

Operational Forecasting

Weather Critical ITS Series

DTn^o

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.

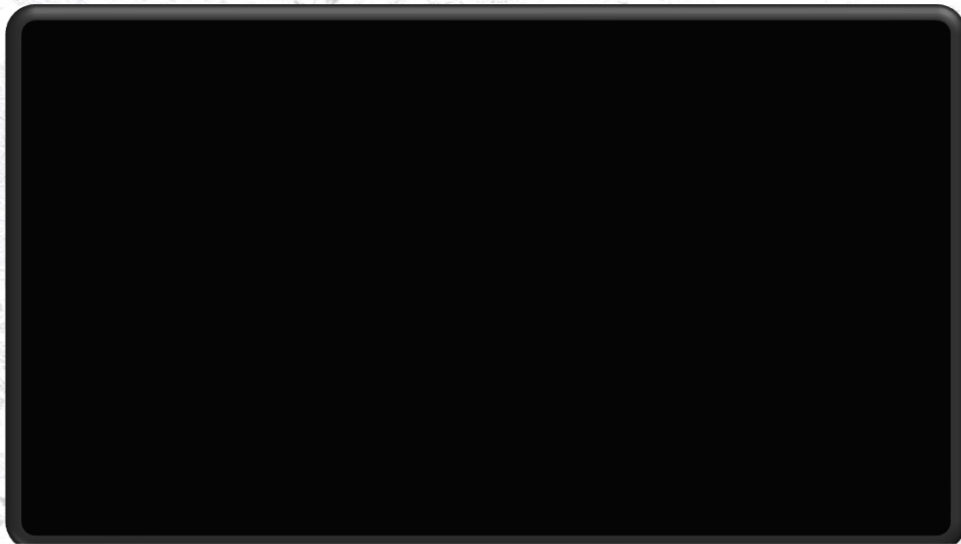
Weather Critical Operations



- **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



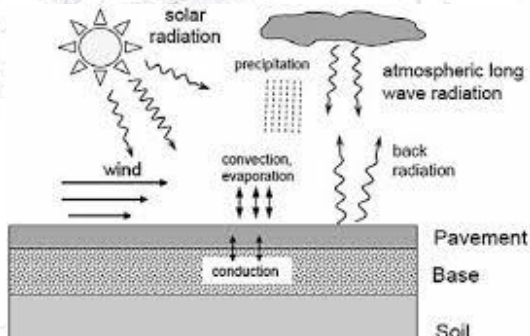
(Snow/Ice Fighting Example)

- **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

Print

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) | |
| | | Liquid | Solid or pretwetted solid | | Liquid | Solid or pretwetted solid |
| 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) |
| 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) |

Comments

1. Applications will need to be more frequent at lower temperatures and higher snowfall rates.
 2. Do not apply liquid chemical onto heavy snow accumulation or packed snow.
 3. 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

LOCAL FORECAST

HISTORICAL WEATHER

Summary | Daily | Hourly | Graphs

Change Station

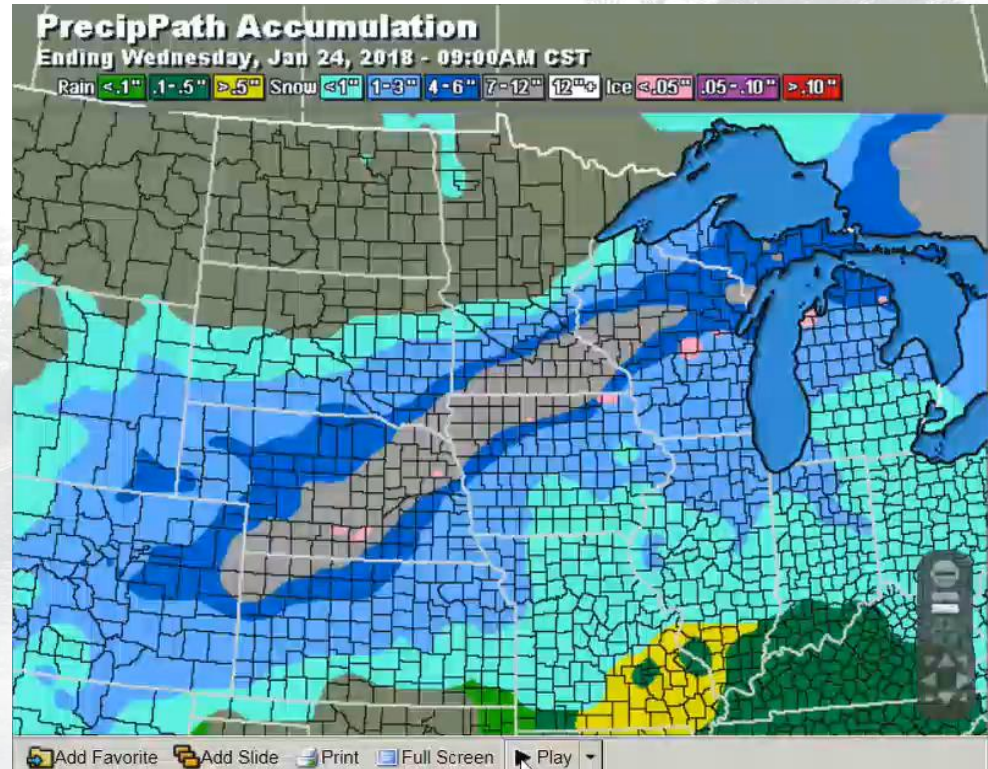
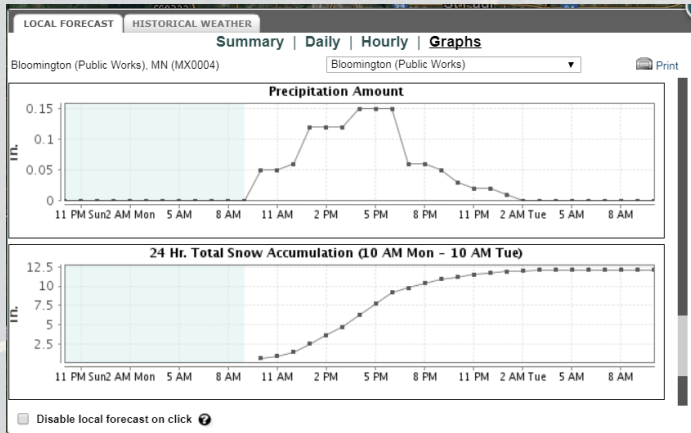
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MONARCH PASS, CO (KMYP)

| 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 | Partly Cloudy | Partly Cloudy | Partly Cloudy | 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 | 28 | 28 | 26 | 25 | 22 | 20 |
| Feels Like (°F) | 0 | 1 | 2 | 1 | 3 | 5 | 9 | 11 | 14 | 14 | 14 | 12 | 8 | 6 | 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 G 20 | 11 G 20 | 11 G 20 | 12 G 20 | 14 G 24 | 15 G 25 | 15 G 25 | 14 G 24 | 14 G 24 | 16 G 27 | 16 G 27 | 15 G 25 | 15 G 25 |
| Dew Point (°F) | 4 | 4 | 4 | 4 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 6 |
| Humidity (%) | 61 | 61 | 61 | 61 | 51 | 49 | 42 | 38 | 37 | 37 | 37 | 40 | 48 | 54 | 54 |
| Precipitation Chance (%) | - | - | - | - | - | - | - | - | 20 | 20 | 26 | 32 | 39 | 46 | 43 |
| Precipitation Type | - | - | - | - | - | - | - | - | NRM Snow | NRM Snow | NRM Snow | NRM Snow | NRM Snow | NRM Snow | NRM Snow |
| Precip Amount (Rain:in., Snow:in.) | None | None | None | None | None | None | None | None | S: <1/4 Trace | S: <1/4 Trace | S: <1/4 L: 0.01 | S: <1/4 Trace | S: <1/4 L: 0.01 | S: <1/4 L: 0.01 | S: <1/4 Trace |
| 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 | 0.10 | 0.00 |
| Blowing Snow Potential | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Chemical Concentration (%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 26 | 26 | 25 | 28 | 28 |
| Bridge Temp (°F) | 22 | 21 | 21 | 21 | 26 | 30 | 35 | 38 | 40 | 38 | 36 | 34 | 32 | 29 | 27 |
| Road Temp (°F) | 21 | 20 | 20 | 20 | 25 | 32 | 36 | 40 | 43 | 38 | 37 | 35 | 32 | 29 | 25 |
| Pavement Condition | | | | | | | | | | | | | | | |
| Condition | Dry | Dry | Dry | Dry | Dry | Dry | Dry | Dry | Wet | Wet | Chem Wet | Chem Wet | Chem Wet | Chem Wet | Chem Wet |
| Bridge Frost Likely? | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No |
| Road Frost Likely? | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No |
| Treatment Recommendation | - | - | - | - | - | - | - | - | - | Pre-wet NACL 100 lb/in-mi | - | - | - | - | Pre-wet NACL 100 lb/in-mi |

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

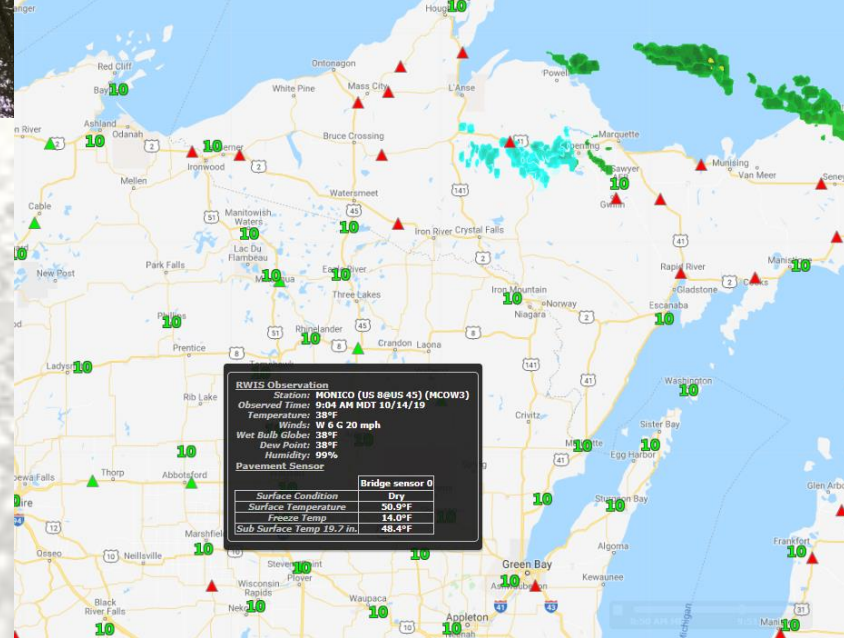
- What is Black Ice?
 - Ice formed in a specific way?
 - Ice you can't see.
- How can Black Ice form
 - Frost
 - Freeze Thaw cycle
 - Freezing Fog
 - Ice Storm



What is Dew Point?

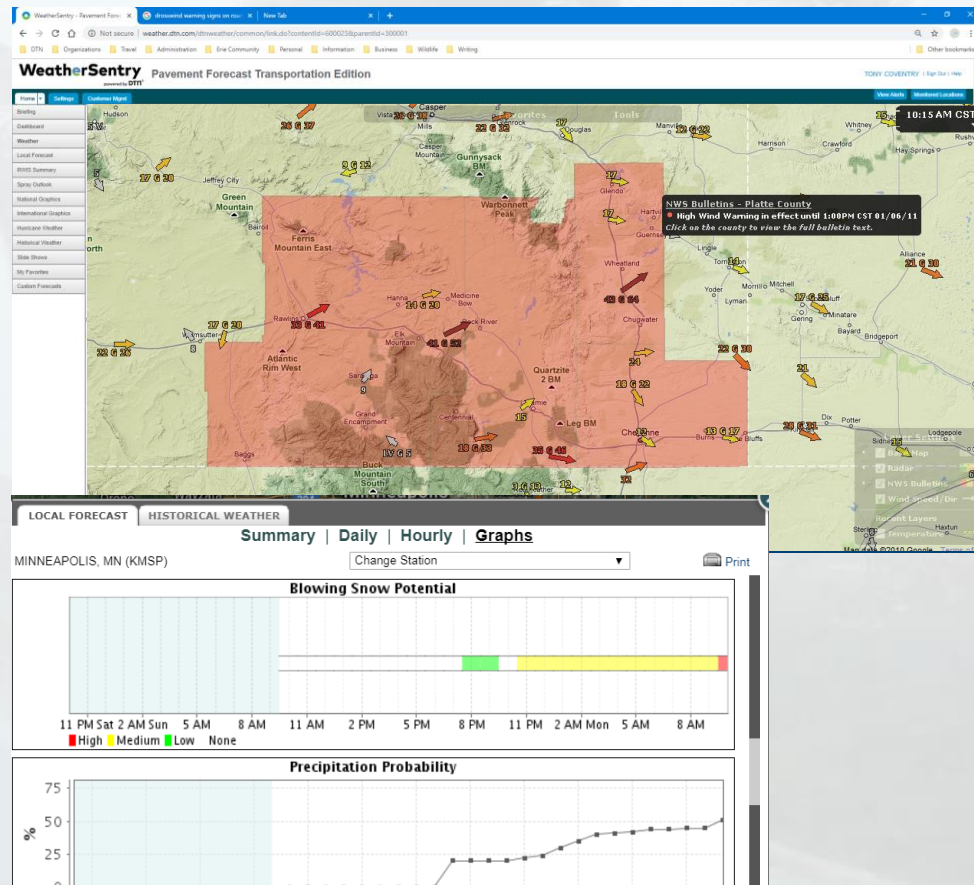
- The temperature at which moisture in the air condenses into the form of water.
- If that temperature is below freezing you get frost.

What's the Maintenance Decision?



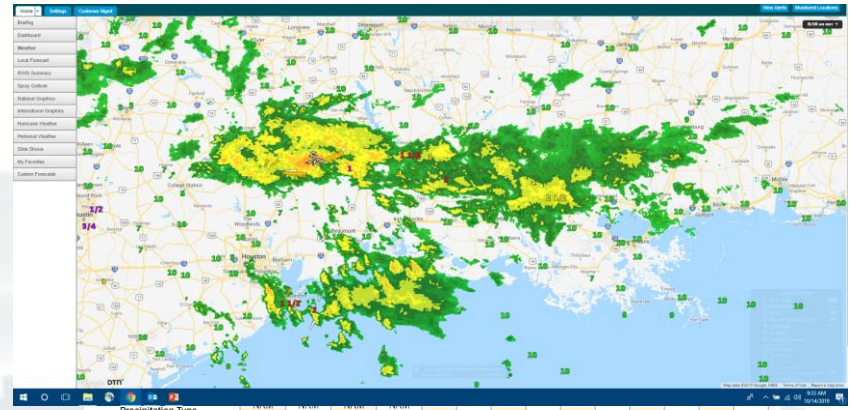
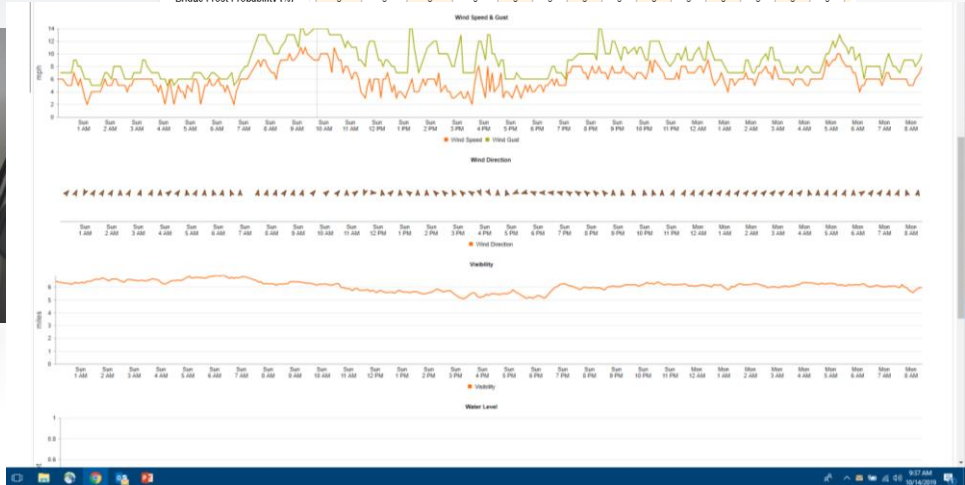
High Wind Forecast

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



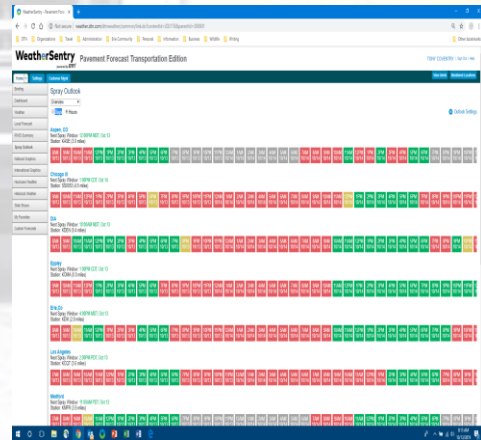
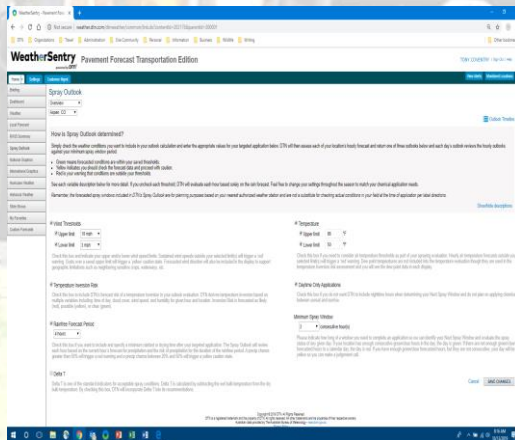
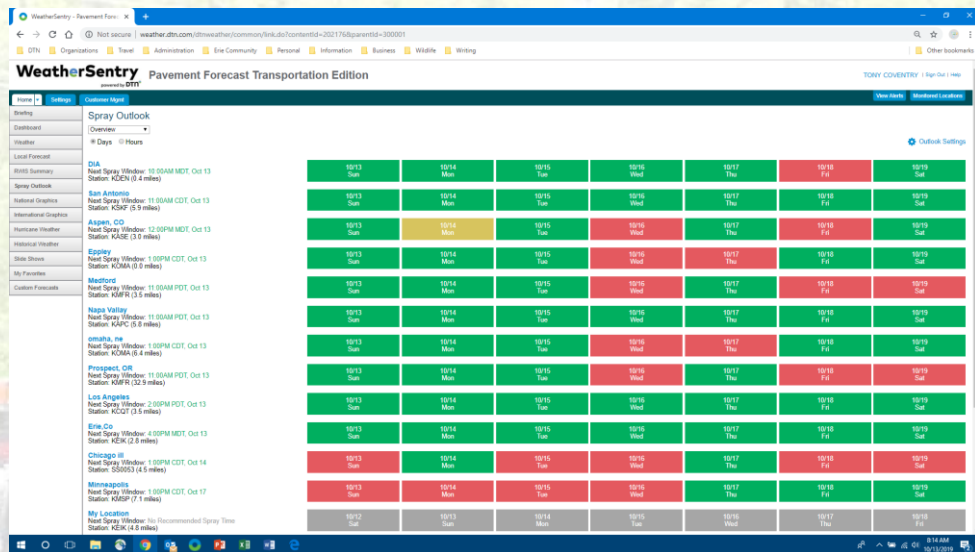
Visibility Warnings

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

[illegible]

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

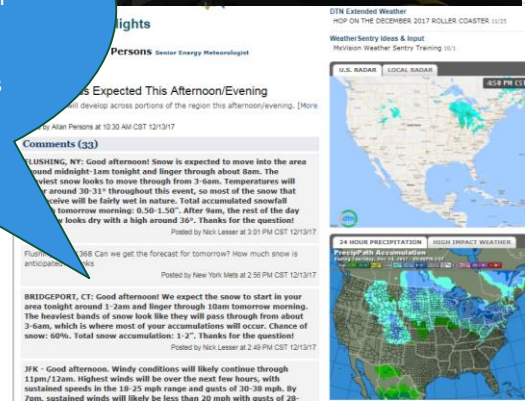
- 24/7/365 Operational Forecast Discussion
 - Forecast Confidence
 - Timing
 - PrecipType
 - Pavement Temperature
 - Forecasts change over time
 - Site specific discussion
- And, you just aren't going to find that level of attention to detail from NWS, Media, on-line sources.
- My Personal Hint about 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?



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Questions?

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Thank You

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