

Operational Forecasting

Weather Critical ITS Series

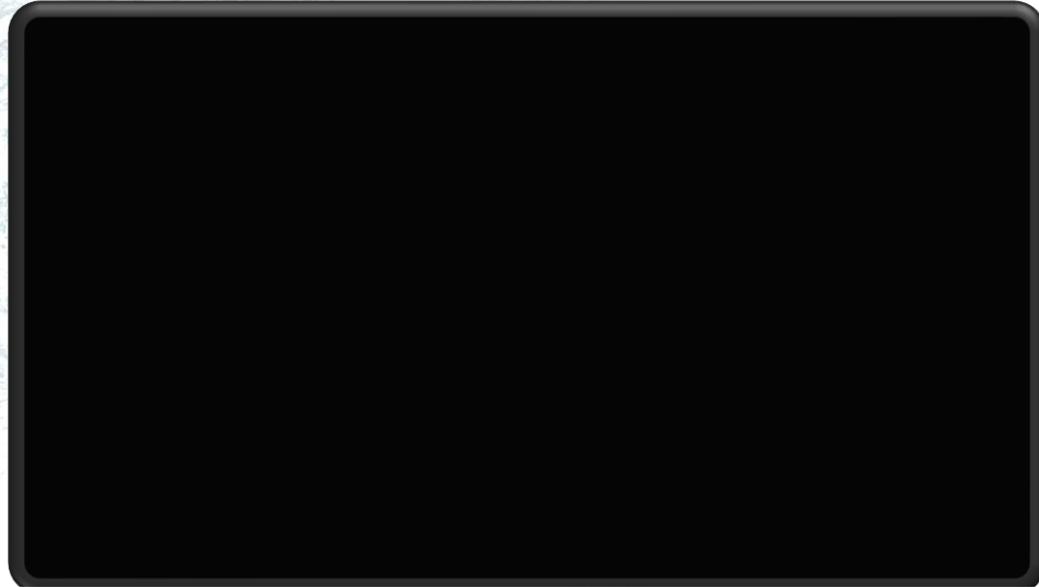
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For Presentation at 2019
Illinois Public Works Mutual
Aid Network(IPWAN)



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Public Media Forecast vs. Operational Forecasts



TV Media Weather Forecast

- Ever wonder why the weather news is last on the nightly news?
- **Mainstream Public Media Weather Information**
 - TV & Radio & Free Internet Sites, Crowd Sourced.
 - National Weather Service
 - These are used for daily planning
 - What to wear or bring
 - Timing of plans or cancelling of plans
 - This is useful information. But it's not operational forecasting
- **What is operational forecasting?**
 - Relevant forecast information for weather critical operations.

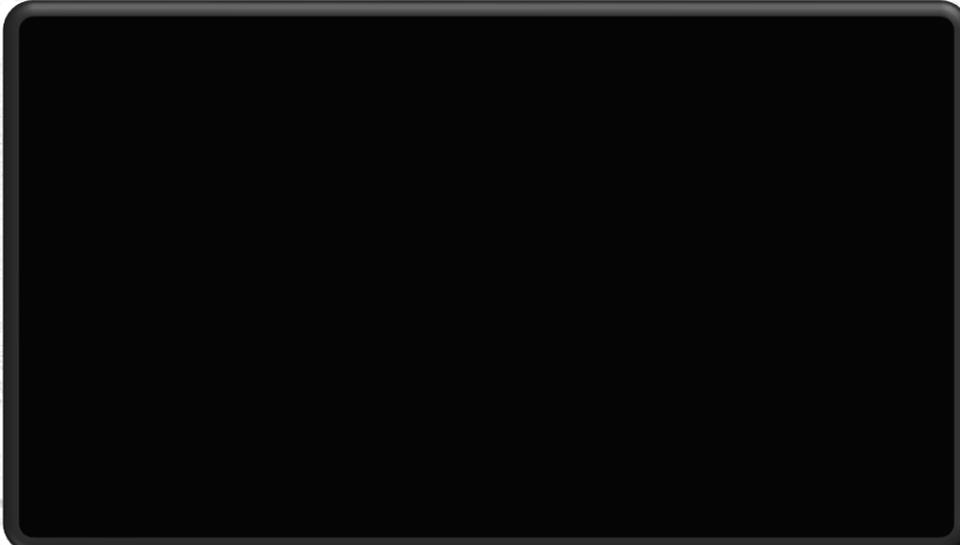
Weather Critical Operations



- **What are Weather Critical Operations?**
 - Critical operations of an organization that can be impacted by weather (business, schools, airports, roads, farms etc.)
 - Can a plane land safely?
 - Can an ambulance get to a hospital?
 - Can people get to work
 - Can children get to school safely
 - Can products get to people (economy)
 - Is there enough wind to produce energy
 - Operational tasks necessary to mitigate the impact of weather on those operations.
 - Snow removal
 - Ice prevention
 - Safe efficient chemical usage
- Surface transportation winter maintenance professionals, who's role it is to remove snow and ice from roads and sidewalks and runways exercise weather critical operations.
- **So we need operational specific forecasting**



Operational Forecasting



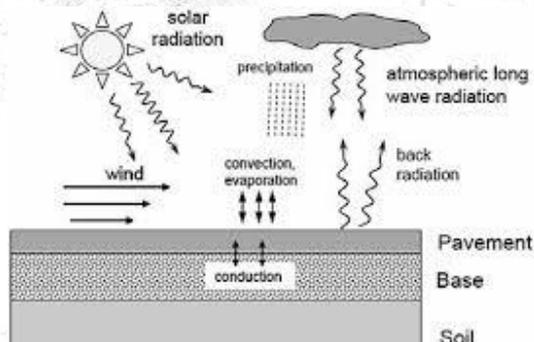
(Snow/Ice Fighting Example)

- **What is Operational forecasting**
 - Forecasts that have a specific objective of providing weather critical operators the information they need to effectively do their job of mitigating the impact weather has on their area of responsibility. Roads, Schools, Businesses, Hospitals, etc...
 - Two-way Forecast Discussion
- **Specific Operational Forecast Elements**
 - Pavement temperature forecast
 - Precipitation type and timing
 - Black ice condition forecast
 - Hazardous high wind forecast
 - Diminished visibility forecast
 - Spray Outlook (summer forecast)
 - Operational Consultation Forecasting
 - Real-Time Condition and Forecast Alerting

Pavement Temperature Forecast

Probably the most critical winter maintenance decision support data set.

- How is a forecast created?
 - Current Observation Data
 - Radar
 - Wind Speed
 - Barometric Pressure /Fronts
 - Air Temperature /Relative Humidity
 - Humidity
 - Other Data (Earths rotation, gulf stream, water cycles, etc.)
 - NWPM (Numerical weather prediction models are computer simulations of the atmosphere.)
 - Output of the model provides the basis for the forecast.
- Pavement Temperature Forecast Models
 - METRo, Model of the Environment and Temperature of Roads
 - FAAST, Fast All-season Soil Strength
 - SNTHERM, Snow Thermal Model
- Data that is part of the model
 - Current Pavement Temperature
 - Subsurface Temperature
 - Solar Radiation
 - Air Temp/ Relative Humidity
 - Wind Speed
 - Precipitation Amount/Type



- New Model Technologies
 - Smart Models (Machine Learning)
 - Adjust given storm type and timing
 - Weighted models give specific conditions
 - Continued research to improve accuracy

Pavement Temperature Forecast

- Forecasts are specific to your operational tactics.
 - Pretreating
 - Type of Chemical
 - Deployment Rates

LOCAL FORECAST | HISTORICAL WEATHER

Summary | Daily | Hourly | Graphs

MONARCH PASS, CO (KMYP) Change Station Print

Hour (Mountain Standard Time)	Fri 4 AM	Fri 5 AM	Fri 6 AM	Fri 7 AM	Fri 8 AM	Fri 9 AM	Fri 10 AM	Fri 11 AM	Fri 12 PM	Fri 1 PM	Fri 2 PM	Fri 3 PM	Fri 4 PM	Fri 5 PM	Fri 6 PM
Weather Condition															
Weather	Partly Cloudy	Mostly Cloudy	Mostly Cloudy	Mostly Cloudy	Flurries Possible	Flurries Possible	Snow Possible	Snow Possible	Snow Possible	Snow Possible	Snow Possible				
Temperature (°F)	15	15	15	15	16	18	22	24	26	26	26	26	25	22	20
Feels Like (°F)	0	1	2	1	3	5	9	11	14	14	14	14	12	8	6
Wind Direction	SW	SW	SW	SW	SW	SW	SSW	SSW	SSW	S	S	S	SSW	SSW	SSW
Wind Speed/Gusts (mph)	14 G 24	12 G 20	11	12 G 20	11	12 G 20	14 G 24	15 G 25	15 G 25	14 G 24	14 G 24	14 G 24	16 G 27	16 G 27	15 G 25
Dew Point (°F)	4	4	4	4	1	2	2	2	3	3	3	3	4	5	6
Humidity (%)	61	61	61	61	51	49	42	38	37	37	37	37	40	48	54
Precipitation Chance (%)	-	-	-	-	-	-	-	-	20	20	26	32	39	46	43
Precipitation Type	-	-	-	-	-	-	-	-	NRM	NRM	NRM	NRM	NRM	NRM	NRM
Precip Amount (Rain:in., Snow:in.)	None	S:<1/4	S:<1/4	S:<1/4	S:<1/4	S:<1/4	S:<1/4	S:<1/4							
24 Hr Snow/Ice Accum (in.)(08AM-08AM)	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-
Snow Depth on Road (in.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	
Blowing Snow Potential	0	0	0	0	0	0	0	0	0	0	27	26	25	28	
Chemical Concentration (%)	22	21	21	21	26	30	35	38	40	38	36	34	32	29	27
Bridge Temp (°F)	21	20	20	20	25	32	36	40	43	38	37	35	32	29	25
Road Temp (°F)	21	20	20	20	25	32	36	40	43	38	37	35	32	29	25
Pavement Condition															
Condition	Dry	Wet	Wet	Chem Wet	Chem Wet	Chem Wet	Chem Wet	Chem Wet							
Bridge Frost Likely?	No	No	No	No	No	No	No								
Road Frost Likely?	No	No	No	No	No	No	No								
Treatment Recommendation	-	-	-	-	-	-	-	-	-	Pre-wet NAACL 100 lb/in.-mi	-	-	-	-	Pre-wet NAACL 100 lb/in.-mi

LOCAL FORECAST | HISTORICAL WEATHER

Summary | Daily | Hourly | Graphs

Light Snow Storm with periods of Heavier Snow (25°F to 32°F, remaining in range) - Cycle Time: 3 hours

MA CHESHIRE RT 8, MA (MX6403) - Tue 12/12/17 9 AM

Initial Operations				Subsequent Operations				
Initial Pavement Surface Conditions	Maintenance Action	Dry Chemical Spread Rate kg/lane-km (lb/lane-mi)		Maintenance Action	Dry Chemical Spread Rate kg/lane-km (lb/lane-mi)		Light heavier snow	light pretwetted solid
		Liquid	Solid or pretwetted solid		Liquid	Solid or pretwetted solid		
		28 (100)	28 (100)		28 (100)	55 (200)		
Dry	Apply liquid or pretwetted solid chemical	28 (100)	28 (100)	Plow as needed; reapply liquid or solid chemical when needed	28 (100)	55 (200)	28 (100)	55 (200)
Wet, slush, or light snow cover	Apply liquid or solid chemical	28 (100)	28 (100)	Plow as needed; reapply liquid or solid chemical when needed	28 (100)	55 (200)	28 (100)	55 (200)

Comments

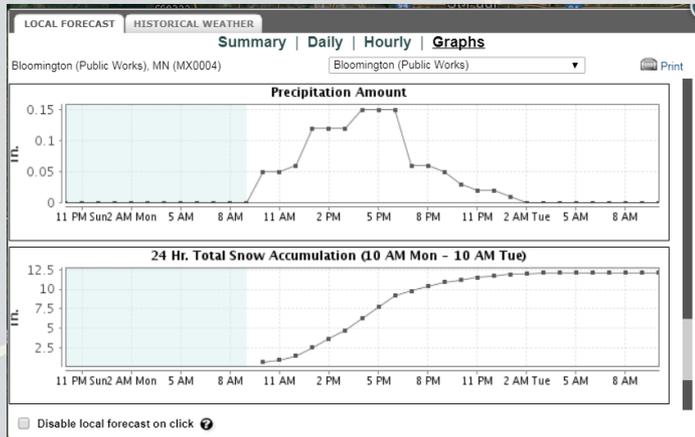
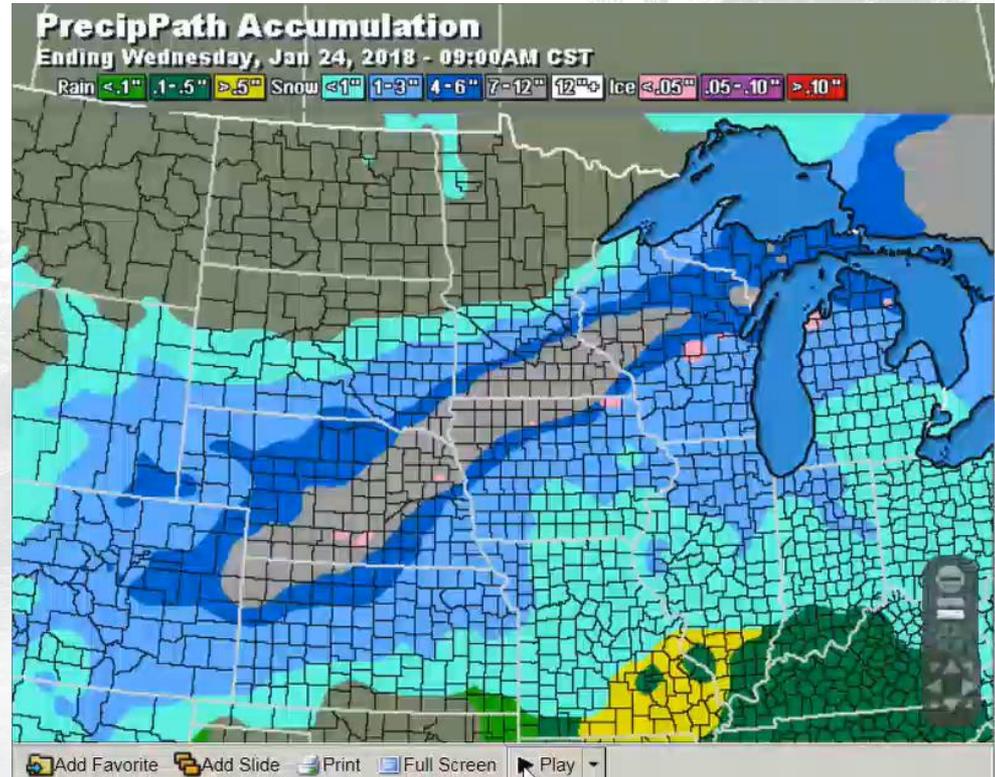
- Applications will need to be more frequent at lower temperatures and higher snowfall rates.
- Do not apply liquid chemical onto heavy snow accumulation or packed snow.
- After heavier snow periods and during light snow fall, reduce chemical rate to 28 kg/lane-km (100 lb/lane-mi); continue to plow and apply chemicals as needed.

[Return to Hourly Forecast](#)

Disable local forecast on click

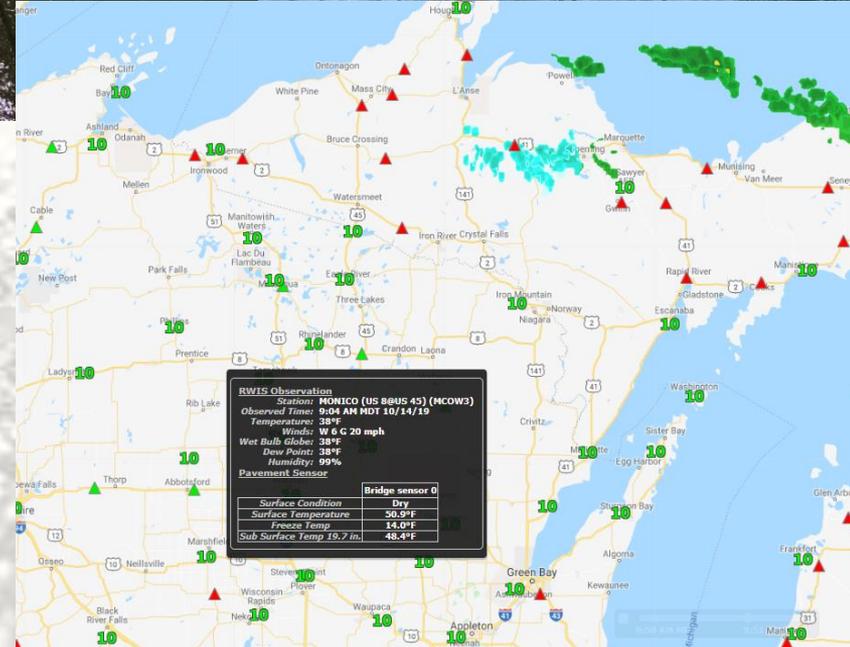
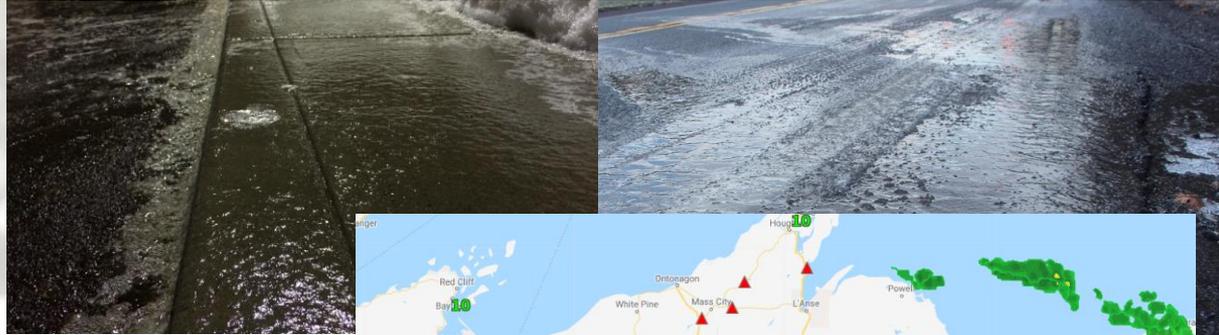
Precipitation Type Timing for Operations

- Precipitation type by location and by time.
- Operations decision support, pretreat?
- Pretreating timing decision support.
- Staffing timing decision support.
- Operations decision support, pretreat?



Black Ice Condition Warnings

- What is Black Ice?
 - Ice formed in a specific way?
 - Ice you can't see.
- How can Black Ice form
 - Frost
 - Freeze Thaw cycle
 - Freezing Fog
 - Ice Storm



What is Dew Point?

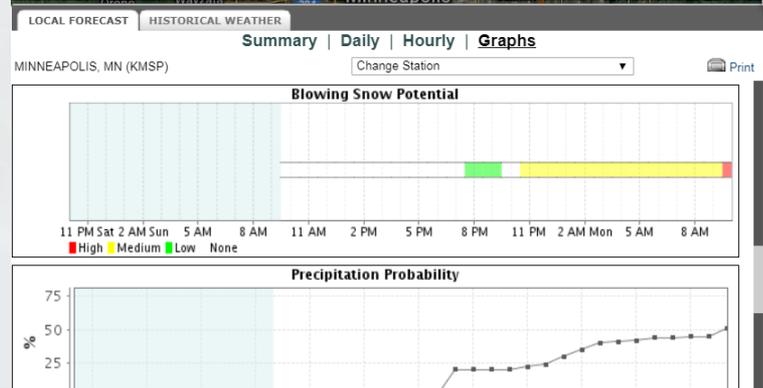
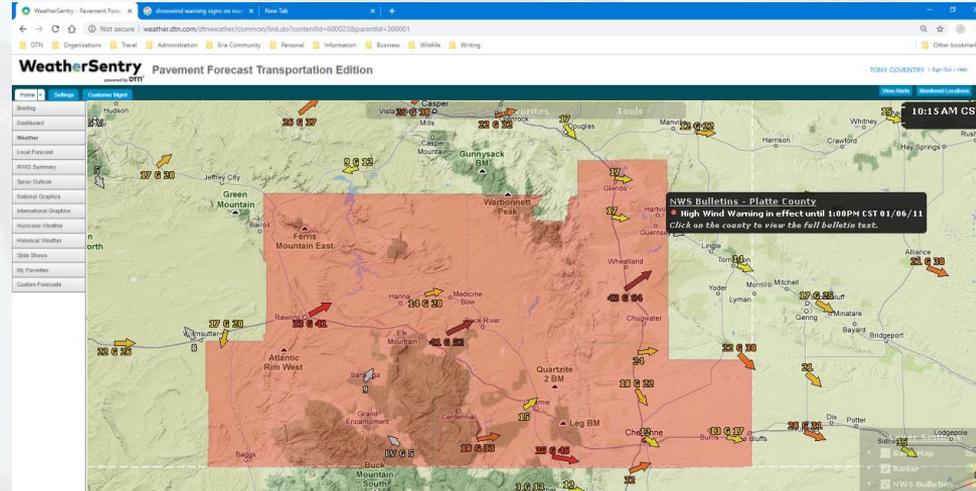
- The temperature at which moisture in the air condenses into the form of water.
- If that temperature is below freezing you get frost.

What's the Maintenance Decision?



High Wind Forecast

- Wind forecast analytics
- Blowing Snow
- Road Closures and Warnings

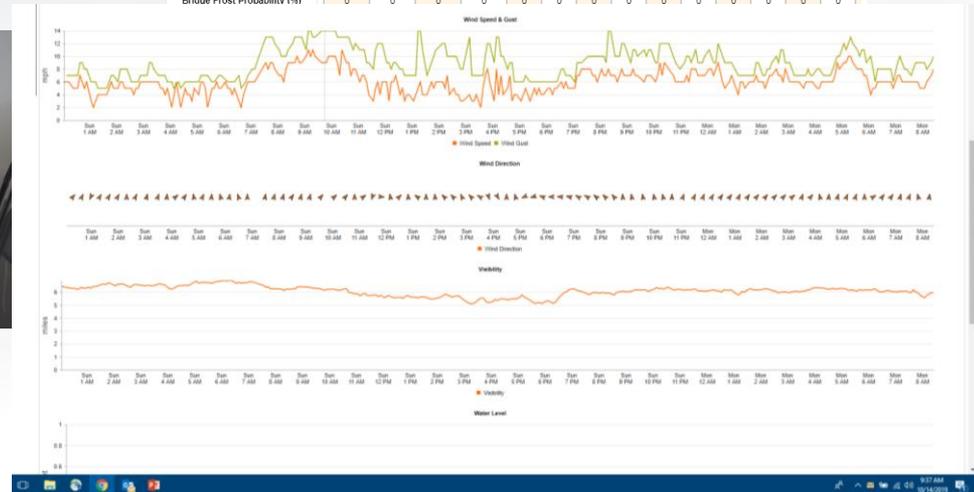


Visibility Warnings

- Visibility can be affected by many things
 - Fog
 - Toule Fog
 - Marine Layer Fog
 - Industrial Fog
 - Smoke
 - Sandstorm
 - Blowing Snow
- Alerting Motorists via ITS

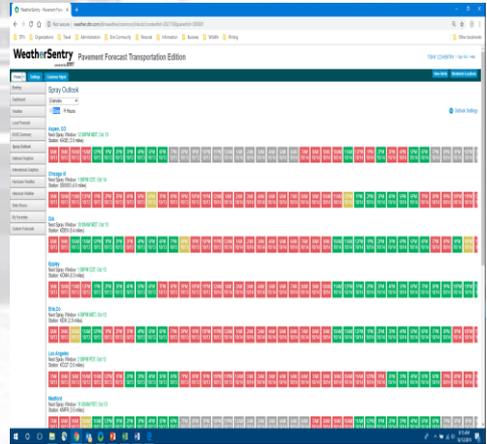
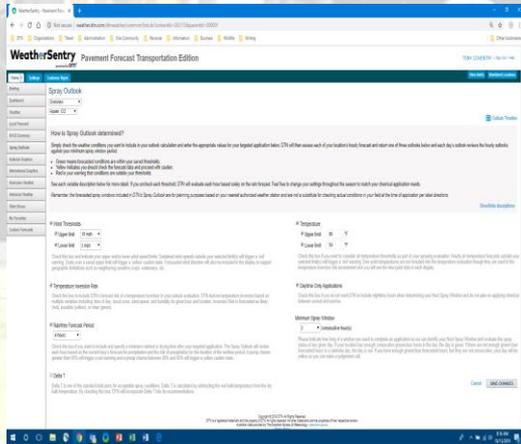
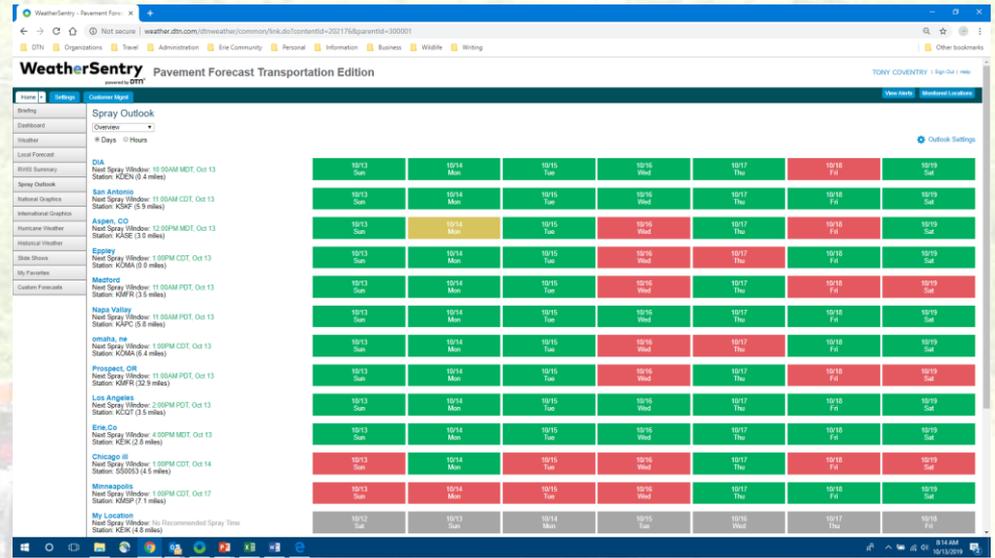


Precipitation Type	None	Light	Medium	Heavy	Very Heavy	Trace	None								
24 Hr Snowfall Accum (in.) (1 PM - 1 PM)	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blowing Snow Potential	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
Bridge Frost Probability (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Spray Outlook

- Forecast analytics provides optimum spray timing decision support.
 - Winter pretreating
 - Summer herbicidal spraying
 - Painting
 - Other maintenance decisions
- Completely customizable parameters.
- Originally designed for agriculture but research adapted for transportation.



Operational Forecast Consultation

- 24/7/365 Operational Forecast Discussion
 - Forecast Confidence
 - Timing
 - PrecipType
 - Pavement Temperature
 - Forecasts change over time
 - Site specific discussion
- And, you just aren't going to find that level of attention to detail from NWS, Media, on-line sources.
- My Personal Hint about Weather Forecasting.
 - Trends are a good gut check
 - There won't be big changes forecasted.



How consistent have the forecasts been regarding next week's freezing rain storm?

What is your confidence in the 3-6" of snow in District 10 on Friday?

Is the severe weather moving across Western Mass still expected by 6am here in Boston?

U.S. RADAR LOCAL RADAR 4:58 PM CST

24 HOUR PRECIPITATION HIGH IMPACT WEATHER

Comments (33)

LUSHING, NY: Good afternoon! Snow is expected to move into the area around midnight-1am tonight and linger through about 8am. The heaviest snow looks to move through from 3-6am. Temperatures will be around 30-31° throughout this event, so most of the snow that will arrive will be fairly wet in nature. Total accumulated snowfall tomorrow morning: 0.50-1.50". After 8am, the rest of the day looks dry with a high around 36°. Thanks for the question!
Posted by Nick Lester at 3:01 PM CST 12/13/17

BRIDGEPORT, CT: Good afternoon! We expect the snow to start in your area tonight around 1-2am and linger through 10am tomorrow morning. The heaviest bands of snow look like they will pass through from about 3-6am, which is where most of your accumulations will occur. Chance of snow: 60%. Total snow accumulation: 1-2", thanks for the question!
Posted by Nick Lester at 2:49 PM CST 12/13/17

3FK - Good afternoon. Windy conditions will likely continue through 11pm/12am. Highest winds will be over the next few hours, with sustained speeds in the 18-20 mph range and gusts of 30-38 mph. By 7am, sustained winds will likely be less than 20 mph with gusts of 28-

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Questions?

Thank You

For Presentation at 2019 Illinois
Public Works Mutual Aid
Network(IPWAN)



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