### Anti-icing

Key Topics

Advantages of Anti-Icing

Materials that can be used to Anti-Ice

Pre-wetted solids

Liquids

When and Where to pre-treat

When not to pre-treat

Types of equipment to be used to pretreat

Use of RWIS or other weather data to assist in timing.

Best Resources

Wisconsin Training Reference\*\* slides 98-100,247-251,269-279,325-326

CDOT Slides110-111

Maine Flow Chart

MDDOT Snow part 1 slides 3-6

MoDOT Guide has good charts

MoDOT pages 33-35

MDOT pages 105-114

Ohio DOT 208-212

Ohio DOT 43-44

PennDOT 102-106

### Assistance to Motorists

This is probably a State specific item

KDOT Policy is pretty general

1. Employees should assist the occupants of stalled vehicles to reach shelter

2. Stalled vehicles should be checked for occupants before a road closure

3. KDOT equipment should not be used to pull a privately owned vehicle that has run off the roadway.

4. KDOT personnel should interrupt snow removal activities to move abandoned vehicles only if they interfere with snow and ice removal operations.

### Avalanche Management

TBD

### Bridge Frost

Best Resources

Iowa DOT New Operator Snow and Ice Training Slides 132-135

### Brine Production and Use

Key Topics

Materials – Rock salt, Coarse or Fine, Cleanliness

 Water, clean, size of water line or meter controls speed of brine making

Equipment – Wide variety

Process - Dissolving salt into water. solids will not dissolve

Testing – Use of hydrometer or salimeter

Storage – Wide variety of tank sizes and materials

Maintenance - cleaning insolubles out of maker and tanks

 Pumps, hoses, valves

Best Resources

Ohio slides 41-46

Ohio Slides 54-57 and 58

2012 Wisconsin Training Reference\*\* Slides 112-117

Iowa DOT 2 slides

MDDOT Slides 70-73

Ohio PowerPoint’s good but duplicates exist

MoDOT Pgs 31 and 32

Ohio 41-46,54-57,199-207 Need verbiage to go with the slides

### Deicing

Key Topics

The distinction between anti-icing & deicing – proactive vs reactive.

When is deicing appropriate/not appropriate.

Best materials and material combinations for deicing.

Allowing your treatments to work – don’t plow off!

Effective application rates for various treatments.

Using weather information to plan deicing actions.

Application equipment & technology.

Best Resources

2012 Wisconsin Training Reference\*\* Slides 280-286

2012 Wisconsin Training Reference\*\* Slides 298-303

Pages 34-39 from MoDot Snow and Ice Plan

### De-Icing Agent Management Policy

TBD

### Drift Control

Key Topics

A. Snow Particle Characteristics

B. Snow Transport

1. Wind Speed Profile

2. Visibility

3. Evaporation

4. Transport distance

5. Deposition Characteristics for different obstructions

C. Equilibrium Drifts

D. Snow Fence Characteristics

1. How to use snow fences

2. Different types of snow fence

3. Rules of Thumb for snow fences

4. Importance of the Prevailing Wind Direction

5. Porosity and trapping efficiency

E. Costs for snow control

### LOS

Key Topics

Definition

Route Classification

Objective/Goal

Effort recommendations

Performance measurement (not very well covered in the existing material)

Best Resources

2012 Wisconsin Training Reference\*\* 17-18

Pg. 8 INDOT

7-18 CDOT

25-28 MODOT

159-164 MDOT

Pages from the Ohio DOT

### Maintenance Yards

No resources available.

Key Topics

Safety/Security

Preserve investment

Work area requirements

Stockpile management

Environmental BMPs

### Managing Snow Disposal Sites

TBD

### Material Use

TBD

### Plowing Procedures

Key Topics and Best Resources

• General techniques and Best Practices

* 2012-Wisconsin Training Reference\*\* slides 213-223.pptx
* CDOT\_Snow-removal-operator-training slide 31.pptx
* City-of-Omaha\_Training-Materials.pdf
* Correct 4way Stop.MPG
* INDOT\_Snow-and-Ice-Training Maual page 20-21.docx
* MDDOT\_Snow-College-Part-1 slides 37-73.pptx
* ODOT\_Driver-Preparedness.mpg -- Hey, this is just a ripped copy of Iowa’s!
* Pages 13-16 from NYSDOT\_Equipment-Operator-Snow-Ice-Manual-4.pdf
* Pages 54-60 from MDDOT\_Single-Tandem-Axle-Dumptruck-4.pdf
* Pages from MoDOT\_Snow-and-Ice-Training-Participant-Book pg 48-53.pdf
* Pages from OhioDOT\_Snow-and-Ice-Control-Course-Manual-105 pg 76-77.pdf

• Bridge Decks

* 2012-Wisconsin Training Reference\*\* slides 213-223.pptx
* CDOT\_Bridge-Plowing.MPG
* CDOT\_Snow-removal-operator-training slides 203-204,213.pptx
* Pages 13-16 from NYSDOT\_Equipment-Operator-Snow-Ice-Manual-4.pdf

• Railroad Crossings

* 10-SPOT-Ripley Railroad and Plows slide 10.pptx
* Pages 13-16 from NYSDOT\_Equipment-Operator-Snow-Ice-Manual-4.pdf

• Roundabouts

* Pages 13-16 from NYSDOT\_Equipment-Operator-Snow-Ice-Manual-4.pdf

• Obstacles

* CDOT\_Bus-Stop-3.MPG
* CDOT\_Bus-Stop-4.MPG
* CDOT\_Bridge-Plowing.MPG
* CDOT\_Guardrail-2.MPG
* CDOT\_Snow-removal-operator-training slides 203-204,213.pptx
* CDOT\_Snowstorm.wmv

• Diverging Diamond Interchanges

* Pages from MoDOT\_Snow-and-Ice-Training-Participant-Book pg 48-53.pdf

• Urban Interchanges

• Tandem and Gang Plowing

* CDOT\_Pulling-Dowd-Canyon.MPG
* CDOT\_Snow-removal-operator-training slides 203-204,213.pptx
* MDDOT\_Snow-College-Part-1 slides 37-73.pptx
* Gang Plowing.ppt
* MoDOT\_Tow-Plow-Manual.pdf

• Cleanup Operations (benching, bridges, storage areas)

* 2012-Wisconsin Training Reference\*\* slides 213-223.pptx
* CDOT\_Pushing-Snow-Vail-1.MPG
* Pages 13-16 from NYSDOT\_Equipment-Operator-Snow-Ice-Manual-4.pdf
* Pages 4-7 from NYSDOT\_Equipment-Operator-Snow-Ice-Manual.pdf

• Avoiding Shoulder Scalping

* MDOT\_White-Shoulder-Policy.ppt
* Pages 4-7 from NYSDOT\_Equipment-Operator-Snow-Ice-Manual.pdf
* PennDOT\_Snow-Academy-Part-4 slides 76-83.pptx

### Pre-wetting

### Key Topics and Best Resources

Pre-wet Salt Benefits

* 2012-Wisconsin Training Reference\*\* Slides 120-122
* 2012-Wisconsin Training Reference\*\* Slides 252-268

Pre-wet Salt use

* Pages from Mo DOT S&I Training Participant Book portions of pg 35, 36
* Pages from Maine DOT Snowfighters Handbook pages 16-17
* Ohio DOT Snow and Ice Control Course Manual Pages 58-59

### Principles of Ice Formation

Key Topics

I. Principles of Ice Formation

A. Weather Characteristics

1. Air Temperature & Dew point

2. Pavement Temperature

3. Wind

4. Time of the snow season

5. Barometric Pressure

B. Roadway Characteristics

1. Concrete or Bituminous Surface

2. Subsurface Temperature

3. Solar Radiation/Cloud Cover

4. Traffic patterns

II. Infrared Temperature Sensors

A. How infrared works

B. Available brands

1. Costs

2. Technological differences

C. Mounting on the vehicle

III. RWIS Equipment

A. How will RWIS help you

B. Available brands

1. Costs

2. Technological differences

### Record Keeping

Key Topics

Why?

* Liability
* Accountability
* Operations tracking
* Materials tracking
* Budget

What?

* Labor
* Equipment
* Materials
* Other

How?

* AVL/GPS
* PDA
* PC input
* Paper forms (TAPER logs, etc.)

Best Resources

PennDOT Snow Academy Part 6 PPT

### RWIS, IRTS and MDSS

Key Topics

I. RWIS

A. Equipment

1. Tower

2. Pavement sensors

a) Invasive

b) Non-invasive

3. Wind

4. Temperature/dewpoint

5. Precipitation

6. Optional equipment

a) Camera

b) Barometric pressure

c) Water level

B. Communications

1. Method

2. Frequency

C. Accessing the data

II. Infrared Temperature Sensors

A. How infrared works

B. Available brands

1. Costs

2. Technological differences

C. Mounting on the vehicle

III. MDSS

A. How it works

1. Inputs

a) Road data

b) Forecast information

c) Vehicle data

2. Outputs

a) Route-by-route weather forecasts, treatment recommendations

b) Current/future radar

c) Alerts

d) Post-storm analysis

Best Resources

2012 Wisconsin Training Reference\*\* slides 81-92.pptx

IowaDOT New Operator Snow and Ice Training Slides 103-114

### Safety

Key Topics

Safety in and around the truck

Safety in the yard

Safe handling of materials

Safety on the road

Best Resources

Lots of good material on the CD. Most of it general safety in nature.

The Ripley training series 9-11 has some good general information with some specific to Snow and Ice.

CDOT Slide 37

CDOT Slide 165-179

CDOT Slide 180-216

InDOT Page 10 and 20

Iowa – Pretty specialized

MDDOT Slide 9-12 and 21-24

Ohio Slide 194-213

MDOT Page 85

MDDOT page 6-11

MoDOT Slide 54-59

PennDOT 11-16

### Science of Freeze Point Depressants

Key Topics

How do they work?

Phase diagrams

Dilution

Factors which influence effectiveness

Endotherms

Exotherms

Hygrosopy

Concentration

Chemical slipperiness – causes

Best Resources

2012 Wisconsin Training Reference\*\* Slides 100 – 105

PennDOT Snow Academy Part 4 Slides 56 – 63

### Snow and Ice Control Agents and the Environment

Key Topics

Chlorides and the environment

* Soil
* Water
* Marine species
* Vegetation

Organics & the environment

* BOD
* Wildlife

Abrasives and the environment

* Air quality
* Fish habitat
* Heavy metals

Best Resources

2012 Wisconsin Training Reference\*\* PPT

MaineDOT Effects Road Salt Environment PPT

MDDOT Snow College Part II slides 12 – 30

### Snow Disposal

TBD

### Spreaders

Key Points and Best Resources

• Spreader Types

* 2012-Wisconsin Training Reference\*\* slides 180-185.pptx (spreader types, maintenance, Liquid application)
* OhioDOT\_Snow-and\_Ice-Control-Course-Presentation-105 slides (ohio spreader types/controls)
* Pages 41-44 from MoDOT\_Snow-and Ice-Training\_Participant Book (types of solid spreaders/boxes. Spreader maintenance pg 44)
* Pages 59-63 from OhioDOT\_Snow and Ice-Control-Course-Manual-105 (Types of Spreaders, calibration, controllers)
* Pages fromOhioDOT\_Course-Manual-Truck-and-loader104 pg 215-218 (same as ohio pages 59-63 above)

• Spreader Controllers

* City-of-Omaha\_Operating –Instruction-Force America (spreader controller: Force America)
* MaineDOT\_Snowfighters-Compusperad-Manual (spreader controller: Compuspread)
* MDDOT\_Snow-College\_Part-1 slides 34-36 (spreader controllers : DickeyJohn)
* MoDOT\_Advanced-ControlSystem\_Manual (Spreader Controllers: ACS)
* Pages 59-63 from OhioDOT\_Snow and Ice-Control-Course-Manual-105 (Types of Spreaders, calibration, controllers)
* Pages fromOhioDOT\_Course-Manual-Truck-and-loader104 pg 215-218 (same as ohio pages 59-63 above)
* Pages from MDOT\_winter operations\_Trucking-Driving\_School pg 127-133 (Dickey John ICS2000 controller manual)
* Pages from MDOT\_winter operations\_Trucking-Driving\_School pg 135-136 (GRESEN GRS31 controller manual)
* Pages from MDOT\_winter operations\_Trucking-Driving\_School pg 137-144 (Dickey John Control Point controller manual)
* Pages from MoDOT\_Snow-and-Ice-Training-Participant-Book pg 60-72 (GL-400 controller manual)
* PennDOT\_Snow-Academy-part-4-slides 41-45 (GL-400 and Freedom controllers)

• Installation

* INDOT\_Snow-and-Ice-Training Manual page 15 (Safe procedures for installing spreader units into trucks, each season)
* MaineDOT\_Material-Spreaders (Good install/ remove instructions and maintenance for operators, on various systems. (stand and gantry hoppers, Henderson, front dump, swap loader, precision placememt system)).

• Calibration

* Pages 59-63 from OhioDOT\_Snow and Ice-Control-Course-Manual-105 (Types of Spreaders, calibration, controllers)

• Maintenance

* 2012-Wisconsin Training Reference\*\* slides 180-185.pptx (spreader types, maintenance, Liquid application)
* Pages 41-44 from MoDOT\_Snow-and Ice-Training\_Participant Book (types of solid spreaders/boxes. Spreader maintenance pg 44)

• Salting Operations

* Pages 11-13 from NYSDOT\_Equipment-Operator-Snow-Ice-Manual-2 (salting practices and salting when controller is not working).
* Pages 81-82 from MDDOT\_Single-Tandem-Axle-Dumptruck-5 (good material on sensible salting, and how salt functions in winter maintenance).
* PennDOT\_Snow-Academy-part-4-slides 84-98 (Salting practices for PennDot, principles and LOS)

### Supervisors and Winter Maintenance

TBD

### Tips from Experienced Drivers

Key Topics

Preparation

* Forecasts
* Equipment check-out
* Loading practices
* Route planning & coordination

Driving

* Drive defensively
* Watch for road/equipment hazards
* Chain-up practices
* Radio use
* Accident reporting
* Controls

Plowing

* Speed
* Plow tension
* Bit wear
* Raised obstacles
* Operating in traffic
* Operating in tandem/echelon
* Ramps
* Shoulders
* Medians
* Intersections
* Convoluted, newfangled roadway designs

Material applications

* Know your materials
* Application rates
* Spinner shut off for traffic
* Material volume on board
* Basic controller ops

Return to base

* Activity reporting
* Equipment check-out
* Equipment washing

Best Resources

INDOT Snow and Ice Training Manual, pages 36 & 37

### Truck Operations

TBD

### Weather and Decision Making

Key Topics

I. Long-range (5-10 days out)

A. Not much certainty in forecast

B. Early planning

1. Vehicle supplies

2. Salt/materials

3. Crew vacations

II. Medium-range (2-5 days out)

A. Forecast becomes more certain and specific

B. Monitor trends (earlier/later, snow amounts increasing or decreasing)

C. Start planning shifts, call-out times

III. Short-range (0.5-2 days out)

A. Very high confidence in forecast

B. Start making treatment decisions

1. Pavement temperature

2. Precipitation amount

3. Precipitation type

4. Winds

5. Traffic

C. Continue to monitor trends

D. Anti-ice if appropriate

E. Fill trucks

IV. Storm start

A. Call crews out

B. Provide treatment instructions to drivers

V. During storm

A. Monitor vehicle status

B. Monitor weather via radar

C. Monitor weather forecasts

1. Relay changes to drivers

2. Changes in precipitation type

3. Has end time changed?

4. Amounts

5. Post-storm conditions

a) Quick freeze?

b) Winds

c) End time versus shift schedule

Best Resources

2012 – Wisconsin Training Reference\*\* slides 32-94.pptx

Adams UW Weather 2012 Madison.pptx

Appendix-A NYSDOT Equipment Operator Snow Ice Manual.pdf

IowaDOT New Operator Snow and Ice Training slides 119-127.pptx

Pages 8-9 MaineDOT Snowfighters Handbook.pdf

Pages 21-31 OhioDOT Snow and Ice Control Course Manual105.pdf

Pages 165-170 MDOT Winter Operations Truck Driving School.pdf

### Weather Forecasts

Key Topics

I. Custom weather services (VAMS)

A. Timeliness—how often is it needed?

B. Lead time—how soon before event?

C. Delivery method

1. Internet

2. Satellite

3. Fax

D. Important features

1. Toll-free access to forecaster

2. Storm warning/alert function

3. Integrated radar

4. Human intervention in forecast process

E. Pavement temperature

1. Cannot get from media, internet forecasts

2. Most important element in operational decisions

II. Media/Internet

A. Use to provide “heads-up” for storms several days out

B. Most use model forecasts with little human intervention

C. Forecasts usually general in nature

D. No pavement temperature information

Best Resources

MaineDOT National Weather Service.pptx

ODOT Weather Forecasting.mpg

### Weather Tracking

Key Topics

I. Radar

A. Best way to track precipitation

B. Strengths

1. Nationwide network run by National Weather Service

2. Thunderstorm detection

3. Latest upgrade allows detection of light precipitation

4. Accurately depicts precipitation movement and intensity

C. Weaknesses

1. Some holes in coverage of winter precipitation

2. Can “miss” light snow events

3. Can overdo leading edge of approaching winter storms

II. Weather satellite

A. Tracks cloud patterns, not precipitation

B. Better for tracking large systems several days out

C. Visible imagery

1. Depicts what satellite actually sees

2. Best in daytime; no imagery at night

D. Infrared imagery

1. Depicts temperature of what is sensed

2. Useful at night

3. Difficult to see low clouds, fog

III. Surface weather reports

A. Use to verify what radar is showing--precipitation

B. RWIS

1. Along highways

2. Atmospheric and pavement conditions

C. ASOS/AWOS

1. At airports

2. Atmospheric only

D. School Net, etc.

1. Great coverage

2. Parameters vary by site

3. Data quality can be questionable

IV. Telephone

A. Contact peers being impacted by storm before it hits

B. Good way to know impacts ahead of an event

V. Freeway cameras

VI. Media reports

Best Resources

ODOT Weather Forecasting.mpg

### Wind

Key Topics

I. Wind

A. Forecasts

1. Barometric and Atmospheric Isobars

2. Weather Terminology

*a) Fronts*

*b) Types*

3. Wind relationships

*a) Effects of Cold and Warm fronts*

*b) Direction of Wind in a system: before, during and after*

4. Wind Chill

5. Precipitation

B. Blowing Snow

1. Effects of wind speed

2. Effects over time of wind on the snow surface

3. Visibility

C. Wind during the Daytime or at Night

II. Wind behavior by region

A. Flatland and over water

B. Mountains

C. In front of a system or on the back side of a system

III. How does Wind effect road treatments

A. What is the prediction for winds

1. Treatment types

2. Will the weather forecast allow a selected treatment

3. What to do for both low and high winds