



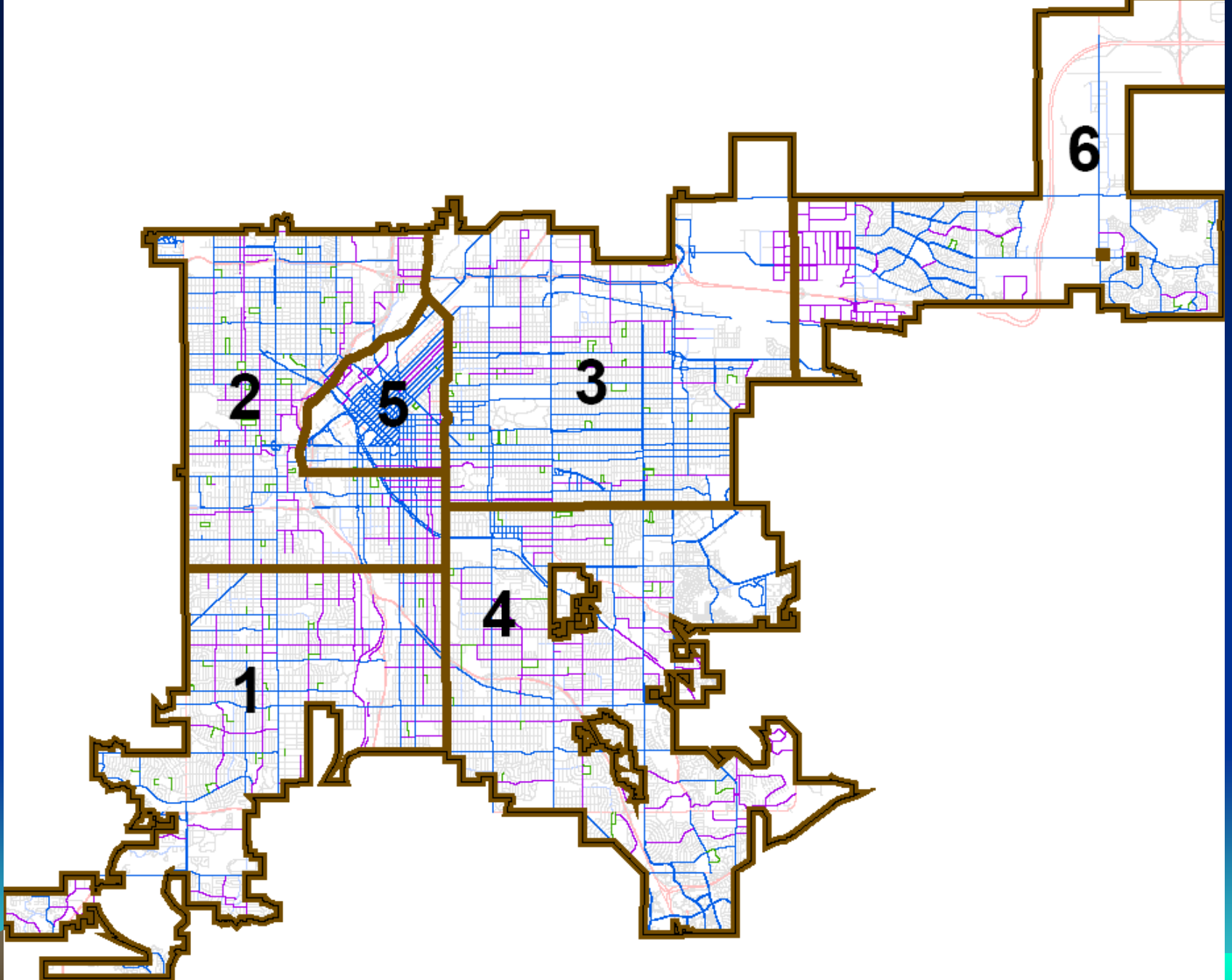
City & County of Denver MDSS Case Study

**6th Clarus ICC/10th MDSS Meeting
Aug 4-7, 2008 Reno, NV**

Pat Kennedy, PE Denver Public Works

MDSS Acquisition

- **Denver joined Clarus Initiative and MDSS Stakeholders in 2005**
- **Saw value of improved forecasting along Front Range**
- **Tested in 2005/2006**
- **Entered contractual arrangement with NCAR/UCAR in 2006**



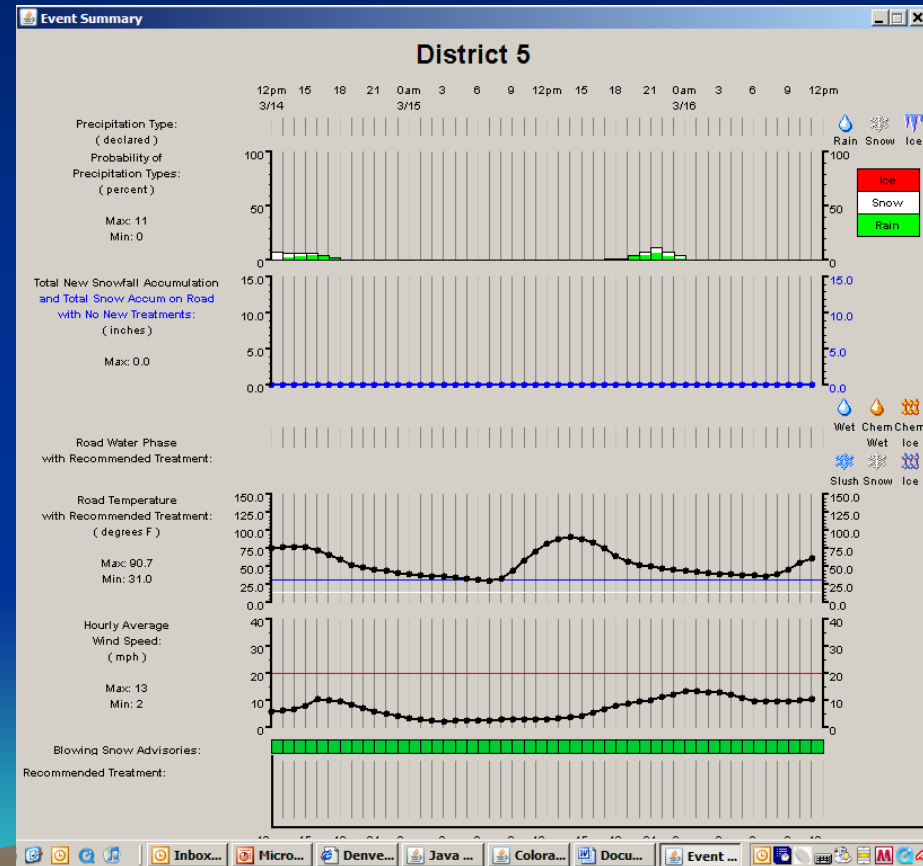
Equipment

- 68 Tandem mounted plows
- Mix of liquid and dry distributors
 - Ice Slicer dry MgCl
 - Apex liquid MgCl
- 100+ light plows for residential streets



March 16, 2008

- Snow meeting Friday 3-14
- Crews on standby
- Too early for MDSS



3-15-08 20:00

Forecaster	Start	End	High	Low	High	Low	Precip	Precip Type	Accumulation
			3-16	3-16/17	3-17				
MDSS	Sunday late	Monday evening	45°	33°	39°		100%	snow	4"
AccuWeather	Sunday late	Monday night	40°	26°	42°			snow	4"-8"
Weather.com	Sunday evening	Monday evening	47°	32°	37°		70%	rain/snow	1"-2"
Channel 2	Sunday afternoon	Monday evening	49°	28°	36°	28°		snow	"enough to shovel"
Channel 4	Sunday afternoon	Monday night	51°	25°	40°	27°		rain/snow	up to 7"
Channel 7	Sunday afternoon	Tuesday early	50°	29°	38°	24°		snow	4"-8"
Channel 9	Sunday evening	Monday evening	49°	30°	38°	25°		rain/snow	up to 8"
Channel 31	Sunday afternoon	Monday evening	50°	28°	20°	25°		rain/snow	

Selected Maintenance Area:

City of Denver

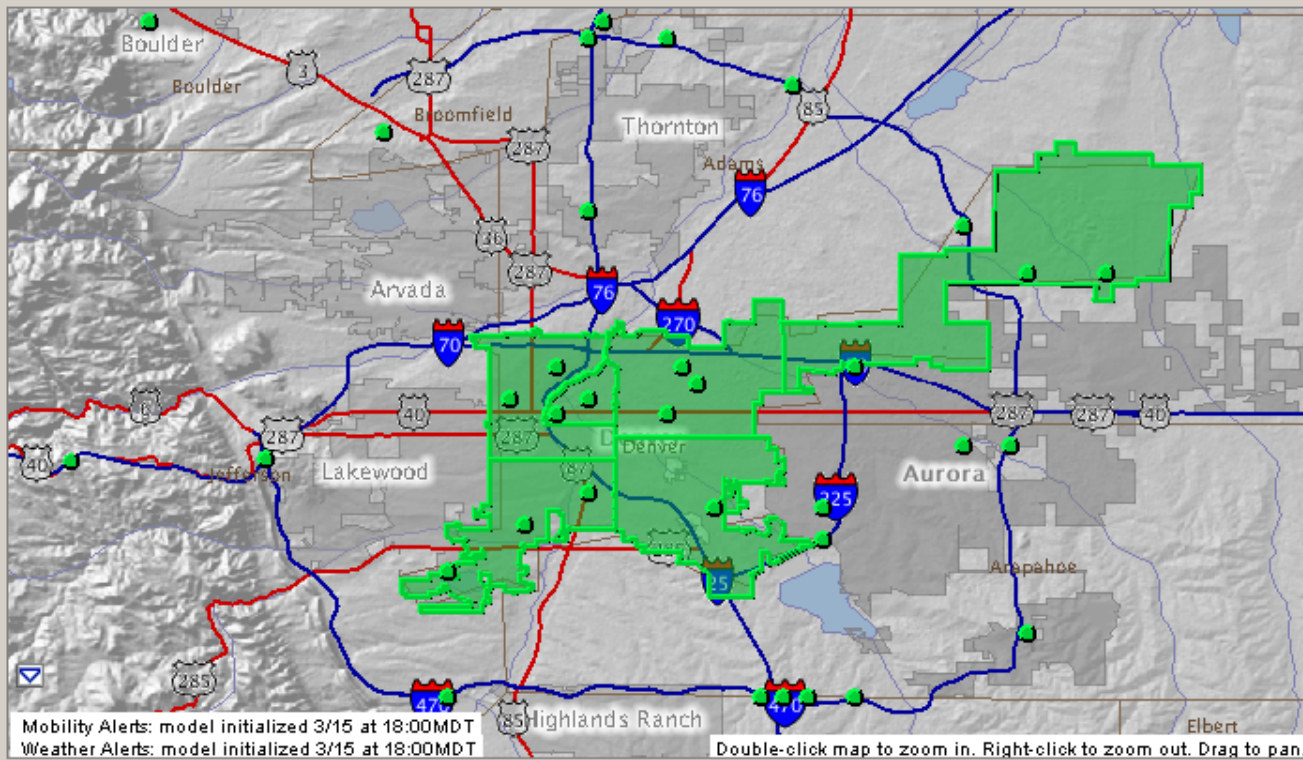
City of Denver Alerts:

	0-12 Hrs	12-24 Hrs	24-48 Hrs
Weather	Green	Green	Red
Road	Green	Green	Yellow
Blowing SN	Green	Green	Yellow
Bridge Frost	Green	Green	Green

	18 Sat 3/15	6 Sun 3/16	18	6 Mon 3/17	18
No Frozen Precipitation Observed	Green Up Arrow			Green Up Arrow	
Road(s) > 32°F					

Map Products:

- State Zone Alerts: None
- Weather Forecasts: Weather Alerts
- Road Forecasts: Mobility Alerts
- Point Observations: None
- Area Observations: None



Selected Plow Route:

District 5

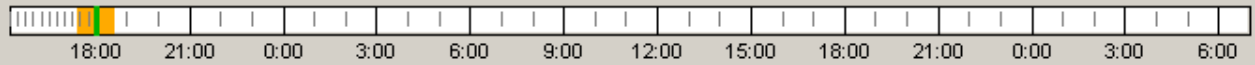
- Event Summary...
- Forecast History...
- Treatment History...
- Treatment Selector...

Blowing Snow Alerts:
Bridge Frost Alerts:
Current Treatment:



Selected Time and Animation:

Observations Only Forecast Only GO

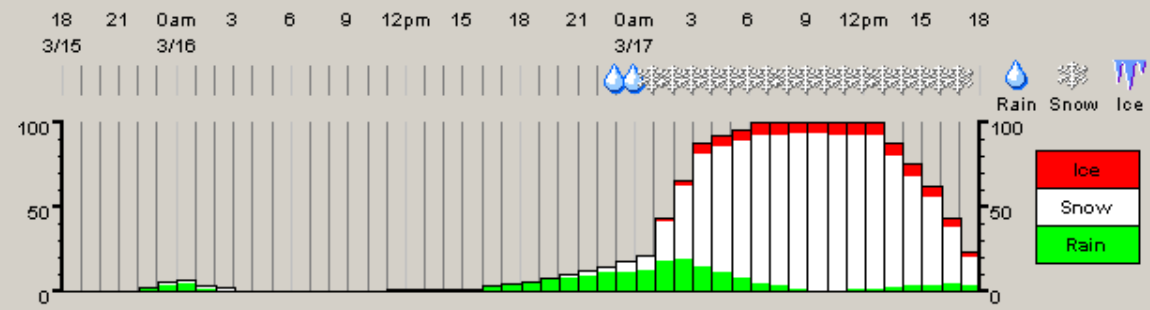


District 5

Precipitation Type:
(declared)

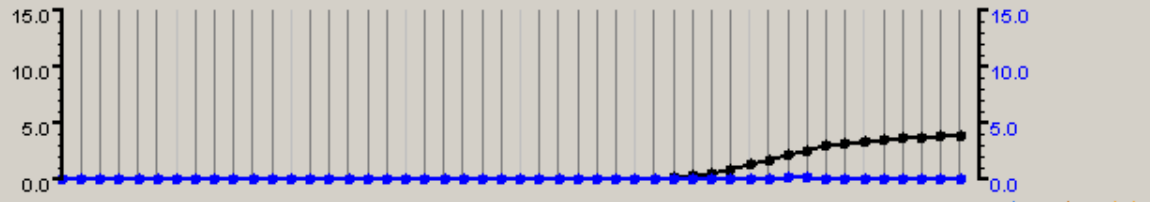
Probability of
Precipitation Types:
(percent)

Max: 100
Min: 0



Total New Snowfall Accumulation
and Total Snow Accum on Road
with No New Treatments:
(inches)

Max: 3.89

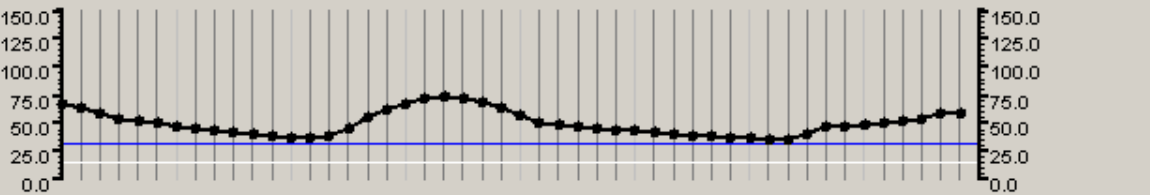


Road Water Phase
with Recommended Treatment:



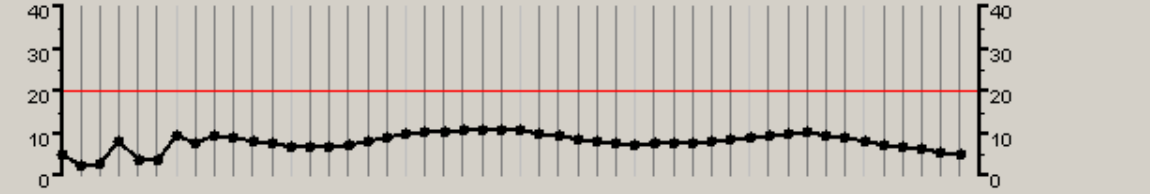
Road Temperature
with Recommended Treatment:
(degrees F)

Max: 73.6
Min: 36.0

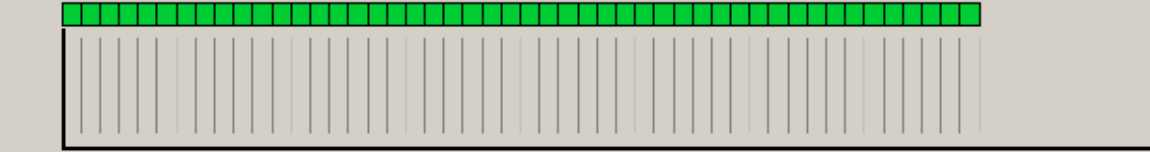


Hourly Average
Wind Speed:
(mph)

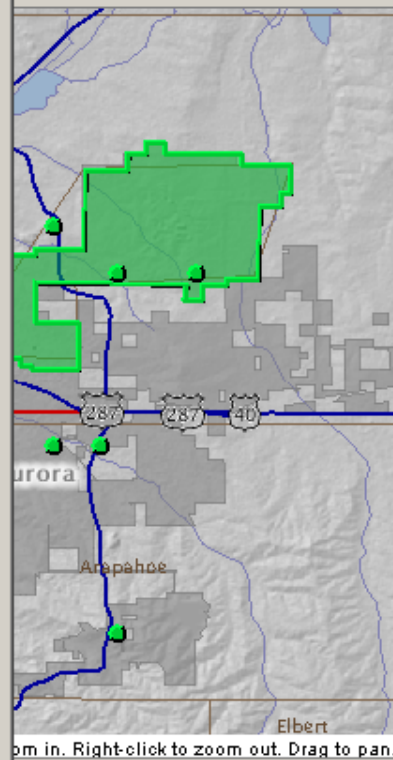
Max: 11
Min: 3



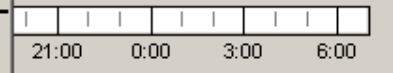
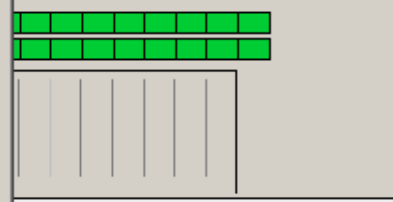
Blowing Snow Advisories:
Recommended Treatment:



Extreme



om in. Right-click to zoom out. Drag to pan.



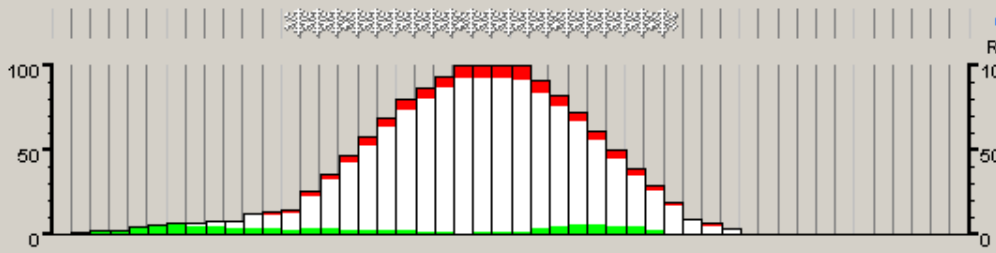
3-16-08 14:00

Forecaster	Start	End	High	Low	High	Low	Precip Proba bility	Precip Type	Accumulation
MDSS	Sunday midnight	Monday late	45°	31°	36°	29°	100%	snow	3"-4"
AccuWeather	Sunday evening	Monday afternoon	45°	23°	37°	25°	75%	rain/snow	5"-10"
Weather.com	Sunday evening	Monday evening	47°	32°	26°	37°	100%	rain/snow	4"-8"
Channel 2	Sunday afternoon	Monday evening	49°	28°	36°	28°		rain/snow	"enough to shovel"
Channel 4	Sunday evening	Monday evening	50°	26°	35°	23°	85%	rain/snow	5"-10"
Channel 7	Sunday afternoon	Monday evening	50°	27°	35°	22°		rain/snow	4"-8"
Channel 9	Sunday evening	Monday afternoon	49°	28°	38°	21°		rain/snow	5"-10"
Channel 31	Sunday evening	Monday afternoon	50°	28°	40°	25°		rain/snow	

District 5

12pm 15 18 21 0am 3 6 9 12pm 15 18 21 0am 3 6 9 12pm
3/16 3/17 3/18

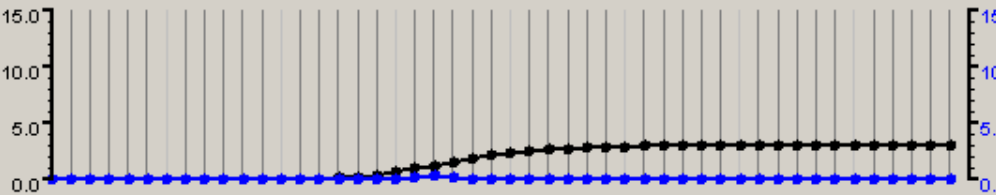
Precipitation Type:
(declared)
Probability of
Precipitation Types:
(percent)
Max: 100
Min: 0



Rain
 Snow
 Ice

Ice
 Snow
 Rain

Total New Snowfall Accumulation
and Total Snow Accum on Road
with No New Treatments:
(inches)
Max: 3.04



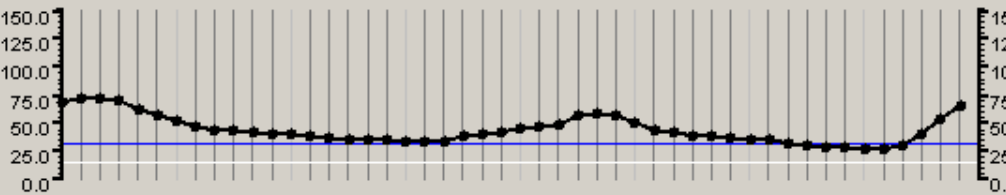
Road Water Phase
with Recommended Treatment:



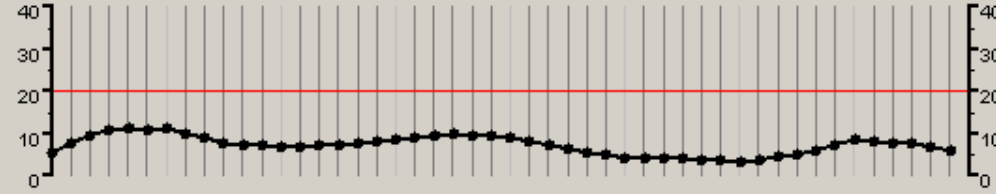
Wet
 Chem
 Wet
 Ice

Slush
 Snow
 Ice

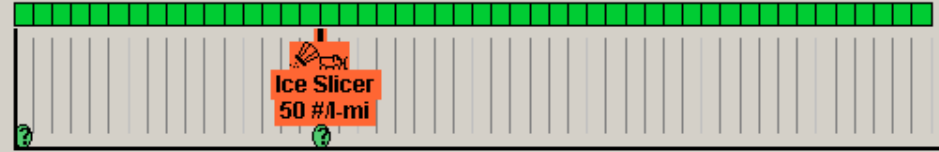
Road Temperature
with Recommended Treatment:
(degrees F)
Max: 72.6
Min: 28.0



Hourly Average
Wind Speed:
(mph)
Max: 12
Min: 3

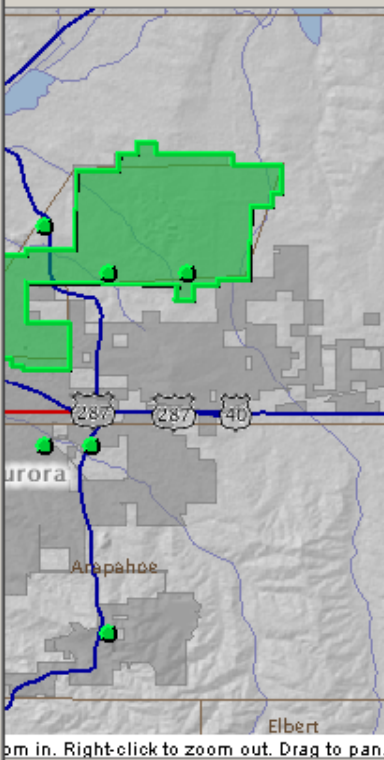


Blowing Snow Advisories:
Recommended Treatment:

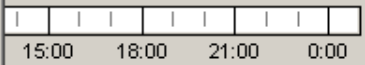


12pm 15 18 21 0am 3 6 9 12pm 15 18 21 0am 3 6 9 12pm
3/16 3/17 3/18

Extreme



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Event

- **Standby Sunday noon shift**
- **Crews deployed Monday midnight shift**
- **Actual accumulation for Denver 2"-4"**
- **Pavement temps at freezing early Monday morning**
- **Other areas received significantly more**

MDSS Contribution

Accurate event prediction resulted in;

–Significant monetary savings

- **one regular shift (\$30k)**

- **no residential deployment (\$135k)**

–Some nervousness

MDSS Utility

- **Strategic**
 - Advance planning
 - Event Timing
 - Pavement Forecast
- **Tactical**
 - Anti-Icing
 - Changing conditions
 - Application rates
 - Expected Mobility
 - Treatment options

Benefits

- **Monetary**
 - Deployment time/options
 - Material use
- **Level of Service**
 - Mobility
 - Prioritization

Why?

- **Public demands**
 - **Mobility**
 - **Safety**
 - **Efficiency**
- **Forecasting**
 - **Accuracy**
 - **Focused**
 - **Tailored**

GARY'S WEATHER FORECASTING STONE



CONDITION
Stone is Wet
Stone is Dry
Shadow on Ground
White on Top
Can't See Stone
Swinging Stone
Stone Jumping Up & Down
Stone Gone

FORECAST
Rain
Not Raining
Sunny
Snowing
Foggy
Windy
Earthquake
Tornado

FLIGHTSEEING