been completely shutdown and all components have come to a complete stop and are lowered to ground level and hydraulic pressure relieved. Always wear PPE when removing collected material and debris from the equipment. Serious injury or death may occur if any of these precautions are not followed when removing plugged or entangled debris. (SNPM-15)



Engine Exhaust, some of its constituents, and certain vehicle components contain or emit chemicals known to the state of California to cause cancer and birth defects or other reproductive harm. (SNPM-20)

SAFETY

DANGER

Do not operate this equipment with hydraulic oil or fuel leaking. Oil and fuel are expensive and their presence could present a hazard. Do not check for leaks with your hand! High-pressure oil streams from breaks in the line could penetrate the skin and cause tissue damage including gangrene. To check for a hose leak, SHUT the ENGINE OFF and remove all hydraulic pressure. Wear oil impenetrable gloves, safety glasses and use Cardboard to check for evidence of oil leaks. If you suspect a leak, REMOVE the HOSE and have it tested at a Dealer. If oil does penetrate the skin, have the injury treated immediately by a physician knowledgeable and skilled in this procedure. (SNPM-21)



WARNING

Always read carefully and fully comply with the manufacturers instructions when handling fuels, oils, solvents, cleansers, and any other chemical agent. (SNPM-22)

WARNING

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer and birth defects or other reproductive harm. Wash Hands after handling. (SNPM-23)

WARNING

Avoid contact with hot surfaces on the bottom of the skid shoes or plow cutting edges. Use gloves and eye protection when servicing hot components. Contact with a hot surface can cause serious injury from burns or scalding. (SNPM-24)

WARNING

Remove the negative battery cable from the battery before performing any maintenance on the electrical system to prevent an accidental circuit shorting and sparks. Sparks can result in wiring damaged, fire or personal injury. (SNPM-25)

WARNING

Before conducting maintenance on the Snow Plow stop the truck or Power Unit, place the transmission in the park position and set the parking brake. Turn the engine off and remove the key to prevent inadvertent or accidental starting of the engine. Unexpected engine start up or vehicle movement can result in serious bodily injuries or death. (SNPM-27)

SAFETY

Transporting Safety Instructions and Practices



Transport the Truck, Power Unit, and Snow Plow only at safe speeds. Serious accidents and injuries can result from driving this equipment at unsafe speeds. Become familiar with the driving characteristics of the equipment and how it handles before operating or transporting on streets and highways. Make sure the Truck's or Power Unit's steering, brakes, and wheels are in good condition and operate properly)

Before transporting the Equipment determine the safe transport speeds for you and the machine. Make sure you abide by the following rules:

- Test the Truck or power unit and Snow Plow at a slow speed and increase the speed slowly. Apply the brakes smoothly to determine the stopping characteristics of the Truck equipped with the Snow Plow. As you increase the speed of the Truck, the stopping distance increases. Determine the maximum safe transport speed for you and the equipment. When driving down a hill or on wet or icy roads, the braking distance increases: use extreme care and reduce your speed. Do not operate the equipment with weak or faulty brakes.
- Obey all traffic laws and regulations. Never exceed the posted speed limit.
- The Snow Plow has moved the center of gravity of the equipment forward. Use extreme caution when transporting at highway speeds. Slow down for sharp corners or on slopes to avoid loss of steering control.
- Only transport the equipment at the speeds determined as safe and which allow for proper control of the machine while driving and stopping during an emergency.
- When operating in traffic, use the Truck's or Power Units directional indicator or signal lights to indicate your movement. Always use the flashing warning lights and other equipped warning features to alert motorists of your presence and slow moving speed when operating in traffic. **Be Aware of Traffic Around You and Watch Out for the Other Guy.** (SNPO-09)

SAFETY

Federal Laws and Regulations

This section is intended to explain in broad terms the concept and effect of federal laws and regulations concerning employer and employee equipment operators. This section is not intended as a legal interpretation of the law and should not be considered as such.

Employer-Employee Operator Regulations

U.S. Public Law 91-596 (The Williams-Steiger Occupational and Health Act of 1970) OSHA

This Act Seeks:

"...to assure so far as possible every working man and woman in the nation safe and healthful working conditions and to preserve our human resources..."

DUTIES

Sec. 5 (a) Each employer-

(1) shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees;

(2) shall comply with occupational safety and health standards promulgated under this Act.

(b) Each employee shall comply with occupational safety and health standards and all rules, regulations and orders issued pursuant to this Act which are applicable to his own actions and conduct.

OSHA Regulations

OSHA regulations state in part: "At the time of initial assignment and at least annually thereafter, the employer shall instruct every employee in the safe operation and servicing of all equipment with which the employee is, or will be involved."

Employer Responsibilities:

To ensure employee safety during plow and truck or other power unit operation, it is the employer's responsibility to:

1. Train the employee in the proper and safe operation of the plow and truck or other power unit.
2. Require that the employee read and fully understand the plow and truck or other power unit Operator's manual.
3. Permit only qualified and properly trained employees to operate the plow and truck or other power unit.
4. Maintain the plow and truck or other power unit in a safe operational condition and maintain all shields and guards on the equipment.
5. Ensure the truck or other power unit is equipped with a functional ROPS and seat belt and require that the employee operator securely fasten the safety belt and operate with the ROPS in the raised position at all times.
6. Forbid the employee operator to carry additional riders on the Tractor or Implement.
7. Provide the required tools to maintain the plow and truck or other power unit in a good safe working condition and provide the necessary support devices to secure the equipment safely while performing repairs and service.
8. Require that the employee operator stop operating equipment if bystanders or passersby come within 25 feet.

Child Labor Under 16 Years of Age

Some regulations specify that no one under the age of 16 may operate power machinery. It is your responsibility to know what these regulations are in your own area or situation. (Refer to U.S. Dept. of Labor, Employment Standard Administration, Wage & Home Division, Child Labor Bulletin #102.)

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MONROE 2006 TEXAS D.O.T. PLOW SERVICE AND PARTS MANUAL

SAFETY INSTRUCTIONS

- Read all installation, safety and maintenance instructions completely before operating this equipment.
- Keep all personnel clear of moving parts while equipment is being operated.
- Do not operate a plow in need of maintenance! Repair immediately!
- While operating this equipment use common sense, use caution, be alert and be safety-conscious.

AVOID HIGH-PRESSURE FLUIDS

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.



MAINTENANCE INSTRUCTIONS




In Season:

- Check for loose bolts and nuts daily, and re-torque before use. (Failure to inspect equipment on a daily basis may seriously affect safety and/or efficiency.)
- Lubricate all grease fittings every ten hours of normal use and more frequently under heavy use.
- A cross over relief valve (1800 PSI) MUST be plumbed into the reversing circuit.
- Check all hydraulic fittings for tightness on a regular basis.
- System pressure should NOT exceed 2000 PSI.
- Check cutting edge for wear. Do not let cutting edge wear closer than 1/2" to 3/8" from the bottom angle of the moldboard.
- Due to the nature of use and environment this equipment is operating in, damage and wear may occur at anytime. Therefore, **Monroe Truck Equipment** recommends the end user establish and follow a daily inspection routine before using this equipment.

Off Season:

- Use care when disconnecting hydraulic lines to assure that no dirt or foreign objects enter the hydraulic system. Use caps to cover hydraulic hose fittings and insert plugs in hydraulic ports.
- Hydraulic cylinders should be fully retracted when stored during the off season to prevent damage or corrosion. The remaining exposed shaft surface should be coated with a thick grease to prevent corrosion, which must be removed before returning to regular service.
- Check mounting bolts for wear and/or damaged threads and replace before next season.

TORQUE CHART

SIZE	 GRADE 2	 GRADE 5	 GRADE 8
1/4-20	50 IN-LBS	75 IN-LBS	9 FT-LBS
1/8-16	15 FT-LBS	23 FT-LBS	35 FT-LBS
1/2-13	35 FT-LBS	55 FT-LBS	80 FT-LBS
5/8-11	75 FT-LBS	110 FT-LBS	170 FT-LBS
3/4-10	130 FT-LBS	200 FT-LBS	280 FT-LBS
1-8	190 FT-LBS	480 FT-LBS	680 FT-LBS
1 1/4-7	380 FT-LBS	840 FT-LBS	1360 FT-LBS

VIDEO 10.2. ARE YOU READY? (01:08)

SCRIPT

(Television playing in the background)

Guy: How does it look out there?

Girl: It is really starting to accumulate. The wind is picking up too.

Guy: Well they just said on tv that the wind is whipping up to almost 25 mph out in the northwest.

Girl: Did they say how cold it is going to get?

Guy: Last report 10 above zero with a wind chill 29 below. I'm sure I'm going to get a call from the shop if it keeps snowing like this.

Girl: Are you ready?

With the second shift ready to begin soon, all the knowledge you gain both in your training sessions and during your first ride is going to be tested because today is the real thing.

Out on that highway it is going to be just you with all that you have learned and that truck with all its equipment fighting Mother Nature. Are you ready for the challenge?

VIDEO 10.3. KNOW YOUR ROUTE (01:57)

SCRIPT

Curbs, raised islands, guardrails, and many other obstacles can present real problems when the snow is deep. Many of these obstacles can be totally hidden, and the only way to avoid hitting them is to know where they are, exactly where they are. You need to memorize the location of these obstacles along your route so you don't hit them when you are plowing. Now that may sound so obvious that it doesn't even need to be mentioned but stop and think for a second, is there a guardrail that is within two miles of your home? Do you know exactly where it starts and stops? Most people don't.

If it is at all possible, drive your route before it snows so you can learn as much as you can about potential problems.

Guardrails, curbs, and islands are fairly obvious problems to watch for but there are a number of other obstacles that you've probably never even noticed.

For example, utility companies used steel plates to cover temporary excavations, new sewer lines, water lines, and so on. You can imagine what would happen if you push the plate away from the excavation, an open hole.

Manholes can present a problem in the same way as steel plates. Usually they are flushed with the pavement surface, which is no problem but some stand above the surface and they can snag your plow.

Other obstacles that you need to be on the watch for include mailboxes, fire hydrants, delineators, light poles, guide wires, and signs. In a bad storm, any of these can be hard to see and easy to hit. Stalled or stuck vehicles can't be checked on ahead of a snow fall but can appear quickly so be on a constant watch for them too.

VIDEO 10.4. PLOWING SPEED (00:30)

SCRIPT

About 25 miles per hour has proven to be the most efficient plowing speed.

When speed exceeds 25, the plow tends to skip over the snow and it will require an extra trip to clear the snow that was left.

As an operator you need to know that excessive speed can damage snow plow equipment very easily.

VIDEO 10.5. PLOWING IN TRAFFIC (01:24)

SCRIPT

Others rely on you to make their trip safer so always think prevention and drive defensively at all times. Don't assume that others see or hear you approach. Be on constant watch so that you can compensate for others mistakes. Scan well ahead for oncoming traffic and potential hazards. In snowy conditions with decent visibility that's about a quarter of a mile or 12 to 15 seconds ahead.

Also, scan the rearview mirror every 3 to 5 seconds to check for drivers that are ready to pass you. If a long line of vehicles forms behind you, use your judgment about moving over to allow traffic to pass by. If you make a decision to pull over, always signal your intentions and pick your spot carefully.

Shoulders and driveways can be icy and slick or soft and muddy at various times during the winter months so be cautious. Also, always be on the alert for emergency vehicles. It is not always possible for you to pull your plow entirely off the road but when an emergency vehicle needs to pass, slow down and pull over to the right as far as possible.

VIDEO 10.6. PLOW TRUCK HANDLING (01:10)

SCRIPT

When roads are snow and ice covered, it of course takes longer to stop. Try to anticipate when you need to slow down or stop and leave yourself plenty of room.

Turning takes more room too. When you add a plow to the front of the truck, the truck becomes longer and wider. You won't be able to make a lot of turns that you could make without the plow attached so think ahead. Be selective in finding a spot to turn around. Make sure there is plenty of space to turn and that you have a clear view in all directions.

Even driving on straight sections of road is like nothing you have ever experienced. The snow really has an effect on how the truck handles.

As you push the snow it is pushing your truck in the opposite direction you are pushing the snow. If you are plowing to the right the snow will push the truck to the left. When there is a lot of snow on the road you will have to oversteer to counter act that force.

VIDEO 10.7. VISIBILITY (00:45)

SCRIPT

Visibility is generally an issue when you are plowing snow. If the wind isn't blowing the snow, your plow or other vehicles are kicking it up.

Keep your windows as clean as possible so you can see in all directions.

If your truck is equipped with heated mirrors make sure they are turned on.

Always keep your windshield wipers clean and always have your lights on so others can see you.

There will be times when you must slow down because of visibility problems or even have to pull off the road in case of a complete white out.

VIDEO 10.8. HANDLING FATIGUE AND STRESS (01:13)

SCRIPT

Operating a snow plow, especially in severe weather conditions, can be highly stressful.

If at all possible, prepare yourself and get plenty of sleep before you arrive for your shift. Once you are on the job, drink liquids and eat enough foods to stay alert and keep your energy level up. Also, whenever you feel the need, stop your truck; get out for some fresh air and stretch. Wear comfortable clothing appropriate for the conditions so that you stay warm and dry even when you have to be outside the truck cab.

Your safety and the safety of other drivers on the road is of utmost importance at all times.

There may be times where the conditions may be so severe that you can't keep your route clear. If this should happen, remain calm and know that sometimes conditions are beyond your control. If at any time you have an important question or a serious problem, use your radio to call your supervisor or another experience operator.

VIDEO 10.9. PLOWING TWO-LANE ROADS (01:58)

SCRIPT

On your first time out alone, you will probably be assigned to plow two-lane, two-way roads.

To begin, stay in your own lane. Position the left side of the plow near the center of the road and angle your plow to the right to push the snow off of the right hand side of the road.

Always try to uncover the center line on your first pass. Normally you will also use your light-duty wing as a plow extension to increase your plowing width. If the wind is blowing hard or if it is especially still then the snow is falling straight down, you may have difficulty from time to time seeing the center line. When you can't see the center line you may have to revert to using the edge of the road as your guide. Veteran snow plow operators often watch the shoulder for sign or rock or grass if there is not a hard surfaced shoulder. You can also look for delineators, guardrails, road signs, mailboxes, and other objects that can help give you some idea where the center line is.

You can usually feel when the front wheel goes off the road on the shoulder. If this happens, compensate by carefully steering back towards the center line. When you get to the end of your run, find a safe place to turn around. Once you have made your turn and are ready to head back, position the plow to catch the snow that was left near the center of the road. If you are lucky, you'll be able to see the center line but many times the center line is already covered up by the time you head back.

Continue making passes until both of the deriving lanes are opened and have been returned to near normal winter driving conditions or you are reassigned to a different route.

VIDEO 10.10. PLOWING MULTIPLE-LANE ROADS (01:57)

SCRIPT

Everything you will learn about plowing a two-lane highway applies to plowing a multiple-lane freeway or interstate with the exception of where you make your first pass. As with any road, the first concern on a multiple-lane divided highway, is provide a pathway for vehicles to get through. Where you plow that first lane depends on whether there is a median wide enough to hold the snow.

If there is a wide median, then logical thing to do is to make your first path in the right hand lane with your plow angled to the right. Move the snow on that first pass to the right hand shoulder. With your second pass, angle your plow to the left and move your snow to the left, towards the median. If two trucks can work together of course, you can get a lot more done with one plow moving the snow to the right and second moving the snow to the left. Here the lead truck is in the right lane with a plow angled to the right pushing snow toward the shoulder. The second truck follows with the plow angled to the left. This truck has to be lined up so that it catches the snow left by the first truck. If there isn't a wide median, you do not have a choice; you'll have to push all of the snow to the right. Here the lead truck can't push snow to the left; there is no place for it to go so it pushes snow to the right. The second truck lines up so that it catches snow that was left by the first truck and continues pushing the snow to the right.

When you are working alone and you are in a situation where you can't move snow to the left, then you will have to make your first pass in the left lane, and then follow up by catching the snow that was left by your first pass and continue pushing snow to the right.

VIDEO 10.11. BLADE WEAR & REPLACEMENT (00:57)

SCRIPT

Question: What is your call on when a blade needs to be replaced? Is it two fingers or an inch and a half (1 1/2")?

Answer: Before it gets to that moldboard.

Alright so right here is the moldboard. Here are the bolts that bolt the cutting edges on; and see, this one is worn right here on the edge so they run these down close enough that it's worn, it's okay, it's fine, it's not hurt; but when these cutting edges get to that moldboard right there, you got to change them. So these have got a fingers width, three-quarters of an inch (3/4") or so, and an inch maybe, of wear left before these have got to be changed.

VIDEO 10.12. PLOWING RAMPS (00:50)

SCRIPT

Cleaning ramps is much the same as plowing any other type of road. There are a couple of points to keep in mind though.

First, whenever possible, move the snow from the high side of the ramp to the low side, the same as on super elevated bridges. You do not want a buildup of snow on the high side of the ramp because when it melts it will run across the road and possibly refreeze if the temperature drops.

And second, be sure that your plow is angled in the proper direction when coming off a ramp and before entering a roadway. There are cases where you will be pushing snow one way and then after leaving the ramp, have to push snow the other way.

VIDEO 10.13. PLOWING INTERSECTIONS (00:43)

SCRIPT

With the main roadway clear, it's time to start cleaning intersections. Here are a couple of ways it can be done.

One is to straighten your plow as you enter the intersection. Go on across moving slightly to the right as you go through the intersection to catch as much snow as possible.

Another method is to go through the intersection from every direction, always moving the snow to the right.

This method may also require a couple of final passes with the plow straight to cleanup any snow that is left in the center of the intersection.

VIDEO 10.14. PLOWING BRIDGES (02:03)

SCRIPT

If you are plowing an open or low side rail bridge, one that is open or low enough to allow the snow to go through or over, and if there is not another railway or road below, then you will plow it much the same as a road, moving the snow to the right, over or through the bridge barrier.

However, if there is a railroad or road below, or if the road has high closed barriers on each side, then you are going to have to plow it differently than a road. You have to go slower to avoid throwing the snow over the bridge and on to any traffic or tracks below.

And instead of moving the snow to the right, set the plow straight or nearly straight and move the snow to the end of the bridge, that way you don't end up with snow piled along the barrier. That's important, because if the snow builds up along the barrier it can form a ramp, and a vehicle could go up over the barrier and off the bridge. So, for bridges with high closed barriers, plow straight and slow.

On super elevated bridges, always move as much snow as possible to the low side of the bridge. That prevents snow on the high side from melting and then refreezing into ice as it flows across the bridge to the low side.

Whenever you go on and off a bridge, you must make certain that the angle your blade is not parallel with the expansion joint. If it is, the blade can fall into the expansion joint and cause considerable damage.

Also, be as especially careful when plowing truss or pony truss bridges. Hitting a truss with a plow can also cause damage. As you already know or will quickly become aware of, bridge decks tend to ice up before the roadway so use caution whenever plowing a bridge.

VIDEO 10.15. SNOW PLOW TRIP MECHANISM (00:32)

SCRIPT

Regardless of the type of plowing you're doing, travel speed is always important.

Sometimes when the plow trips, it can pitch straight up and down turning the blade into a big ice skate. If the blade is loaded with snow or if you hit a patch of ice, it can pull your truck in the direction where the blade is aimed, into a ditch, or worse yet into oncoming traffic.

VIDEO 10.16.RAILROAD CROSSINGS (00:38)

SCRIPT

When approaching railroad tracks, raise your plow high enough to clear the tracks. Then lower it when you are completely across. Otherwise you could catch the plow in the tracks and damage the mold board, the blade, or the tracks.

Also, turn off the spreader when crossing tracks. There is a very good reason for this. A buildup of snow, ice, salt, or abrasives on the tracks could actually derail a train so at all railroad crossing raise your plow and turn off your spreader.

VIDEO 10.17. READY TO HIT THE ROAD (00:47)

SCRIPT

Well, are you ready to hit the road? If there were ideas or techniques presented in this video that you did not completely understand or don't fully agree with discuss them soon with your supervisor.

Every newly trained snow plow operator heads out on that first run with some trepidation. There is much to remember. However, if you apply what you have learned during your training and use good common sense out on the road you are certain to soon be a respected DOT snow plow operator.

Good luck, and good plowing!

VIDEO 10.18. DON'T CROWD THE PLOW (00:47)

SCRIPT

When winter weather hits, Texas Department of Transportation snow plows work around the clock to make sure roads are safe and passable for you.

However, these large vehicles can present a hazard to drivers who get too close. Return the favor and give them room to work. **DON'T TAKE A CHANCE... DON'T CROWD THE PLOW!**

A winter safety reminder from TxDOT. For road conditions call 800-452-9292 or log on to dot.state.tx.us

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Class Exercise – Review Questions
Module 10 – SNOW PLOWING TECHNIQUES

MNT812 Winter Weather Operations Training

1. [True/False] I have read and understand the manufacturer's safety information and operating instructions for the snow plow I am using.
 - A. True
 - B. False

2. A good target speed for plowing snow is 25 miles per hour. Plowing at higher speeds can cause the following:
 - A. The plow will start to "skip" over the snow and create a "rub board" effect which can cause traffic to lose control
 - B. A more violent trip and possible loss of control can occur if the snow plow hits an obstruction in or adjacent to the road
 - C. The likelihood of a plow truck driver losing control of his vehicle is increased if the plow truck encounters an unexpected or unforeseen section of ice on the road
 - D. All of the above

3. [True/False] All reversible plows are equipped with a trip mechanism which allows the plow to tip forward to reduce damage to the plow and truck if an immovable object is hit.
 - A. True
 - B. False

4. Which of the following does NOT represent accepted practice when plowing two-lane roads:
 - A. Plow one lane at a time
 - B. Plow in the same direction as traffic
 - C. Try to uncover the centerline on the first pass, pushing snow to the right
 - D. Position approximately two feet of the moldboard into the path of oncoming traffic to ensure that you uncover the centerline on the first pass

5. [True/False] On superelevated ramps or bridges, remove as much snow away from the high side as possible to prevent meltback and refreeze.
 - A. True
 - B. False

6. Assume you are plowing a divided, two-lane road that slopes from the inside lane to the outside lane (left to right). A median exists that is wide enough to hold plowed snow. Accepted procedure is to:
 - A. Plow the right (outside) lane first, pushing snow to the right
 - B. Plow the left (inside) lane to the left, pushing snow toward the median
 - C. If two plow trucks are available, both lanes of the road may be plowed in tandem using the same approach described above
 - D. All of the above
7. [True/False] When plowing snow or ice in the area of a bridge expansion joint, the snow plow or grader moldboard should always be aligned parallel to the expansion joint.
 - A. True
 - B. False
8. [True/False] It is acceptable to leave small windrows of snow (less than 2 feet wide and 2 feet high) along the centerline of a road, between lanes, or along bridge rails.
 - A. True
 - B. False
9. [True/False] When plowing railroad crossings, in order to prevent dense snowpack or ice build-up that could cause a train to derail, accepted practice is to remove snow and ice from the railroad crossing by plowing in the same direction as the rails, but being careful not to plow past the road right-of-way.
 - A. True
 - B. False
10. [True/False] When plowing snow or ice in a situation where the correct approach is not clear, the operator should get input from his Supervisor, and use his best judgment.
 - A. True
 - B. False

MODULE 11 Post-Storm Cleanup



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012

Learning Objectives POST-STORM CLEANUP

Upon completion of this section, the learner will be able to:

1. Identify situations where additional plowing is necessary after ice and snowfall cease.
2. Describe how to clean, inspect and repair equipment.



POST-STORM CLEANUP

SLIDE 11.2

Learning Objectives, cont'd.

POST-STORM CLEANUP

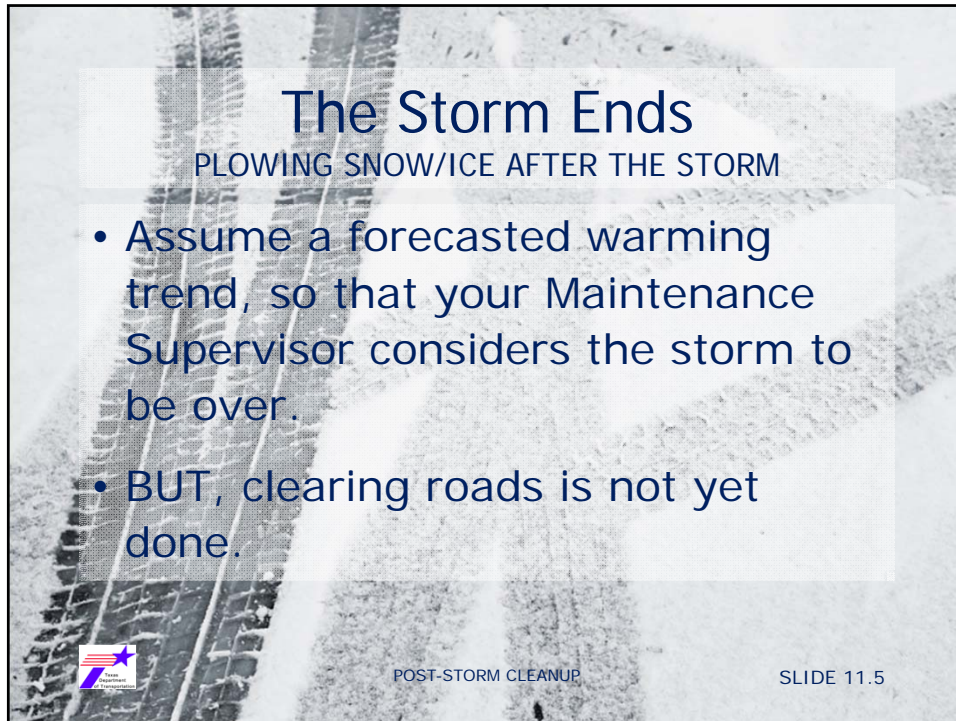
3. Explain how to inventory snow and ice control materials.
4. List the typical road repairs necessary after a winter storm.
5. Summarize the purpose of post-storm evaluation.



POST-STORM CLEANUP

SLIDE 11.3






The Storm Ends

PLOWING SNOW/ICE AFTER THE STORM

- Assume a forecasted warming trend, so that your Maintenance Supervisor considers the storm to be over.
- BUT, clearing roads is not yet done.



POST-STORM CLEANUP

SLIDE 11.5



De-Icing Continues

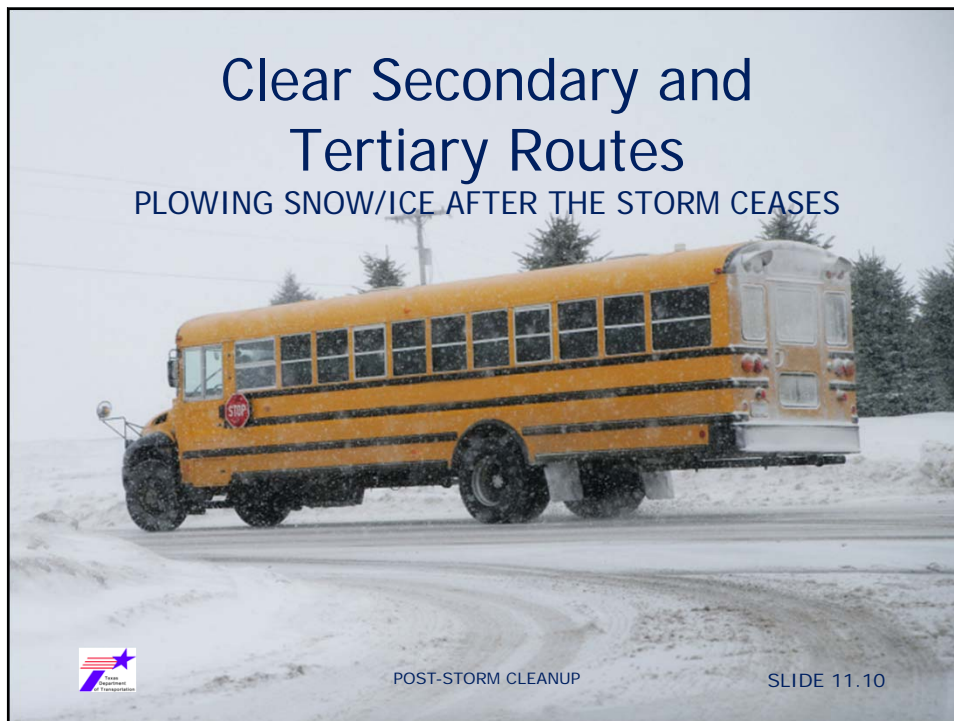
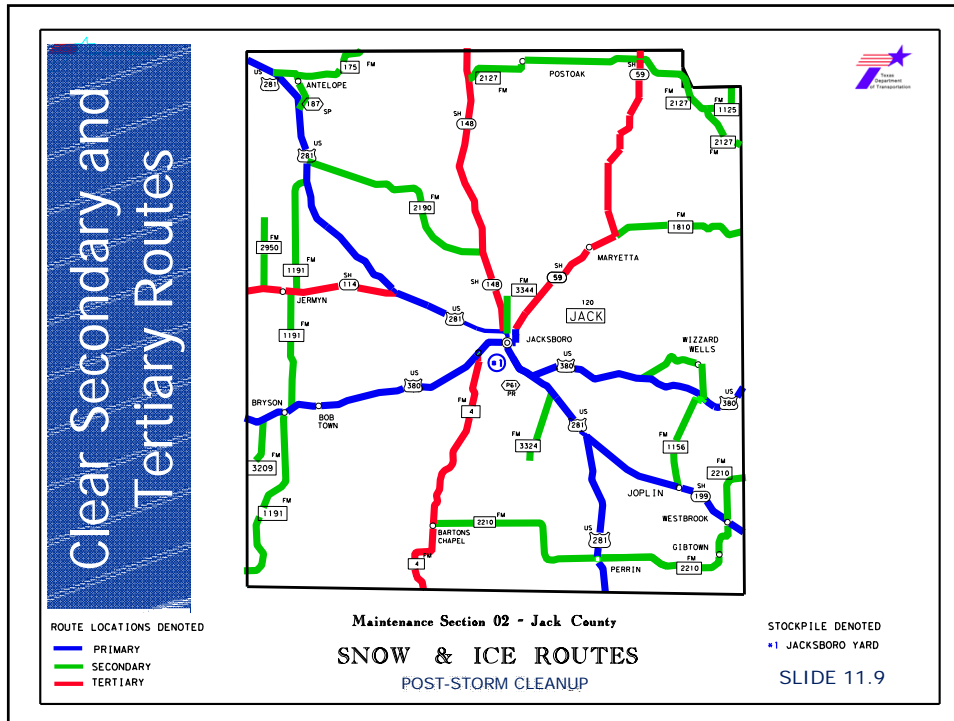
PLOWING SNOW/ICE AFTER THE STORM CEASES



POST-STORM CLEANUP

SLIDE 11.6








VIDEO 11.1 (00:19)
Plowing Snow/Ice After the Storm



CREDIT
“Proper Plowing Techniques”
AASHTO Winter Roadway Maintenance Computer-Based Training
Used with permission.



R_{11.1}
[11.39]




POST-STORM CLEANUP


SLIDE 11.12




VIDEO 11.2 (01:06)
Plowing Gores



CREDIT
“Winter Operations Training Series”
 Iowa Department of Transportation
Used with permission.



"Intro to Winter Operations" 10:00
 "Pre-Season Preparation" 29:55
 "Equipment Operation" 10:29
 "Plowing Techniques" 29:46



POST-STORM CLEANUP

SLIDE 11.14

Advice from the Pros...

PLOWING GORES

- Plow snow away from gores
- Backing or stopping in the area of a gore or ramp is situation dependent
- Backing or stopping to plow a gore in rural areas or where traffic volumes are low may be OK



POST-STORM CLEANUP

SLIDE 11.15

Advice from the Pros...

PLOWING GORES

- Gore plowing may require several passes
- When plowing gores, carry the snow straight past the gore and deposit it to the right
- Do not plow snow up against the guard rail



POST-STORM CLEANUP

SLIDE 11.16

Preliminary Snowfall Reports Through 12:00 PM

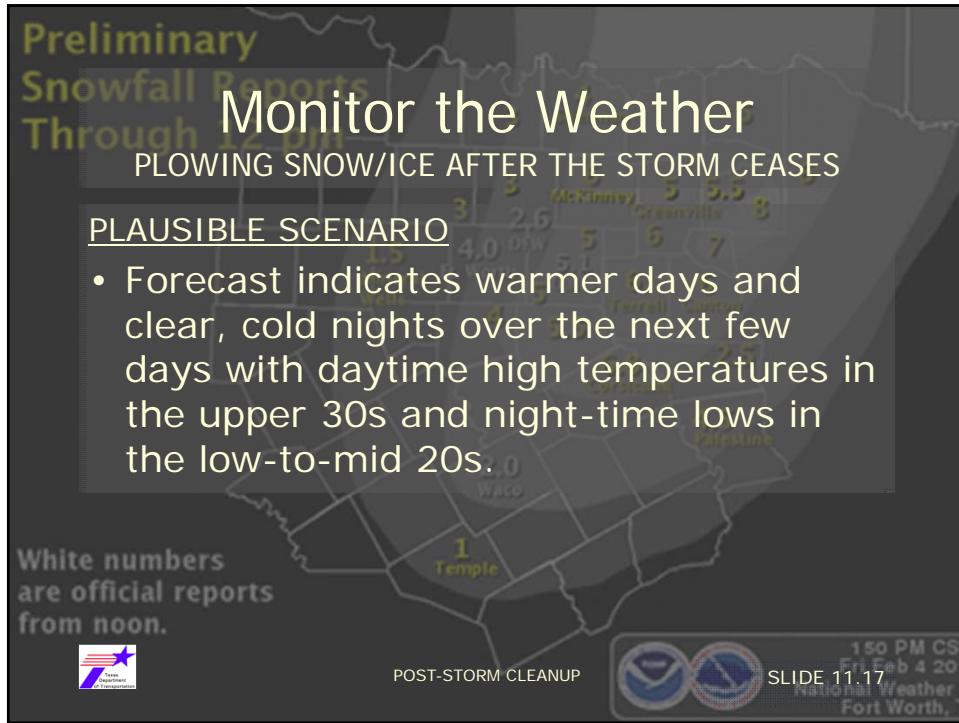
Monitor the Weather

PLOWING SNOW/ICE AFTER THE STORM CEASES

PLAUSIBLE SCENARIO

- Forecast indicates warmer days and clear, cold nights over the next few days with daytime high temperatures in the upper 30s and night-time lows in the low-to-mid 20s.

White numbers are official reports from noon.



POST-STORM CLEANUP

SLIDE 11.17

1:50 PM CST
Feb 4 2011
National Weather Service
Fort Worth, TX

Melt-Back and Re-Freeze

PLOWING SNOW/ICE AFTER THE STORM



POST-STORM CLEANUP


SLIDE 11.18



Post-Storm Cleanup

CLEAN, INSPECT AND REPAIR EQUIPMENT

- All snow and ice control equipment should be thoroughly cleaned and inspected, with repairs as necessary, upon return to the yard.

 POST-STORM CLEANUP SLIDE 11.20

Exercise 11.1

Clean, Inspect and Repair Equipment



In groups of 3 or 4 persons:

1. Discuss what you think are the top three reasons for cleaning snow and ice control equipment.
2. Jot down your reasons.

Be prepared to discuss your answers (3 minutes).



POST-STORM CLEANUP

SLIDE 11.21



Thoroughly Wash Equipment

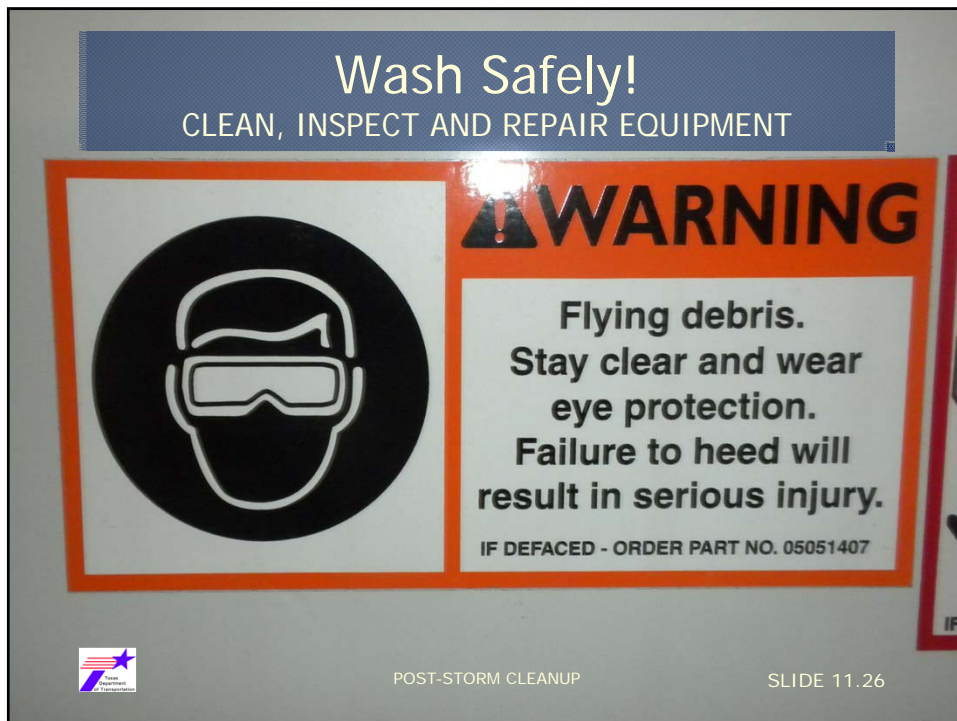
CLEAN, INSPECT AND REPAIR EQUIPMENT



POST-STORM CLEANUP

SLIDE 11.22

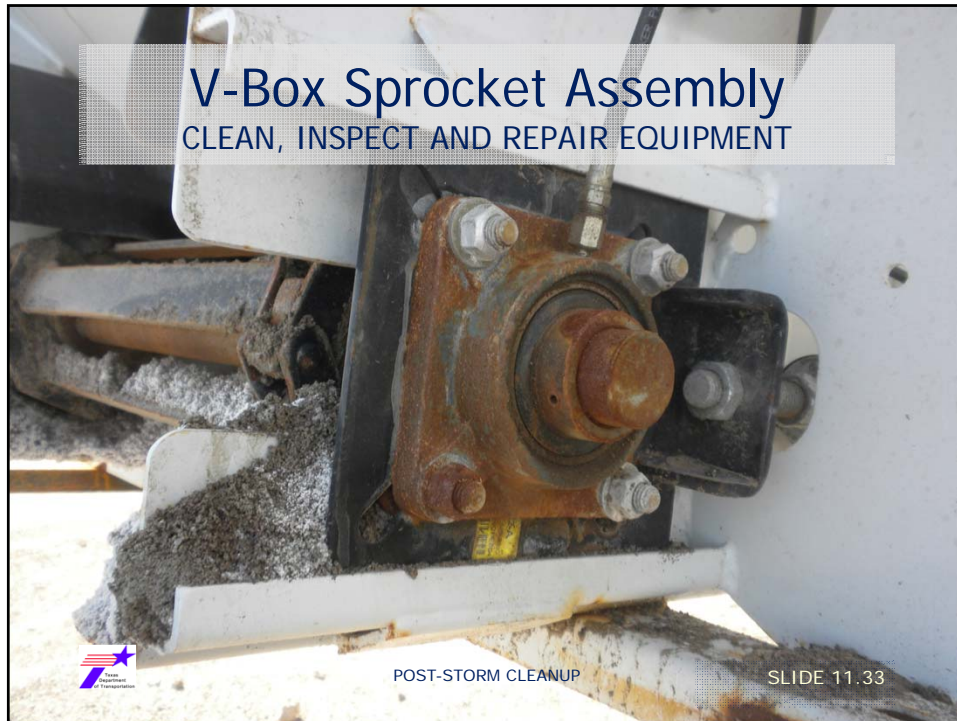








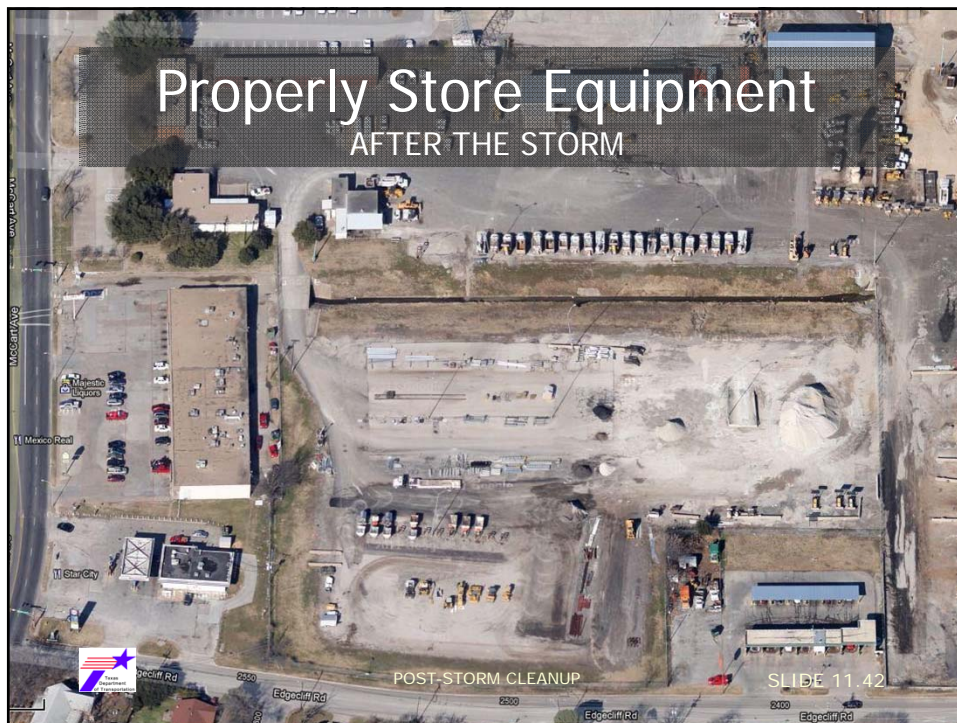












Properly Store Equipment AFTER THE STORM

- Attachments such as the snow plows and the V-box spreaders are removed from the trucks and placed in their storage locations after they have been thoroughly cleaned, blades replaced as necessary, and repairs made.



POST-STORM CLEANUP

SLIDE 11.43







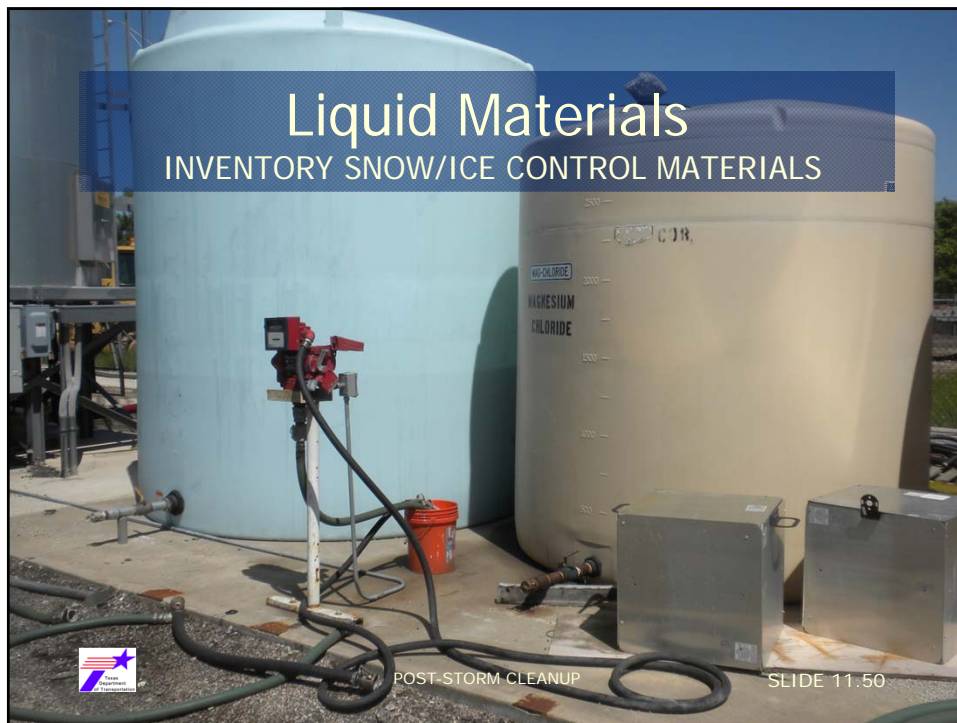
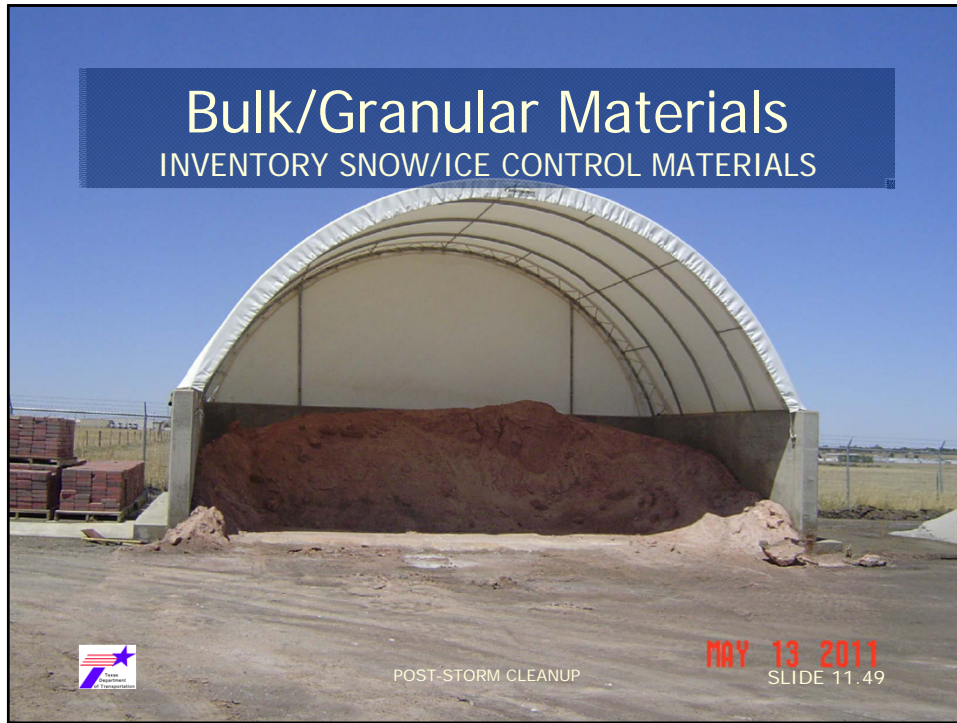
Verify Materials

INVENTORY SNOW/ICE CONTROL MATERIALS

Conduct inventory of in-stock snow and ice control materials:

- Granular chemical materials
 - Stockpiled
 - Palletized
- Liquid chemical materials
- Abrasives

 POST-STORM CLEANUP SLIDE 11.48





Replacement Parts

INVENTORY CONSUMABLES AND WEAR PARTS

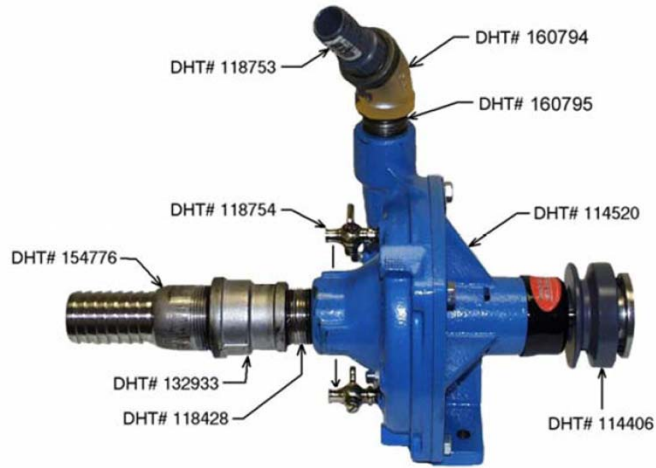
- GOAL: Don't get shut down for something simple... lack of a low-cost, readily-obtainable part
- For Liquid Spray Rigs, use the **Parts Catalog**



POST-STORM CLEANUP SLIDE 11.52

Replacement Parts

INVENTORY CONSUMABLES AND WEAR PARTS



POST-STORM CLEANUP

SLIDE 11.53

Replacement Parts

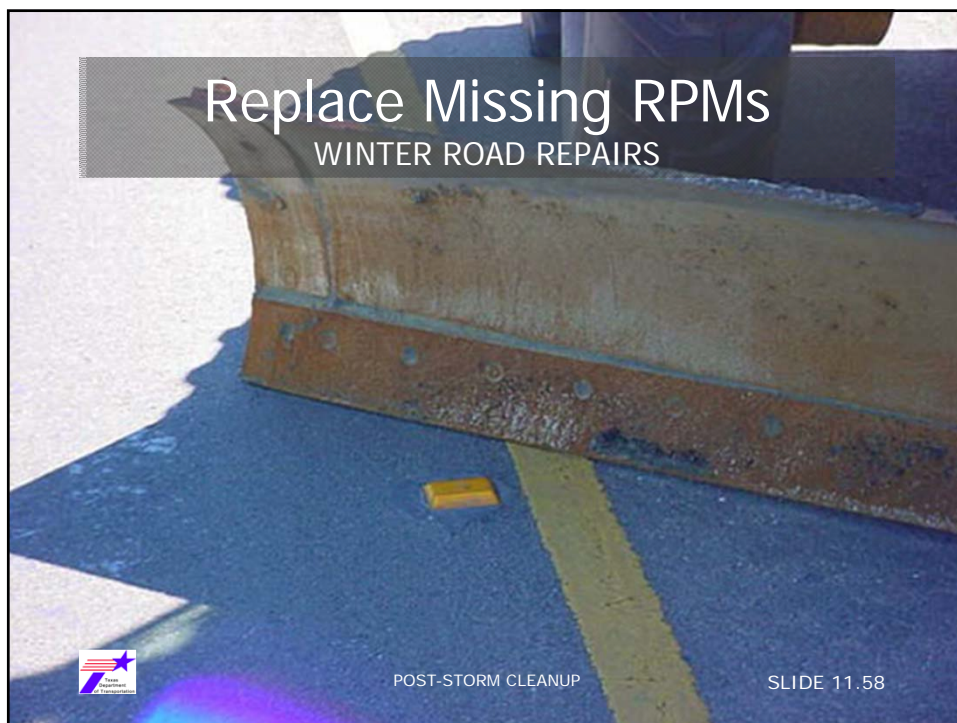
INVENTORY CONSUMABLES AND WEAR PARTS



POST-STORM CLEANUP

SLIDE 11.54











Equipment Evaluation

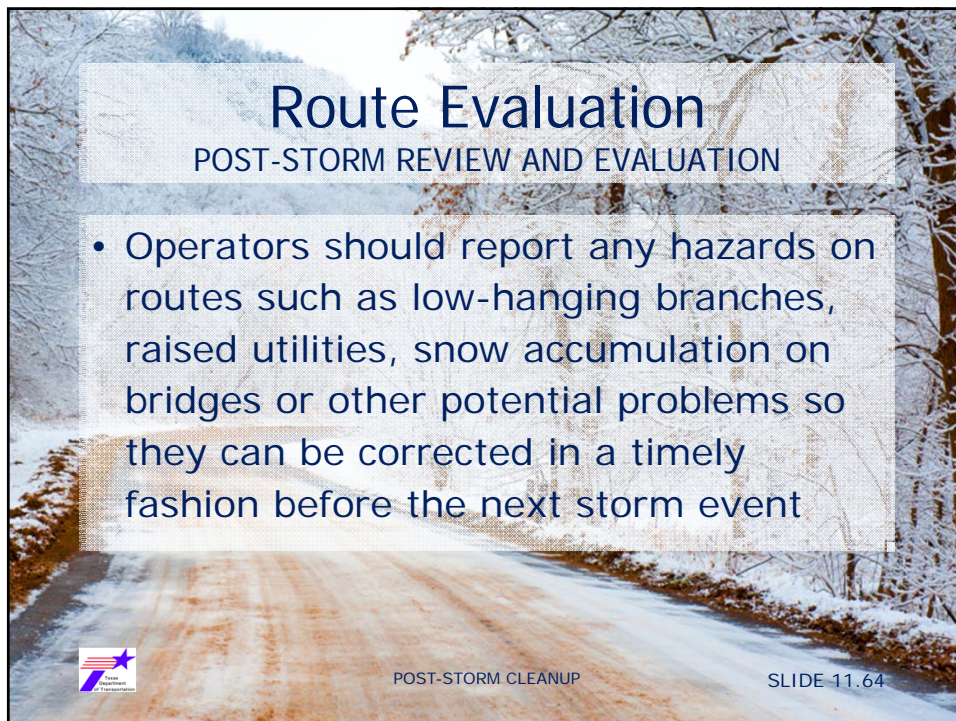
POST-STORM REVIEW AND EVALUATION

- Operators should identify any problems with the equipment so these are repaired in advance of the next storm event



POST-STORM CLEANUP


SLIDE 11.63



Route Evaluation

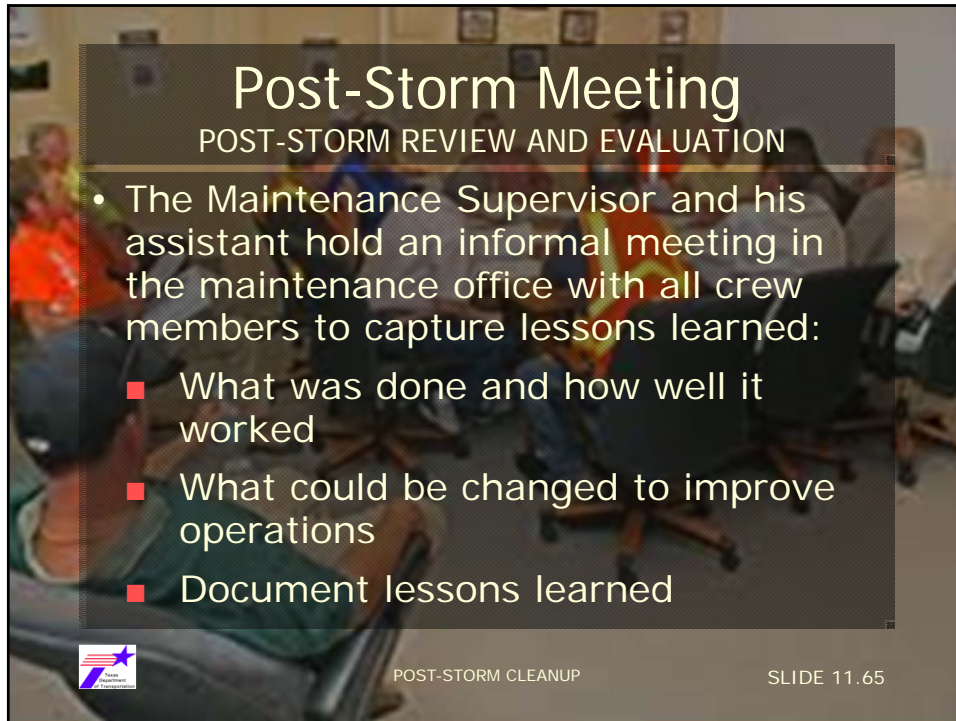
POST-STORM REVIEW AND EVALUATION

- Operators should report any hazards on routes such as low-hanging branches, raised utilities, snow accumulation on bridges or other potential problems so they can be corrected in a timely fashion before the next storm event



POST-STORM CLEANUP


SLIDE 11.64



Post-Storm Meeting

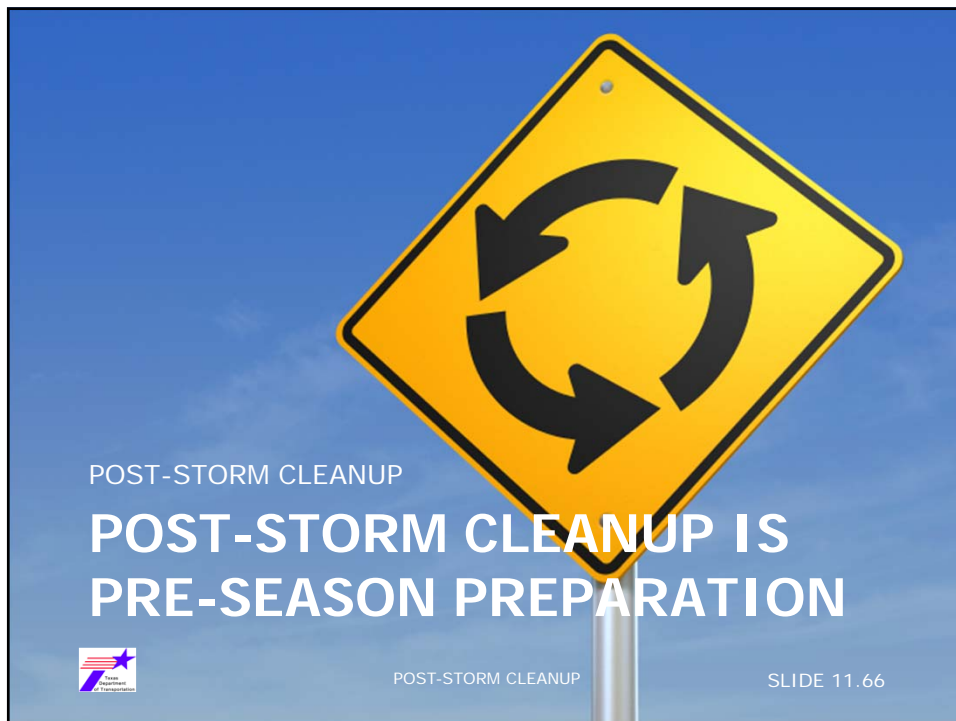
POST-STORM REVIEW AND EVALUATION

- The Maintenance Supervisor and his assistant hold an informal meeting in the maintenance office with all crew members to capture lessons learned:
 - What was done and how well it worked
 - What could be changed to improve operations
 - Document lessons learned




POST-STORM CLEANUP

SLIDE 11.65



POST-STORM CLEANUP

POST-STORM CLEANUP IS PRE-SEASON PREPARATION



POST-STORM CLEANUP

SLIDE 11.66

End-of-Season Checklist

PRE-SEASON EQUIPMENT CHECK

- Remove and properly store detachable winter-only tools/equipment
- Thoroughly wash vehicle and equipment; use chloride neutralizers
- Clean, apply silicon, and cover electrical connections
- Paint or treat any bare metal parts
- More... see Reference 11.3

R_{11.3}
[11.41]



POST-STORM CLEANUP

SLIDE 11.67



POST-STORM CLEANUP

SLIDE 11.68

AASHTO Clear Roads Computer Based Training Series PERSONNEL READINESS



POST-STORM CLEANUP

SLIDE 11.69



Summary and Review

1. Plowing snow and ice after the storm
2. Clean, inspect and repair equipment
3. Inventory snow and ice control materials
4. Winter road repairs
5. Post-storm review and evaluation
6. Post-storm cleanup is pre-season preparation



POST-STORM CLEANUP

SLIDE 11.70

Exercise 11.1

Clean, Inspect and Repair Equipment



In groups of 3 or 4 persons:

1. Discuss what you think are the top three reasons for cleaning snow and ice control equipment.
2. Jot down your reasons.

Be prepared to discuss your answers (3 minutes).



VIDEO 11.1. PLOWING SNOW/ICE AFTER THE STORM (00:19)

SCRIPT

During a significant snow event, you may only have time to make one pass on lower volume roads and on neighborhood streets.

During clean-up operations, widen these plowed routes.

VIDEO 11.2. PLOWING GORES (01:06)

SCRIPT

The area between the road and the ramp is called a gore.

With gores, the whole idea is to carry the snow past the gore, depositing it beyond the shoulder.

To do that, keep the plow straight as you enter the gore, then angle the plow to the right after you pass it.

Never push the snow straight into the gore, that would be like building a concrete wall near the roadway.

Some gores have crash cushions. These come in a lot of different shapes and sizes but the procedure is always the same; keep snow away from them!

That is because a buildup of snow here can form either a wall or ramp, and both are deadly.

When cleaning some gores or point areas, it may be necessary to back up and make several passes; and that means you may have to team-up with one operator controlling traffic while the other handles the cleanup job.

END OF SEASON CHECKLIST

End-of-Season Tasks

- Remove trash and personal items
- Inventory tools
- Inventory safety equipment
- Remove and properly store winter-only tools/equipment
- Report damaged or missing items to supervisor
- Thoroughly wash vehicle and equipment; use chloride neutralizers
- Remove detachable equipment:
 - Perform additional cleaning as required
 - Lubricate
 - Safely store
- Clean and cover hydraulic connections
- Clean, apply silicon, and cover electrical connections
- Lubricate chains and sprockets
- Oil or collapse cylinders to protect rods
- Set air intake valve to summer use setting
- Paint or treat any bare metal parts
- Submit equipment requests
- Discuss modifications/improvement ideas with supervisor

Source: "End of Season Tasks," Documents, **Equipment Maintenance CD**, Version 1, AASHTO Clear Roads Computer Based Training, July 2007.

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Class Exercise – Review Questions

Module 11 – POST-STORM CLEANUP

MNT812 Winter Weather Operations Training

1. [True/False] When the storm is over, it is safe to say the roadway maintenance work is pretty much complete also.
 - A. True
 - B. False
2. Plowing snow after the storm may be required for which of the following situations:
 - A. Conditions that relate to melt-back and re-freeze
 - B. Removing snow from pavement shoulders
 - C. Clearing secondary and tertiary routes
 - D. All of the above
3. [True/False] Thorough cleaning of winter maintenance equipment requires multiple wash-rinse cycles, but that is what it takes to help protect the equipment from corrosion.
 - A. True
 - B. False
4. For which snow and ice control materials must you conduct a post-storm inventory?
 - A. Granular chemical materials
 - B. Liquid chemical materials
 - C. Abrasives
 - D. All of the above
5. Post-storm road repairs may include which of the following:
 - A. Repair potholes
 - B. Replace pavement delineators and RPMs
 - C. Repair/replace damaged guardrail and cable barriers
 - D. All of the above
6. [True/False] One of the benefits of the post-storm evaluation is to document lessons learned.
 - A. True
 - B. False
7. [True/False] Post-storm cleanup is pre-season preparation.
 - A. True
 - B. False

MODULE 12 COURSE SUMMARY



Winter Weather Operations Training

Course No. MNT812
ISSUE: JULY 2012

MODULE 1 INTRODUCTION

1. Safe... there is no substitute for safety
2. Confident... you know what to do and how to do it
3. Efficient... you perform winter operations tasks in a professional and competent manner



COURSE SUMMARY

SLIDE 12.2



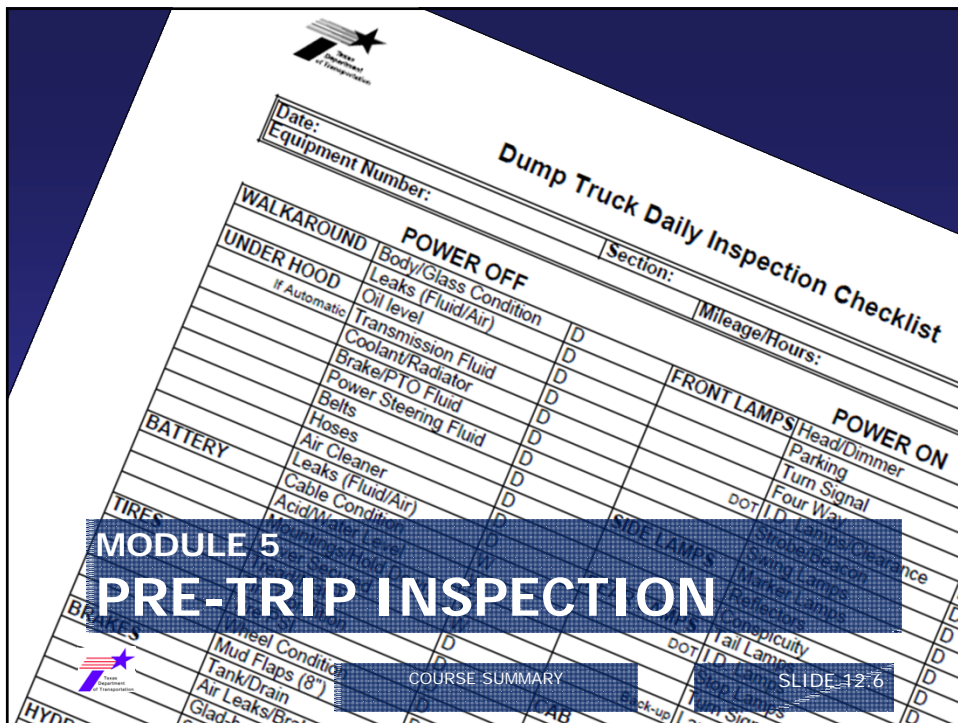
MODULE 2
PRE-SEASON PREPARATION

 COURSE SUMMARY SLIDE 12.3



MODULE 3
MOUNT A
V-BOX SPREADER

 MOUNT A V-BOX SPREADER SLIDE 12.4





MODULE 6
SNOW AND ICE CONTROL MATERIALS


 COURSE SUMMARY SLIDE 12.7

MODULE 7
CALIBRATE A V-BOX SPREADER

LOCATION: *TBB District Office*

Truck No.: *4856-F* Spreader No.: *4856-F*
Date: *06/28/2012* By: *W.D. Lawson*

GATE OPENING (HOPPER TYPE SPREADERS)			POUNDS DISCHARGED PER MILE											
Control Setting	A	B	C	MINUTES TO TRAVEL ONE MILE										
				5 mph x 12.00	10 mph x 6.00	15 mph x 4.00	20 mph x 3.00	25 mph x 2.40	30 mph x 2.00	35 mph x 1.71	40 mph x 1.50	45 mph x 1.33		
1														
2														
3														
4	30	7.0	210	2520	1260	840	630	504	420	359	315	279		
5														
6	↑	↑	↑				↑							
7	↑	↑	↑				↑							
8	↑	↑	↑				↑							
9	↑	↑	↑				↑							
10	↑	↑	↑				↑							

 COURSE SUMMARY SLIDE 12.8



MODULE 8
CALIBRATE A LIQUID SPRAY APPLICATOR

 COURSE SUMMARY SLIDE 12.9



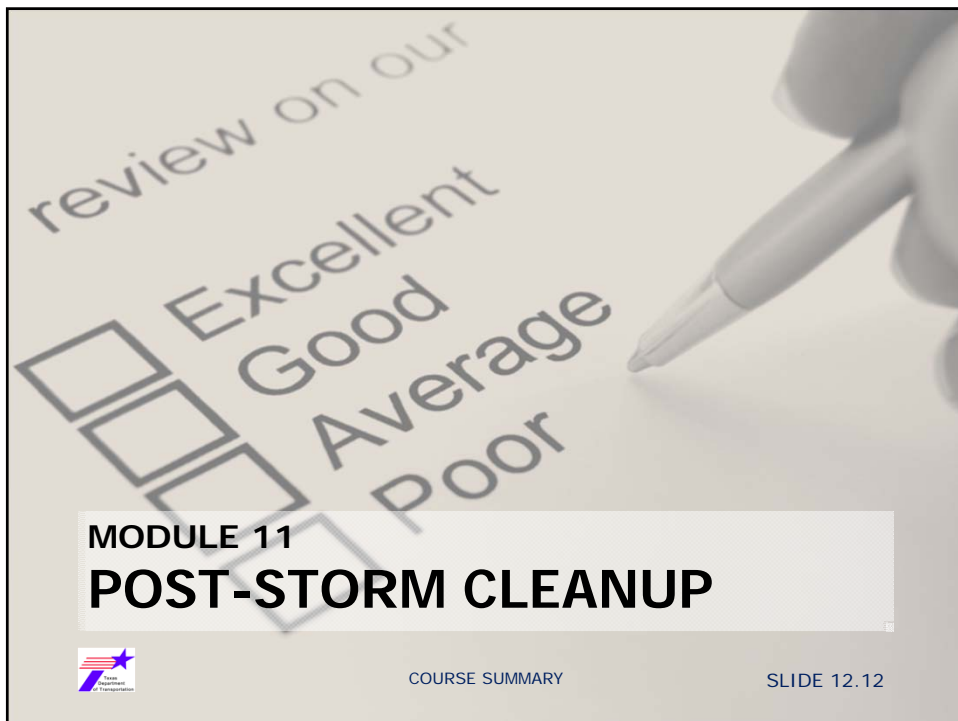
MODULE 9
PREPARING FOR SNOW/ICE REMOVAL

 COURSE SUMMARY SLIDE 12.10



MODULE 10
**SNOW PLOWING
TECHNIQUES**


 SNOW PLOWING TECHNIQUES SLIDE 10.11


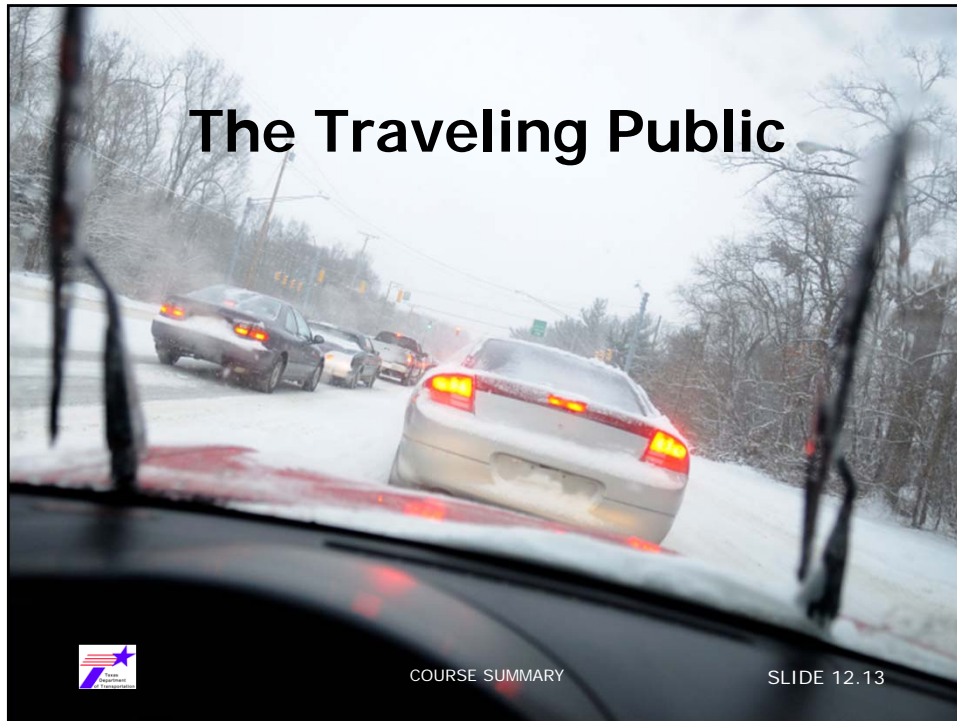


review on our

Excellent
Good
Average
Poor


MODULE 11
POST-STORM CLEANUP

 COURSE SUMMARY SLIDE 12.12



Summary and Review

1. Final Exam
2. Course Evaluation

 COURSE SUMMARY SLIDE 12.14