

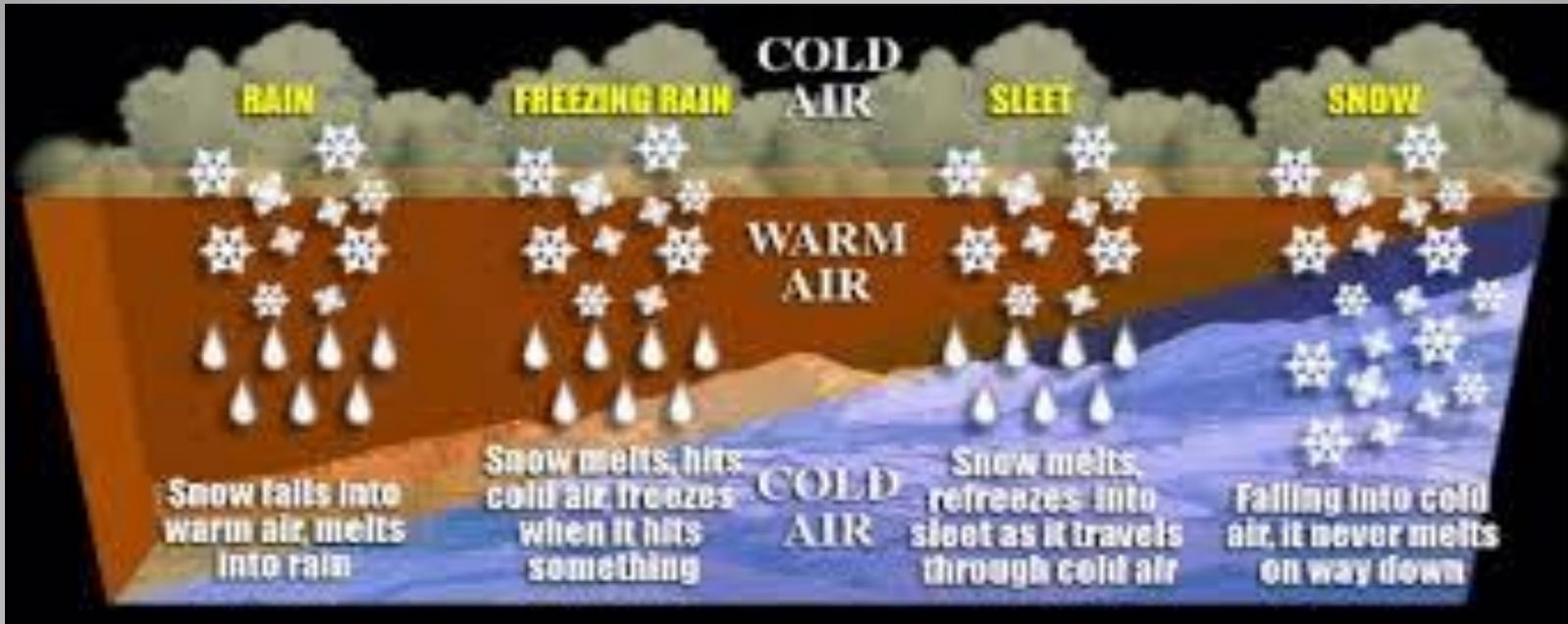
Managing Snow & Ice Control Operations

Maintenance & Operations



Topics Covered

- Weather & Weather Technology
- Snow Equipment
- Snow and Ice Treatments
- Winter Maintenance Management



Weather & Weather Technologies

Weather - Types

- Rain
- Freezing Rain
- Snow
- Sleet



Weather - Types

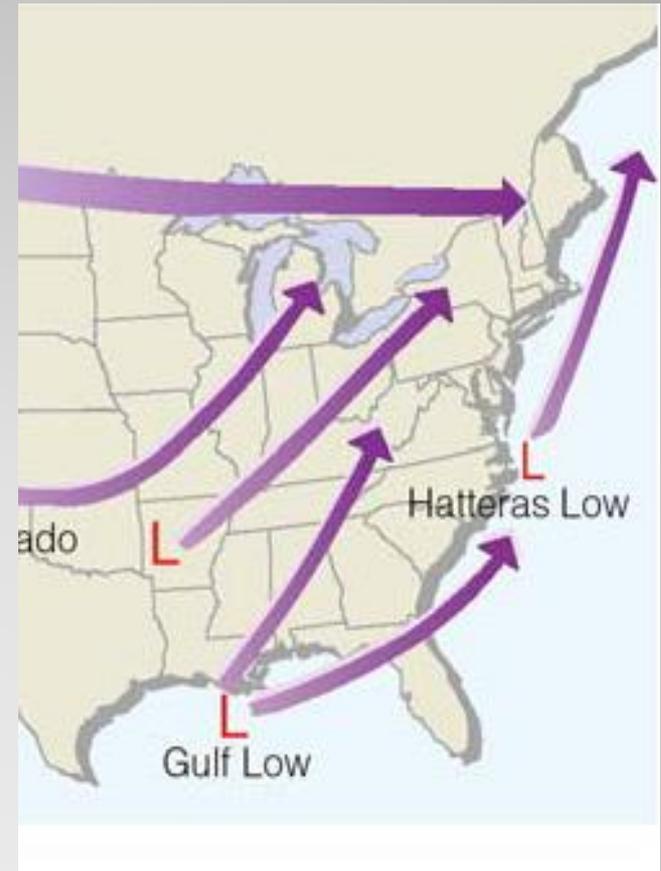
- **Flurries**
 - Light snow for short durations
 - No accumulation; dusting
- **Showers**
 - Rates at varying intensities
 - Some accumulation
- **Squalls**
 - Brief, intense snow showers
 - Gusty winds
 - Accumulation significant
- **Blowing Snow**
 - Wind-driven
 - Reduced visibility
 - Significant drifting
- **Blizzard**
 - Winds over 35 MPH with snow
 - Blowing snow reducing visibility to near zero



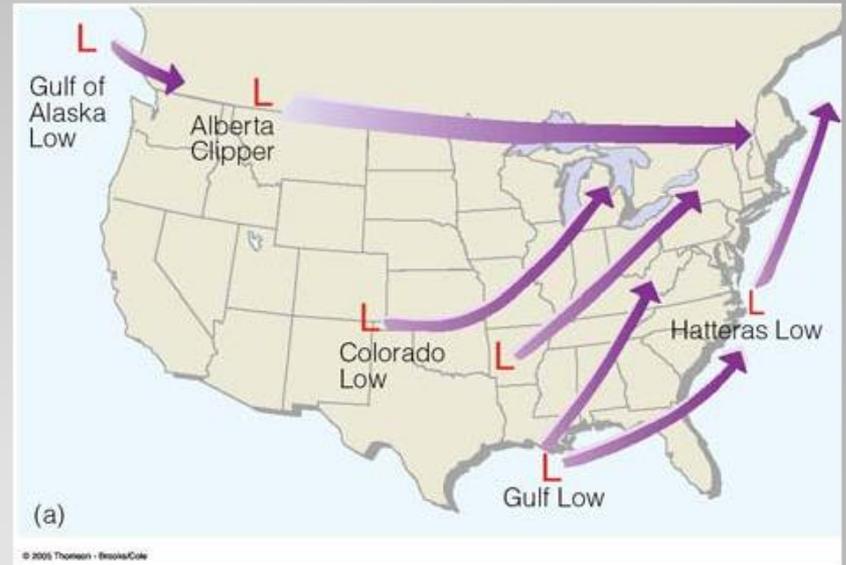
Snow - Types

- The Gulf Low
 - Biggest snow-maker for the East
 - Weak system develops in Gulf of Mexico along old frontal boundary
 - Intensifies as moves North/Northeast
 - Draws moisture from Gulf, Atlantic
 - Clashes of air masses fuels storm

Typical Storm Tracks



- Alberta Clipper
 - Forms in/near Alberta, Canada
 - Moves rapidly southeast
 - Usually already in a cold airmass
 - Produces all snow
 - Little available moisture = dry snow
 - Strong winds, blowing snow



Typical Storm Tracks

- Dew Point

- Absolute measure of amt of water vapor in air
- More moisture = higher dew point
- Cannot be higher than air temperature
- More drying the greater the difference between Dew Point and Air Temperature

Dewpoint

- Weather Forecast Services
- Weather Radar

Weather Technologies

- Timeliness
- Lead Time
- Important Criteria
- Delivery Method
- Types

Weather Forecast Services

- Detected Weather vs. Undetected Weather
- North District monitors three radar sites:
 - Sterling, VA
 - Dover, DE
 - Mt. Holly, NJ
- http://www.everythingweather.com/weather-radar/Animated_Radar_Explination2.gif

Weather Radar

- More meaningful than air temperatures
- Could vary 10 – 15 deg from air temps
- Pavement type, frozen ground, day or night, sun or shade influence pavement temps
- RWIS – Road Weather Information System

Pavement Temperatures

- North
 - I-95/896
 - I-95/141
 - I-95/Marsh
 - I-495 @ Terminal Ave
 - SR 7/Valley Rd
 - US 202/Naamans
- Canal
 - US 40/Summit Bridge
 - SR 1/Roth Bridge
 - US 13/Pine Tree Rd
 - SR 1/Paddock Rd
- Central
 - SR 1@Symrna Leipsic Rd
 - SR 1@Trap Shooters Rd
 - SR 1 @ N. Fred
 - US 13 @ Murderkill River
 - US 13/SR 14
- South
 - SR 1/30
 - US 113/SR 16
 - SR 1/16
 - SR 1 @ IRIB

RWIS locations - statewide

TEMPERATURE FORECAST

DECEMBER-FEBRUARY

MUCH ABOVE
AVERAGE

ABOVE
AVERAGE

BELOW
AVERAGE

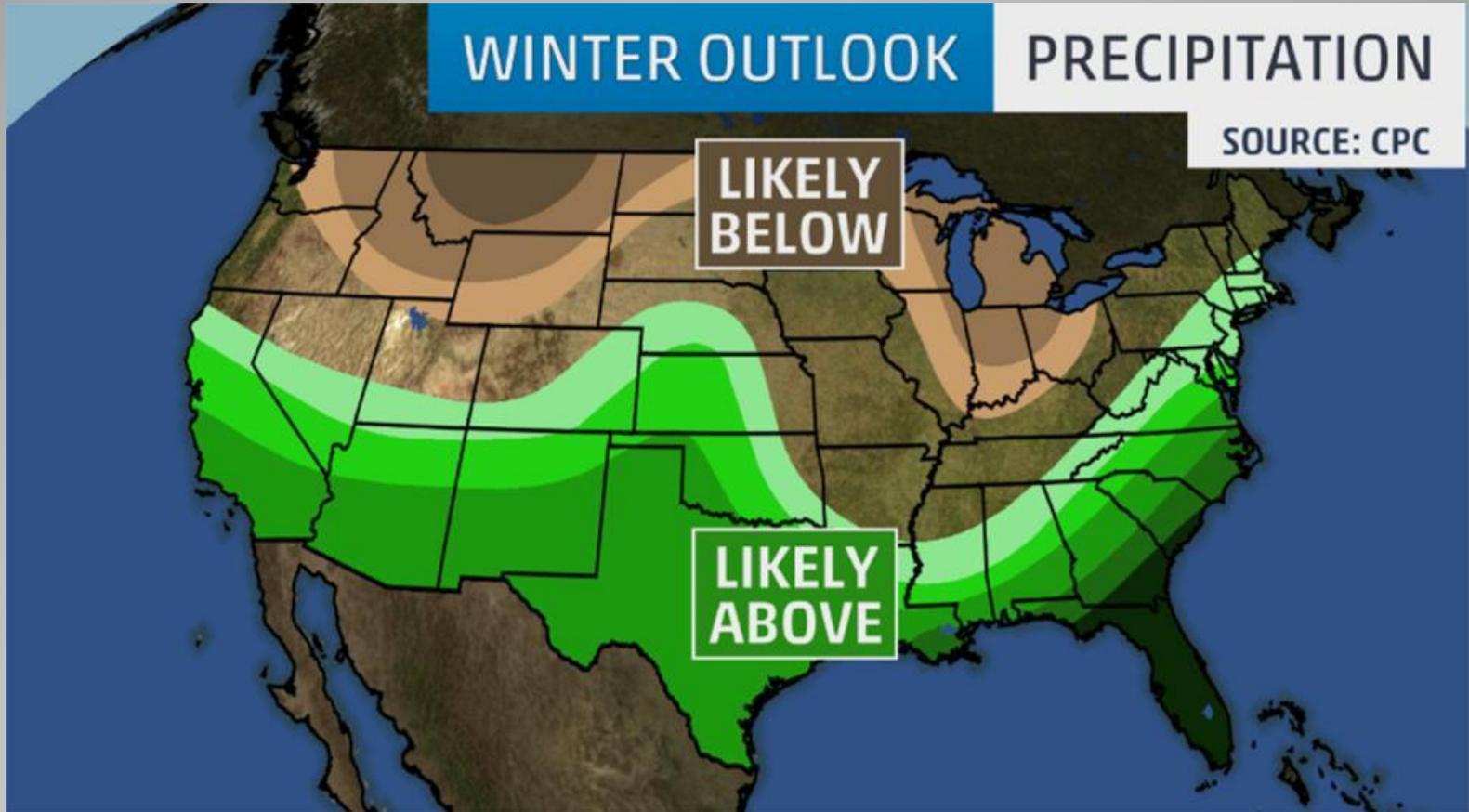
MUCH BELOW
AVERAGE

Winter Weather Predication

WINTER OUTLOOK

PRECIPITATION

SOURCE: CPC



Winter Weather Prediction

Snow Equipment

- Plow Trucks
 - 6 Wheel
 - 10 Wheel
 - Low Pros
- Snow Blowers
- Loaders, Skid Steers
- Brine Tankers

Snow Equipment



Plow Trucks – 10 Wheel



Plow Truck – 6 Wheel



Plow Truck – Low Pro



Snow Blower (Central District)



Loaders (Salt and Removal)



Brine Tankers



Plows



Plows and Scrapers – South District

Snow and Ice Treatments

- Basic terminology
- Types of snow & ice conditions on pavement
- Salt & Deicing

Snow and Ice Chemicals

- **Anti-Icing/Brining**
 - Application of salt or other deicer (usually liquid) before a storm to prevent bonding of snow/ice to pavement
- **Deicing**
 - Application of salt or other deicer after a storm has started, used to melt snow/ice on pavement
- **Pre-Wetting**
 - Application of liquid brine or other liquid deicer onto rock salt, applied before spreading salt

Basic Terminology

- Fresh Snow
- Snowpack (Hardpack)
- Slush
- Frost
- Black Ice
- Glare Ice
- Icings

Types of Snow & Ice Conditions on Pavements

- Occurs when snow bonds to pavement
- Compacted snow is hard to remove
- Tough to plow
- Difficult to “burn” through
- Prevent bonding by getting salt on surface early in storm



Snowpack (Hardpack)

- Water content important
- Light to medium salting keeps slush “slushy”
- Need to melt 20-30% of snow to make slush
- Slush easier to plow off, effective



Slush

- Condensed water vapor freezes on cold surfaces
- Bridges, shaded areas, & low lying
- Very light salting to remove
- Use anti-icing to prevent from forming



Frost

- Forms when air is at 32 deg or below at the surface and rain is falling
- Thin, transparent layer of ice despite it's name
- Occurs around dawn and in late evening



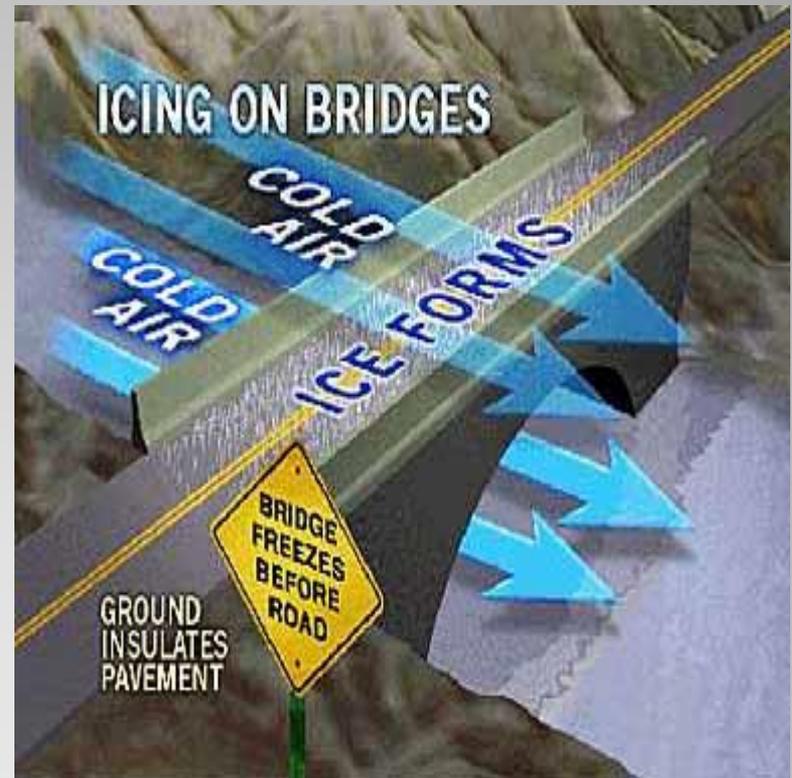
Black Ice

- Ice having a smooth, glassy surface that reflects sunlight



Glare Ice

- Affects stopping distances
- Re-melt from plowed snow
- Bridges at risk



Icings



- De/DOT uses Rock Salt (per Ton)
- Needs moisture to dissolve into a solution
- Lowers the freezing point
- Used for:
 - Anti-Icing
 - Deicing
 - Prewetting
 - Treating Sand



Salt



Oceanport, Philly Pike (Wilm.)

- Apply early
- Re-apply as needed
- Conventional wisdom:
 - 100-300 pounds per lane mile
- DeIDOT directive:
 - 225-250 pounds per lane mile
- Use amount required by conditions



Salt - Application

- DON'Ts

- Do not apply when too cold – good above 20 deg F
- Do not spread beyond traffic lane – bounce/scatter
- Do not apply and plow off
- Do not apply to cold, dry pavement

Salt – Don'ts

- The process of spraying deicing salt with a solution of liquid chemical before spreading the salt on the roadway
- Pre-wetted salt works faster and at a lower temp than dry salt (remember, dry salt ineffective under 20 deg F)



Pre-Wetting

- Wet salt sticks to roads, therefore...
- Reduces lost rock salt by 20% + (reducing scatter and bounce)
- Provides faster melting by providing the moisture needed for salt to work
- Moisture dissolves salt, releasing heat, dissolving snow/ice
- Less salt usage = saving money



Pre-Wetting

- Liquid applied to pavement before storm
- Goal: prevent ice/snow bond to pavement
- Improves safety
- Can last for days
- Easier storm clean up



Anti-Icing (or Brining)

- Typical application: 15-50 gallons per lane mile
- Need a reliable forecast
- 23.3% salt concentration brine can work in temps down to -6 deg F



Anti-Icing



Area-10 Del Laws Rd

Plowing – Canal District

- Speeds!
 - Character of Snow
 - Roadside Conditions
 - Wind Conditions
 - Traffic Conditions
 - Pavement Conditions
 - Highway Geometry
 - Pavement Obstructions
 - Less than 35 MPH, generally



Plowing

- Different roadways dictate plowing methods
- Right or Left side Angling
- Plow Trains
- Bridge Plowing



Plowing



Plow Train – South District

Winter Maintenance Management District Operations

- Operations Management
- Priority Roadways
- Crew Scheduling
- District Snow Manual
- Winter Inspections
- Snow Facts

Winter Maintenance Management

- **Operations Management**
 - Four Maintenance Districts
 - North, Canal, Central, South
 - Management Personnel
 - District Engineer, Maintenance Engineer, Maintenance Superintendent, Equipment Superintendent

Operations Management

- Personnel
 - Finance
 - Design/Contract (DART Routes & Sidewalk Removal, 4")
 - Parts
 - Shop
 - Equipment Operators
 - Administration Assistants & Operations Support Specialists
 - Supplemental Forces – Snow Volunteers

Operations Management

- Communication
 - Media – Local News, DeIDOT Snow Plow App
 - Staff
- Timeline for a “typical” storm
 - Forecast
 - “Public Service Announcement”
 - Pre-Storm Activities
 - Defined Hour for Staffing Needs
 - Working the Storm
 - Post-Storm Activities
 - Partial Staffing for After Hours

Operations Management

- Storm Event: Amount Defines Activities
 - > 4" Storms = No additional activities
 - 4" Storms
 - All Districts Sidewalk Removal
 - All Districts DART Route Plowing
 - Districts below Canal Subdivision Plowing
 - 6" Storms
 - All Districts Sidewalk Removal
 - All Districts DART Route Plowing
 - All Districts Subdivision Plowing

Operations Management

- http://www.deos.udel.edu/odd-divas/snow_current.php
- Districts divided into zones, reading determines sidewalk and subdivision plowing

DEOS Website

- Priority Roadways:
 - Interstates – I-95, I-295, I-495
 - Primaries (or Arterials) – SR 1, 7, 13, 40, etc.
 - Secondaries – Harvey Rd, Pine Tree Rd, Hazelville Rd, Roxana Rd (SR 17), etc.
 - Locals – Snuff Mill Road, Blue Jay Ln, Salt Barn Rd, etc.
 - Subdivisions – Not in reimbursement program

Winter Maintenance Management

- Crew Scheduling
 - Plow Teams
 - Forecast
 - Supervisor Meetings and Conference Calls
 - Consistency with Other District
 - 2016 Director's Notes
 - Outside Staffing

Winter Maintenance Management

- District Snow Manual
 - Annually Updated
 - Plow Teams Adjusted
 - Inclusion of New Employees
 - Other Staff Changes
 - Subdivision Updates
 - Expectations Defined

Winter Maintenance Management

- North District's Expectations
 - Bare Pavement Policy
 - Objective: To provide the safest driving conditions and to continue with snow and ice removal in manner that will ensure the fastest return to a bare and dry pavement surface
 - Plowing starts at a depth of 0.5"
 - Means: brining, salting, and plowing
 - I-95 Most Critical
 - Most heavily travelled road in Delaware
 - Vital to the economy and security of the East Coast
 - **Has never been shut down**

Winter Maintenance Management

- Statewide Winter Equipment Inspection
- Annually, Late October/Early November



Winter Inspection



AREA 12 - TALLEY



AREA 11 - KIAMENSI



CHAPMAN YARD



South District - Brining Fleet

- Approx. 45,000 Tons of Stored Salt in 20 stockpiles around the state
- On an average storm, 12,000 tons of salt used statewide
- 450 pieces of equipment
- 575 snow-fighting personnel (inc. volunteers)
- Over 13,450 lane miles maintained (not including subdivisions), 87%+ roads within the state.

Snow Facts



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Blizzard Jonas - Flooding



Blizzard Jonas



Blizzard Jonas



Blizzard Jonas



Blizzard Jonas – I-95 NB (near Service Plaza)



Blizzard Jonas



Blizzard Jonas



Area-10 Del Laws Rd

Blizzard Jonas



North District – Area 12



Area 11

- Weather.com
- Marian Pelesi
- University of Wisconsin, *Managing Snow and Ice Control Operations*
- Iowa State University, Institute for Transportation
- Henderson Products
- State of NJ – Images
- BC.eo.org – Images
- Northjerseylandscapingserives.com – Images
- Getty images
- Flickrhivemind.net – Images
- DelDOT PR and Anne Brown
- Jamie Larkin Photos
- Canal District
- Central District
- South District

Sources

Governor Douglass

