Iowa DOT Winter Maintenance Innovations

2013 Peer Exchange

About Iowa DOT

- 24,000 lane miles
- 901 plow trucks
- 1,100 operators
- 109 garages
- Approx. 140K – 220K tons salt per winter
  - Includes salt for ~16M gallons brine
- ~54 precip days per winter

Recent Focus Areas

- Managing winter operations
  - Salt and Labor Use
  - Shifting to traffic-based performance analysis
  - GPS plow information
- Equipment
  - Salt spreader evaluations
  - Nontraditional RWIS

Tracking Salt and Labor Use

- Use storm type and pavement temps to estimate expected salt use
- Compare Estimates to actual use
- Make dashboards for managers

YTD Winter Operations Statewide Summary

Statewide	Salt Used	197726		675 Hrs Used	237599
	Target Salt	140263		Target 675	232504
	Allocation	131383		All Winter hours	299394
	% Allocation Used	150%	Statewide Salt Use vs. Target	target all hours	279004
District 1	Salt Used	31730		675 Hrs Used	44343
	Target Salt	27044		Target 675	46491
	Allocation	27537		All Winter hours	55889
	% Allocation Used	115%	Salt Use vs. Target	target all hours	55789
District 2	Salt Used	28646		675 Hrs Used	43936
	Target Salt	26146		Target 675	45082
	Allocation	21140			
	% Allocation Used	136%	Salt Use vs. Target		
District 3	Salt Used	23592			
	Target Salt	20607			
	Allocation	20008			
	% Allocation Used	118%	Salt Use vs. Target		
District 4	Salt Used	43150			
	Target Salt	18557			
	Allocation	15905			
	% Allocation Used	271%	Salt Use vs. Target		
District 5	Salt Used	24370			
	Target Salt	19001			
	Allocation	19405			
	% Allocation Used	126%	Salt Use vs. Target		
District 6	Salt Used	46239			
	Target Salt	28909			
	Allocation	27388			
	% Allocation Used	169%	Salt Use vs. Target		

Color Legend	<90% of Target
	90%-100% of Target
	Over Target

Payperiod Summary | YTD Summary | Garage da

Last Peer Exchange you saw the first version made with Excel spreadsheets

Example Winter Operations District Report

Select District: 3

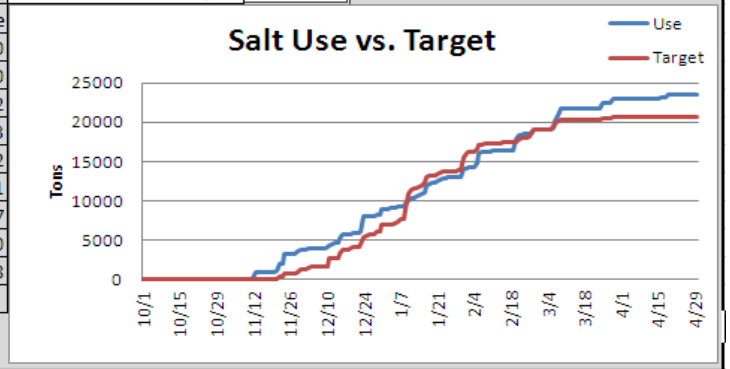
Select Graph: Salt

YTD Salt Use: 23591.7
YTD Target Use: 20606.9
% of Target: 114.5%
Allocation: 20007.8
% of Allocation Used: 117.9%

YTD 675 Hours: 37296.3
YTD Target 675 Hrs: 36757.3
% of Target: 101.5%

YTD Winter Hours: 48113.4
YTD Target Hrs: 44108.8
% of Target: 109.1%

Weather Summary for the Year To Date	
Weather Index	28.0
Salt Index	203.0
Mobility Index	1.2
Normal Time A	11.3
Wheel Time A	11.2
Normal Time B	10.1
Wheel Time B	8.7
Normal Time C	10.0
Wheel Time C	9.8
Data Timliness	



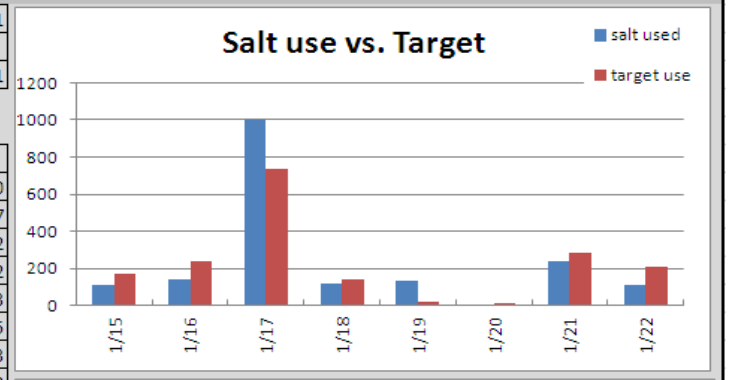
select start date: 1/15/2011
select end date: 1/22/2011

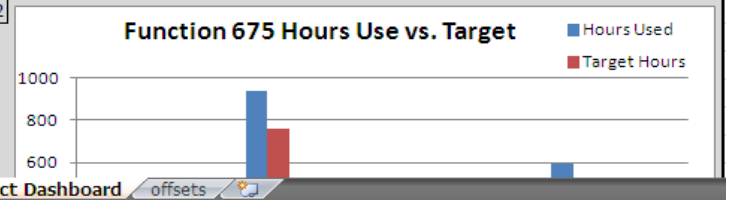
Period Salt Use: 1868.8
Period Target Use: 1819.7
% of Target: 102.7%

Period 675 Hours: 2914.1
Period Target 675 Hrs: 2782.2
% of Target: 104.7%

Period Winter Hours: 3883.7
Period Target Hrs: 3338.6
% of Target: 116.3%

Weather Summary for the Period	
Salt Index	17.0
Total Precip Hours	784.7
Freezing Rain Hours	47.2
Sleet Hours	15.2
Heavy Snow Hours	44.3
Med Snow Hours	301.5
Light Snow Hours	147.3
Blowing Snow Hours	229.2





Payperiod Summary | YTD Summary | Garage dashboard | District Dashboard | offsets

Statewide Detail

10/1/2011 | End of today | Update

Salt | 675 Hours | All Hours

Tons Used: 62,326

Target Salt
92,135

Target - Use
29,809

% Of Target Used

67.6 %

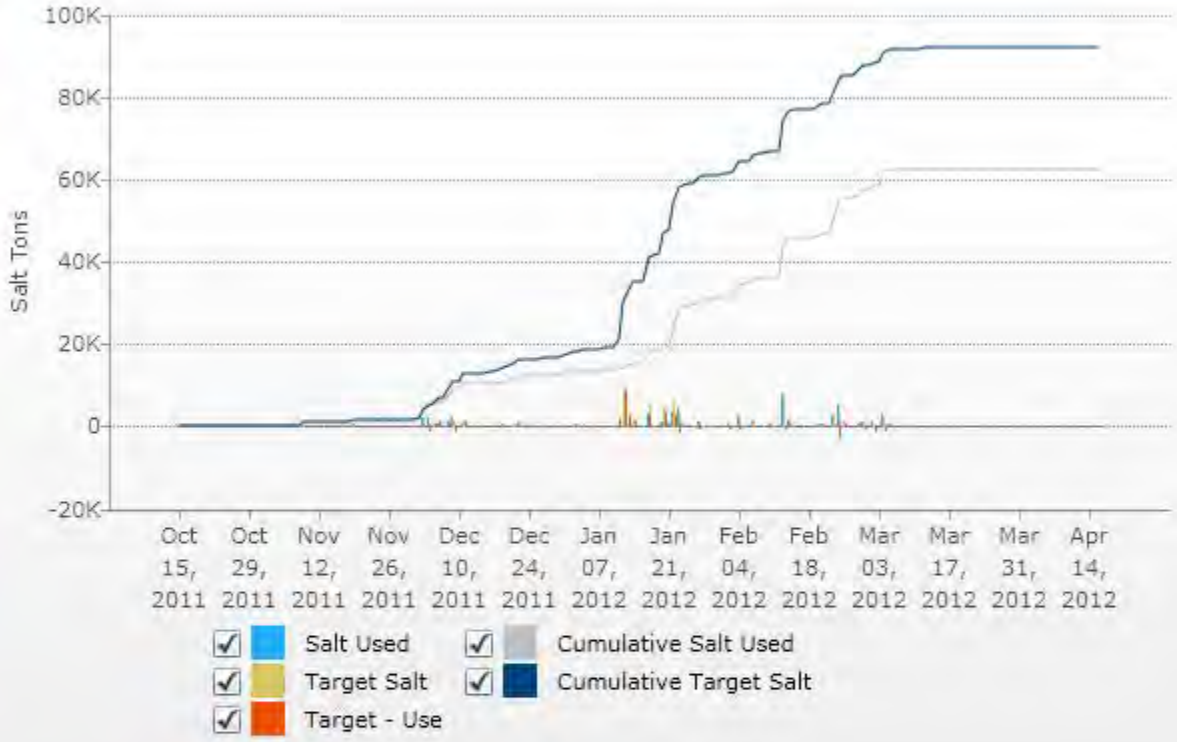
Allocation
169,133

Allocation - Use
106,807

% Allocation Used

36.9 %

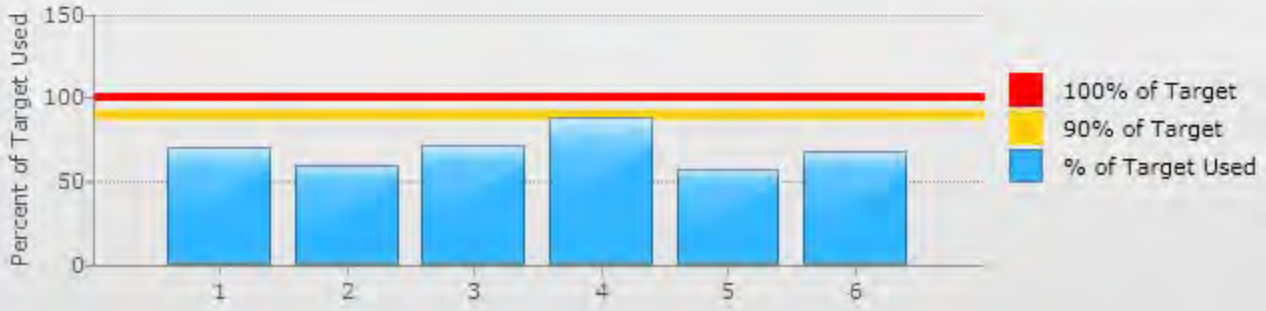
A, BC Details

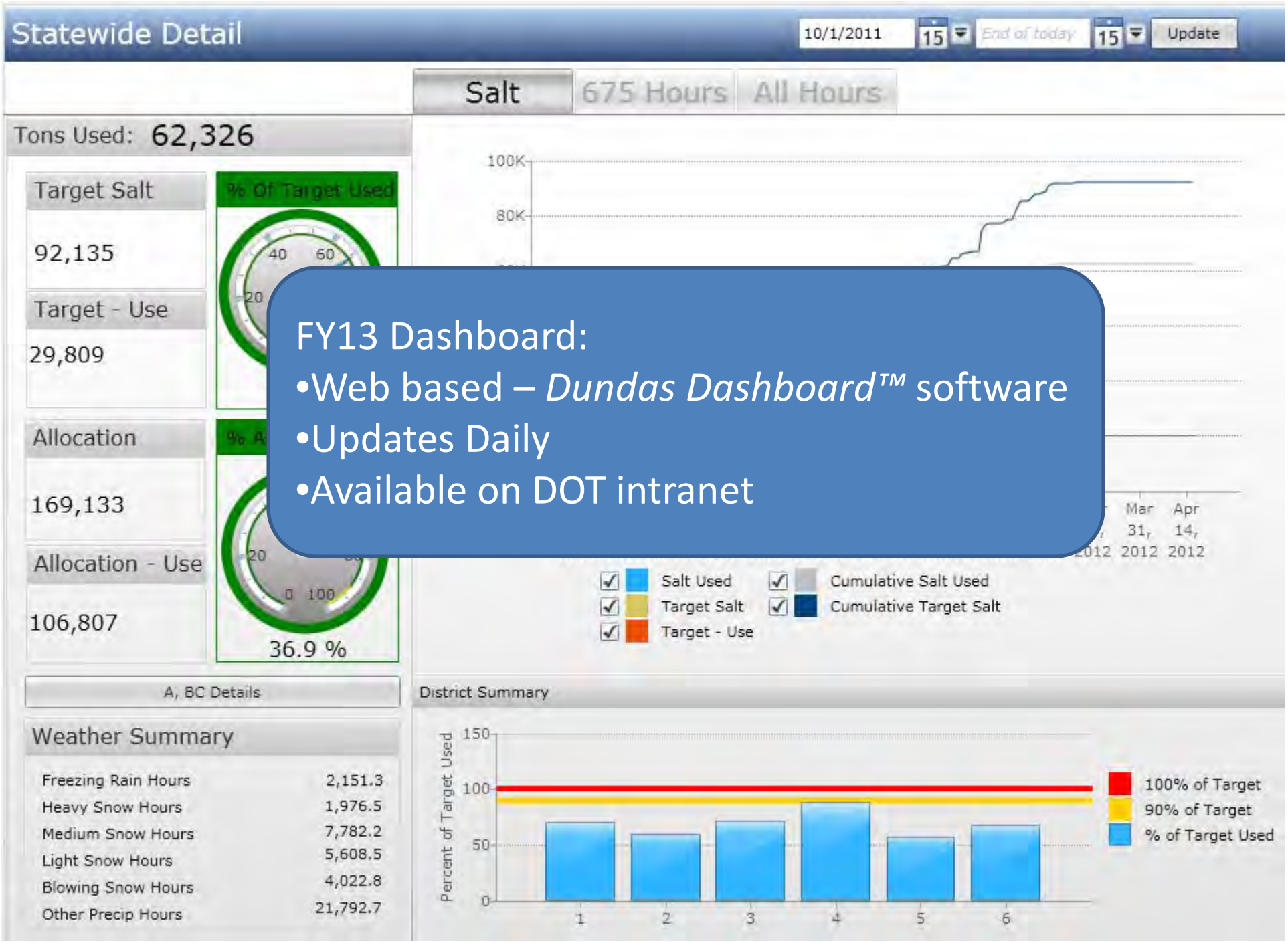


Weather Summary

Freezing Rain Hours	2,151.3
Heavy Snow Hours	1,976.5
Medium Snow Hours	7,782.2
Light Snow Hours	5,608.5
Blowing Snow Hours	4,022.8
Other Precip Hours	21,792.7

District Summary




Statewide Detail
10/1/2011
End of today
Update
Salt
675 Hours
All Hours
Tons Used: 62,326
Target Salt
92,135
Target - Use
29,809
Allocation
169,133
Allocation - Use
106,807
% Of Target Used
36.9 %
100K
80K
Mar 31, 2012
Apr 14, 2012
Salt Used
Target Salt
Target - Use
Cumulative Salt Used
Cumulative Target Salt
FY13 Dashboard:
•Web based – *Dundas Dashboard™* software
•Updates Daily
•Available on DOT intranet
A, BC Details
District Summary
Weather Summary
Freezing Rain Hours 2,151.3
Heavy Snow Hours 1,976.5
Medium Snow Hours 7,782.2
Light Snow Hours 5,608.5
Blowing Snow Hours 4,022.8
Other Precip Hours 21,792.7
Percent of Target Used
150
100
50
0
1
2
3
4
5
6
100% of Target
90% of Target
% of Target Used


Circle Detail
Boone
Back to District
12/1/2011
15
12/11/2011
15
Update
All Hours
Tons Used: 250
Target Salt
182
Target - Use
-68
137.3
Allocation
2,529
Allocation - Use
2,279
9.9 %
Select a value: LocationTWINOP
IOWA
1
Altoona
Ames
Boone
Carlisle
Des Moines North
Fort Dodge
Grimes
Grinnell
Marshalltown
Newton
Williams
2
3
4
(All)
OK
Cancel
Dec 03, 2011
Dec 04, 2011
Dec 05, 2011
Dec 06, 2011
Dec 07, 2011
Dec 08, 2011
Dec 09, 2011
Dec 10, 2011
Dec 11, 2011
Cumulative Salt Used
Cumulative Target Salt
A, BC Details
Weather Summary
Freezing Rain Hours 0.0
Heavy Snow Hours 1.2
Medium Snow Hours 26.7
Light Snow Hours 3.3
Blowing Snow Hours 6.2
Other Precip Hours 35.8
Garage Summary
Percent of Target Used
200
100
0
551613
551614
100% of Target
90% of Target
% Target Used


District Detail
1
Back to State
12/1/2011
15
12/11/2011
15
Update
Salt
675 Hours
All Hours
Tons Used: 1,342
Target Salt
1,990
Target - Use
648
Allocation
34,181
Allocation - Use
32,839
A, BC Details
ABC Details
A Routes
Target Salt 530
Salt Used 377
Target - Use 152
% of Target Used 71.2 %
BC Routes
Target Salt 1,460
Salt Used 965
Target - Use 495
% of Target Used 66.1 %
Dec 03, 2011
Dec 04, 2011
Dec 05, 2011
Dec 06, 2011
Dec 07, 2011
Dec 08, 2011
Dec 09, 2011
Dec 10, 2011
Dec 11, 2011
Cumulative Salt Used
Cumulative Target Salt
Weather Summary
Freezing Rain Hours 0.2
Heavy Snow Hours 5.0
Medium Snow Hours 136.0
Light Snow Hours 125.7
Blowing Snow Hours 21.0
Other Precip Hours 409.2
Percent of Target Used
100
50
0
Altoona
Ames
Boone
Carlisle
Des Moines North
Fort Dodge
Grimes
Grinnell
Marshalltown
Newton
Williams
100% of Target
90% of Target
% Target Used

District Detail | 1 | Back to State | 12/1/2011 | 15 | 12/11/2011 | 15 | Update

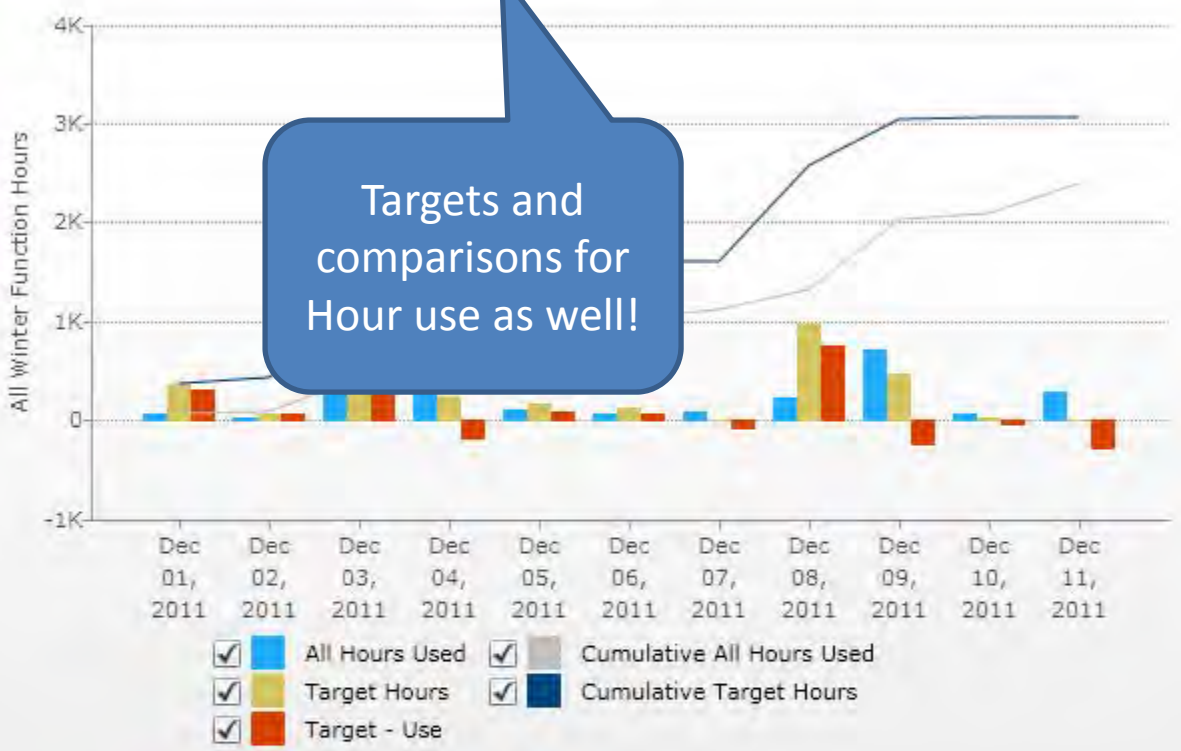
Salt | 675 Hours | All Hours

Winter* Hours Used: 2,381

Target Hours	% Of Target Used
3,066	77.7 %

Target - Use: 685

*Includes hours for 675, 676, and 682



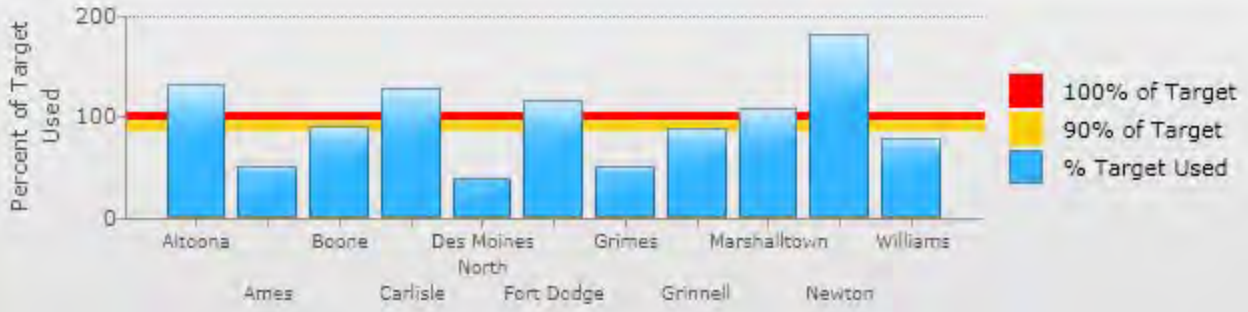
Targets and comparisons for Hour use as well!

A, BC Details

Weather Summary

Freezing Rain Hours	0.2
Heavy Snow Hours	5.0
Medium Snow Hours	136.0
Light Snow Hours	125.7
Blowing Snow Hours	21.0
Other Precip Hours	409.2

Circle Summary




Preview Dashboard - salt State
Statewide Detail
Salt
675 Hours
All Hours
Tons Used: 137,061
Target Salt
139,066
Target Minus Use
2,005
% Of Target Used
98.6 %
Allocation
169,133
Allocation Remaining
32,073
% Allocation Used
81.0 %
10/15/2012
End of yesterd
Update
150K
100K
50K
0
-50K
Salt Tons
Oct 15, 2012
Nov 12, 2012
Dec 10, 2012
Jan 07, 2013
Feb 04, 2013
Mar 04, 2013
Apr 01, 2013
Apr 29, 2013
Cumulative Target Salt
New for FY14 – Salt Purchasing Summaries
Salt Delivery Information
A, BC Details
Weather Summary
Freezing Rain Hours 2,044.0
Heavy Snow Hours 4,062.8
Medium Snow Hours 15,564.3
Light Snow Hours 8,519.5
Blowing Snow Hours 12,445.3
Other Precip Hours 21,347.0
District Summary
Percent of Target Used
150
100
50
0
1
2
3
4
5
6
100% of Target
90% of Target
% of Target Used

Traffic-Based Performance Analysis

- Working on using traffic as an outcome measure for winter operations
- Refining the traffic models and building a manager’s dashboard

Traffic-Based Performance Analysis

- Traffic slows when roads are bad, speed up when conditions improve
  - But how do you know if the drop was acceptable?
  - A blizzard will bring traffic to a halt but is that the fault of a maintenance supervisor??

Traffic-Based Performance Analysis

- Traffic speeds can be an outcome measurement if:
  - You know what the baseline behavior would have been given the weather conditions
  - How ‘reality’ compared
- Baseline model adapted from IHRB Project TR-491 “Performance Measurement for Highway Maintenance Operations”
  - Estimates traffic speed during a storm based on weather data

Specify a Date Range: 2/20/2013 11:00 PM 15 2/22/2013 11:00 PM 15 Export Back to Area

Graph Table Group data

Winter Operations Quality for Manchester (US 20) (R33

Success Rate

(How often speed expectations were met)

Winter Driving Condition Rate

(A measure of winter driving difficulty)

Average Difference from Expected

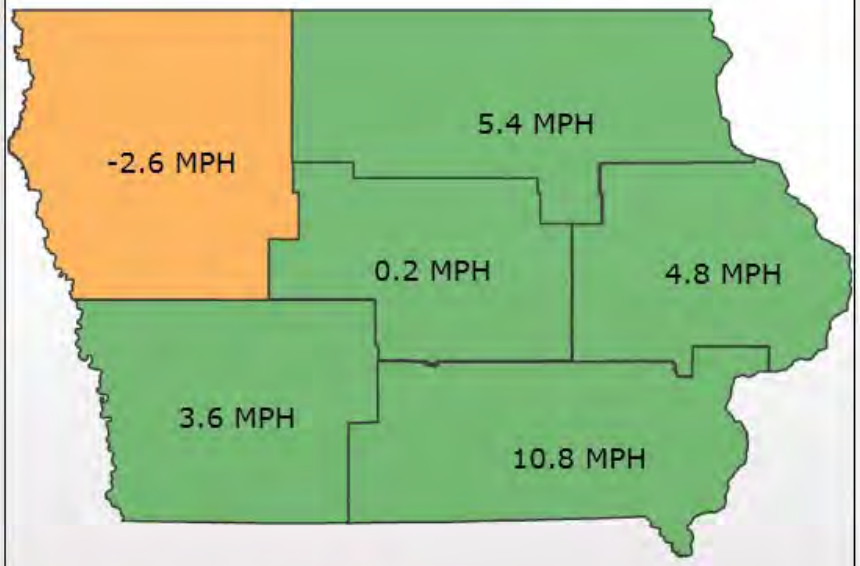
(Average speed difference)

Specify a Date Range: 2/20/2013 11:00 PM — 2/22/2013 11:00 PM

Export

State of Iowa

Average Difference from Expected



Winter Operations Quality for the State

Success Rate
(How often speed expectations were met)

Winter Driving Condition Rate
(A measure of winter driving difficulty)

Average Difference from Expected
(Average speed difference)

Winter Operations Quality by Districts

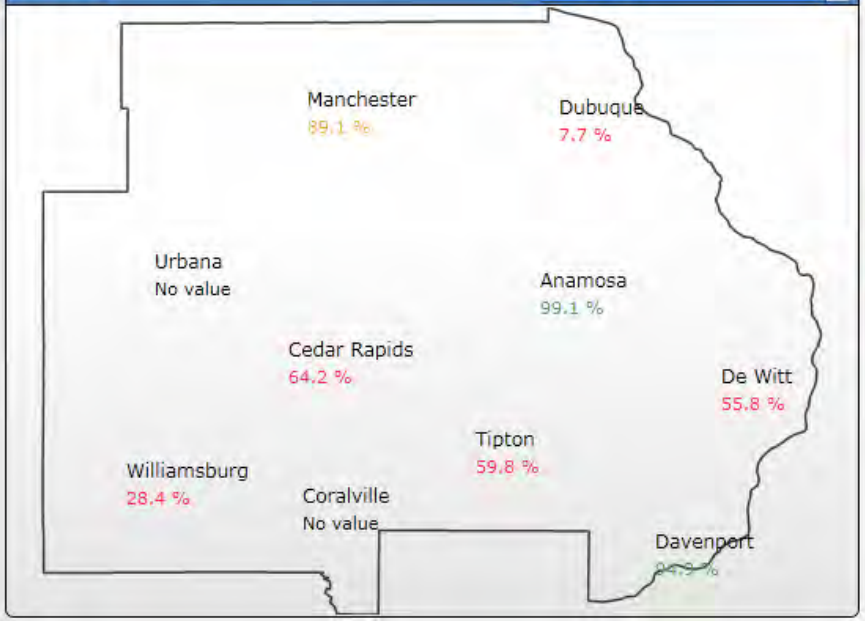
	Success Rate	Winter Driving Condition Rate	Average Difference from Expected	Snowfall Amount	# of precip days	Salt Usage	All hours	675 hours	All winter hours	Snow hours	Blowing snow hours	Other precip hours
Iowa	65.3	58.9	4.6	6.7	2.0	9,425.8	16,264.9	14,752.9	2,310.0	1,977.3	300.5	32.2
District_1	48.9	67.8	0.2	5.5	1.9	1,439.2	52,812.2	41,181.4	352.3	288.3	58.0	6.0
District_2	81.2	38.1	5.4	6.6	1.9	941.7	48,085.0	38,030.2	329.2	278.2	39.0	12.0
District_3	51.7	63.3	-2.6	7.8	2.0	567.7	34,836.0	26,490.9	467.0	422.8	44.2	0.0
District_4	47.0	75.1	3.6	7.4	2.0	2,438.6	34,379.3	26,966.9	398.3	331.3	67.0	0.0
District_5	76.9	58.9	10.8	6.6	2.0	1,699.6	33,520.6	29,631.8	437.5	357.0	73.3	7.2
District_6	63.7	62.3	4.8	5.9	2.0	2,338.9	53,291.6	44,887.8	325.7	299.7	19.0	7.0

Specify a Date Range: 2/20/2013 11:00 PM — 2/22/2013 11:00 PM

Export | Back to State

District_6

Success Rate



Winter Operations Quality for the District_6

Success Rate
(How often speed expectations were met)

Winter Driving Condition Rate
(A measure of winter driving difficulty)

Average Difference from Expected
(Average speed difference)

Winter Operations Quality by Supervisory Area

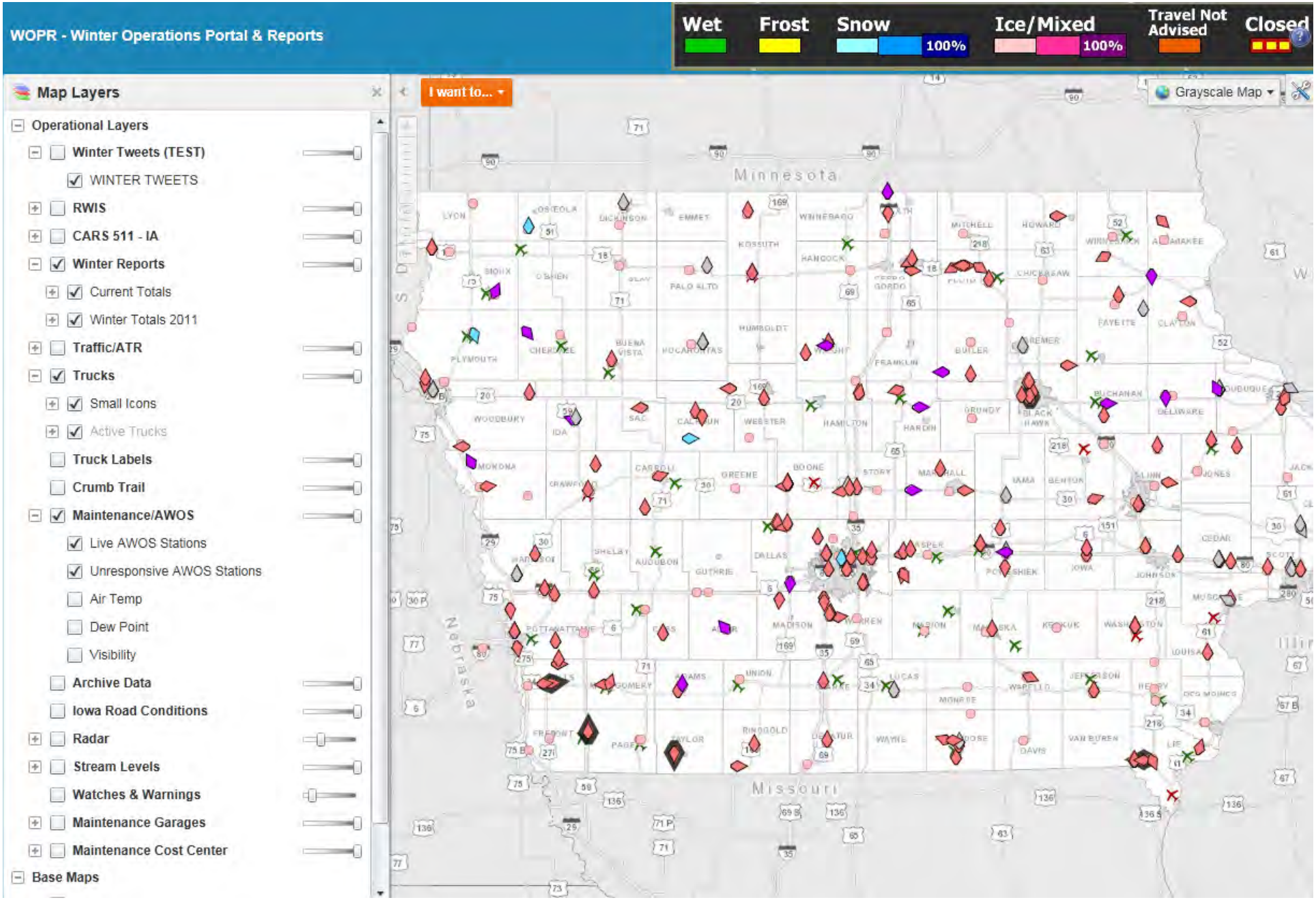
	Success Rate	Winter Driving Condition Rate	Average Difference from Expected	Snowfall Amount	# of precip days	Salt Usage	All hours	675 hours	All winter hours	Snow hours	Blowing snow hours	Other precip hours
District_6	63.7	62.3	4.8	5.9	2.0	2,338.9	53,291.6	44,887.8	325.7	299.7	19.0	7.0
Anamosa	99.1	66.1	31.8	5.5	2.0	212.4	5,157.0	4,280.8	54.7	50.7	0.0	4.0
Cedar Rapids	64.2	52.9	9.1	6.5	2.0	329.3	7,309.5	5,862.6	41.7	41.7	0.0	0.0
Davenport	94.9	22.8	5.9	3.6	2.0	265.9	5,609.4	5,021.8	12.3	9.2	3.2	0.0
De Witt	55.8	82.2	1.6	4.1	2.0	142.4	4,081.3	3,421.1	40.8	37.8	3.0	0.0
Dubuque	7.7	99.8	-7.8	5.3	2.0	235.4	8,224.7	7,248.4	38.8	37.8	0.0	1.0
Manchester	89.1	33.0	2.9	6.5	2.0	195.3	5,901.9	5,177.2	37.0	36.0	0.0	1.0
Oakdale	no value	no value	no value	6.0	2.0	299.1	5,759.3	4,545.9	16.8	16.8	0.0	0.0
Tipton	59.8	40.2	-0.9	5.5	2.0	160.8	3,425.0	3,065.1	20.0	17.2	2.8	0.0
Urbana	no value	no value	no value	6.5	2.0	325.2	4,814.9	3,781.9	42.7	31.7	10.0	1.0
Williamsburg	28.4	100.0	-0.5	10.5	2.0	173.1	3,008.5	2,482.8	20.8	20.8	0.0	0.0

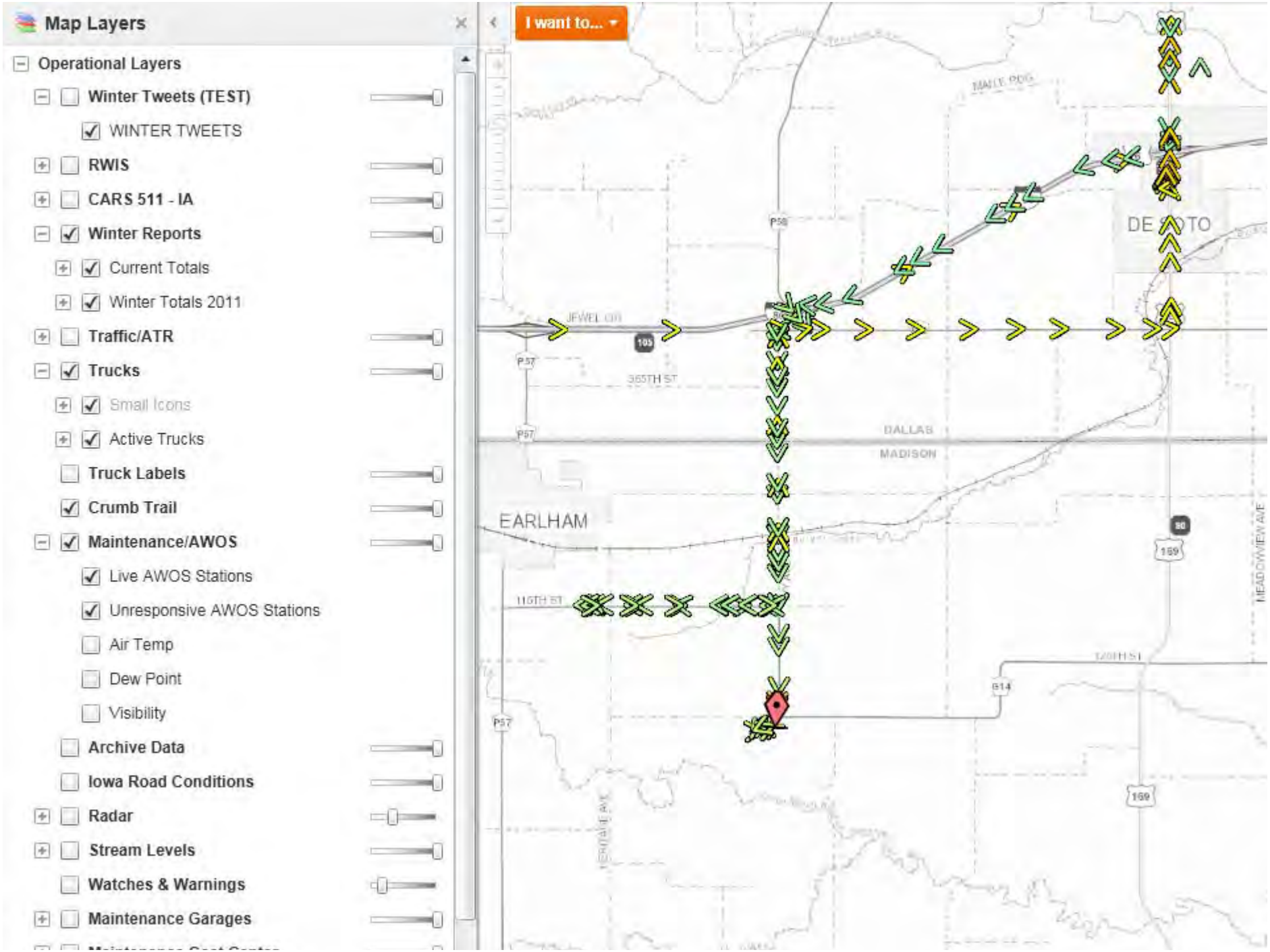
Traffic-Based Performance Analysis

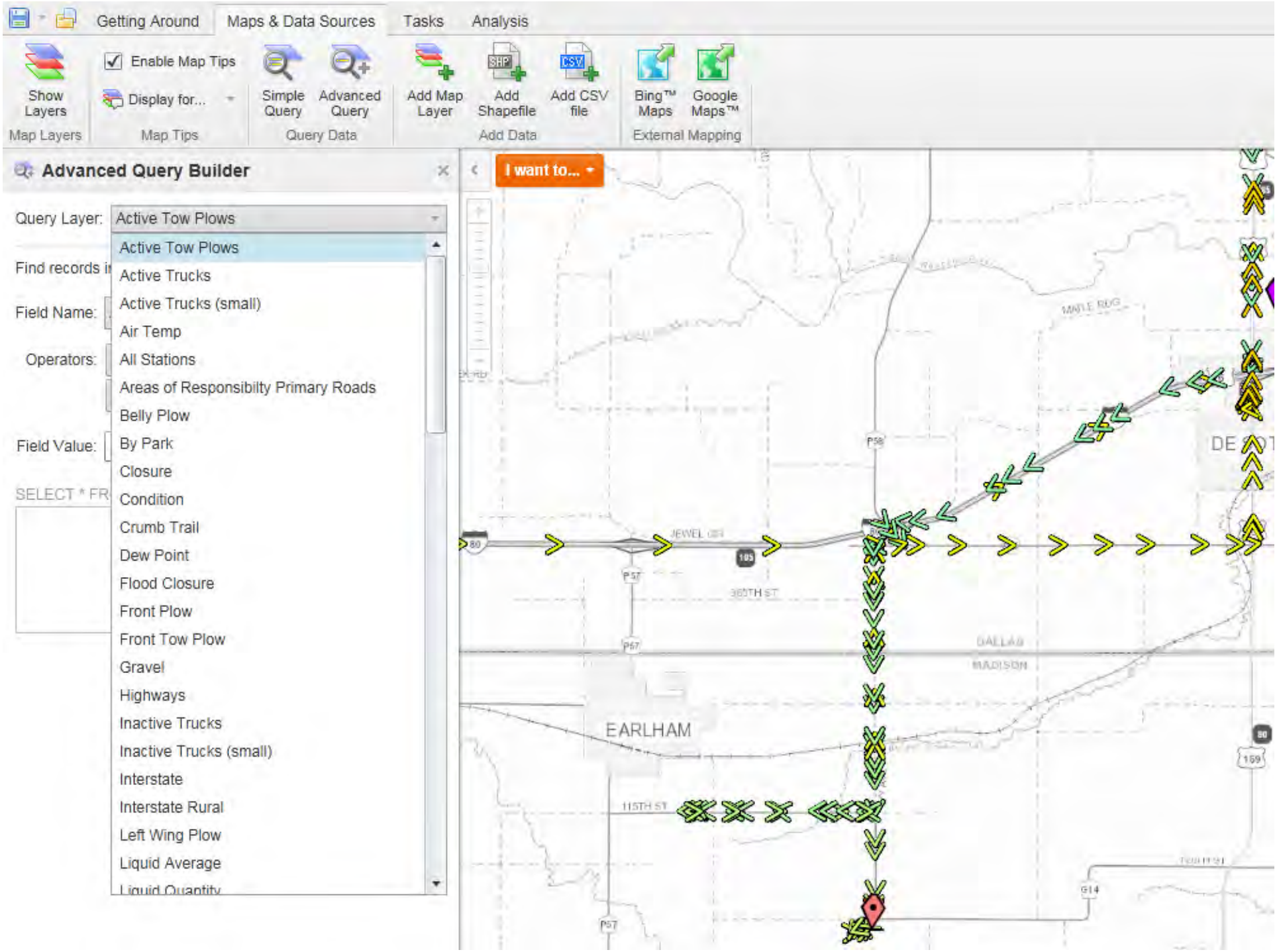
- Next Steps:
  - Getting INRIX traffic data for nearly continuous comparisons along major highways
  - Iowa State University continuing work on traffic model, especially variation in driver behavior

GPS Fleet Information

- Nearly 900 trucks outfitted with GPS/AVL
  - Spreader, plow status
  - Air, pavement temperature
  - Use LTI brand LT6 controllers
- Data is polled through LTI then dumped into our database for further use


WOPR - Winter Operations Portal & Reports
Wet
Frost
Snow
100%
Ice/Mixed
100%
Travel Not Advised
Closed
Map Layers
I want to...
Grayscale Map
Operational Layers
Winter Tweets (TEST)
WINTER TWEETS
RWIS
CARS 511 - IA
Winter Reports
Current Totals
Winter Totals 2011
Traffic/ATR
Trucks
Small Icons
Active Trucks
Truck Labels
Crumb Trail
Maintenance/AWOS
Live AWOS Stations
Unresponsive AWOS Stations
Air Temp
Dew Point
Visibility
Archive Data
Iowa Road Conditions
Radar
Stream Levels
Watches & Warnings
Maintenance Garages
Maintenance Cost Center
Base Maps
Minnesota
Nebraska
Missouri


Map Layers
Operational Layers
Winter Tweets (TEST)
WINTER TWEETS
RWIS
CARS 511 - IA
Winter Reports
Current Totals
Winter Totals 2011
Traffic/ATR
Trucks
Small Icons
Active Trucks
Truck Labels
Crumb Trail
Maintenance/AWOS
Live AWOS Stations
Unresponsive AWOS Stations
Air Temp
Dew Point
Visibility
Archive Data
Iowa Road Conditions
Radar
Stream Levels
Watches & Warnings
Maintenance Garages
I want to...
DE SOTO
EARLHAM
DALLAS
MADISON
365TH ST
116TH ST
MEADOWVIEW AVE
P58
P57
105
80
169
614


Getting Around
Maps & Data Sources
Tasks
Analysis
Enable Map Tips
Display for...
Show Layers
Map Layers
Map Tips
Simple Query
Advanced Query
Query Data
Add Map Layer
Add Shapefile
Add CSV file
Add Data
Bing™ Maps
Google Maps™
External Mapping
Advanced Query Builder
Query Layer:
Active Tow Plows
Find records i
Field Name:
Operators:
Field Value:
SELECT * FR
Active Tow Plows
Active Trucks
Active Trucks (small)
Air Temp
All Stations
Areas of Responsibilty Primary Roads
Belly Plow
By Park
Closure
Condition
Crumb Trail
Dew Point
Flood Closure
Front Plow
Front Tow Plow
Gravel
Highways
Inactive Trucks
Inactive Trucks (small)
Interstate
Interstate Rural
Left Wing Plow
Liquid Average
Liquid Quantity
I want to...
EARLHAM
DALLAS
MADISON
JEWEL
365TH ST
115TH ST
MAPLE RUG
80
169
P58
P57
P67
G14

GPS Fleet Info

- Data from trucks will be used to pre-populate Resource Management System
  - Material use by route segment
  - Equipment hours
- Data will soon be used in operations analysis
- A public plow location page with plow dash cams coming later this winter

Equipment

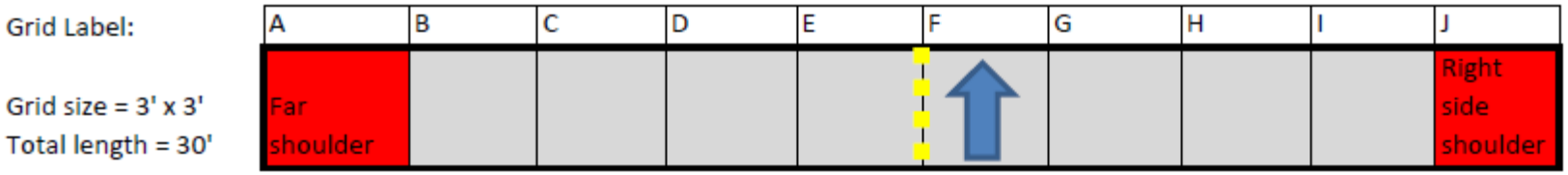
Spreader Development and Evaluation

- Several spreader types in use
  - Rear chute
  - ZV
  - Plate spinner
  - Plus a few homemade versions
- Prewetting is required. Anywhere from 5 gal/lm to 50 gal/lm is common.
- Different opinions abound for what spreader/speed/prewet combo is best – but where's the proof?


Smooth rubber mat with 10 3x3 grids
08/05/2013 15:04

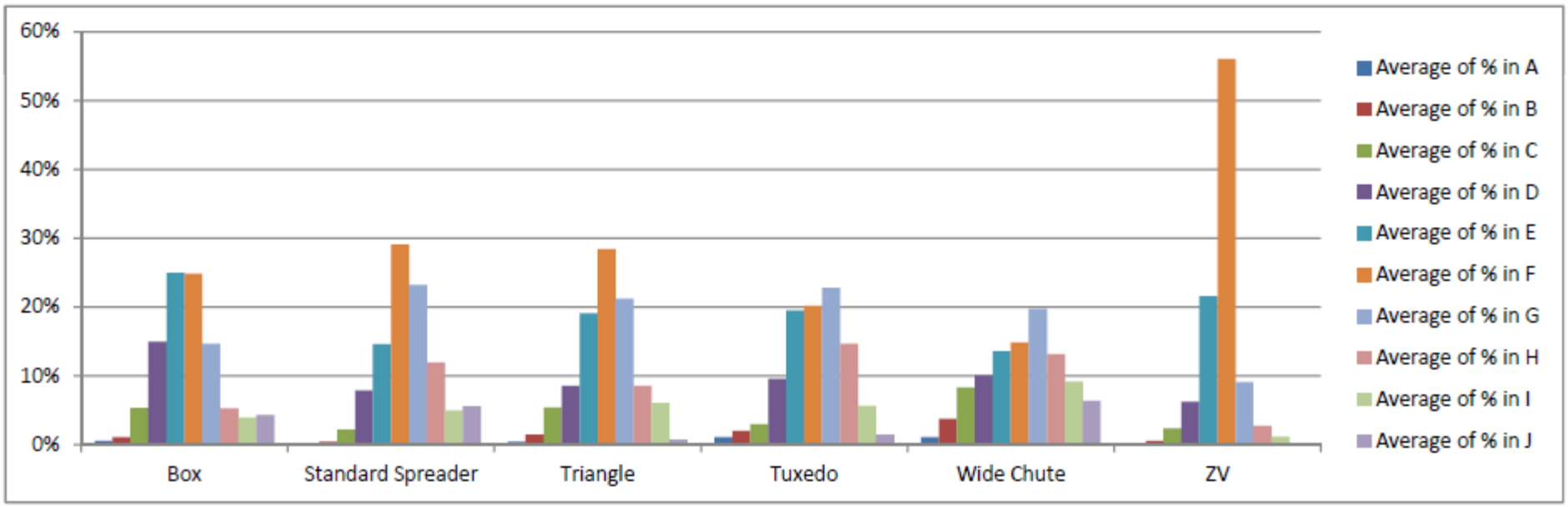

08/06/2013 11:28

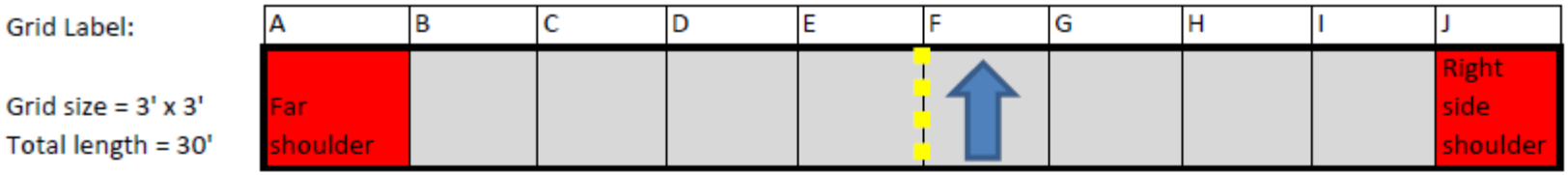

SAVE FOR BOUYOUCOS PANS
WASH PANS
08/08/2013 15:23



Speed	(All)
Prewet Rate	DRY

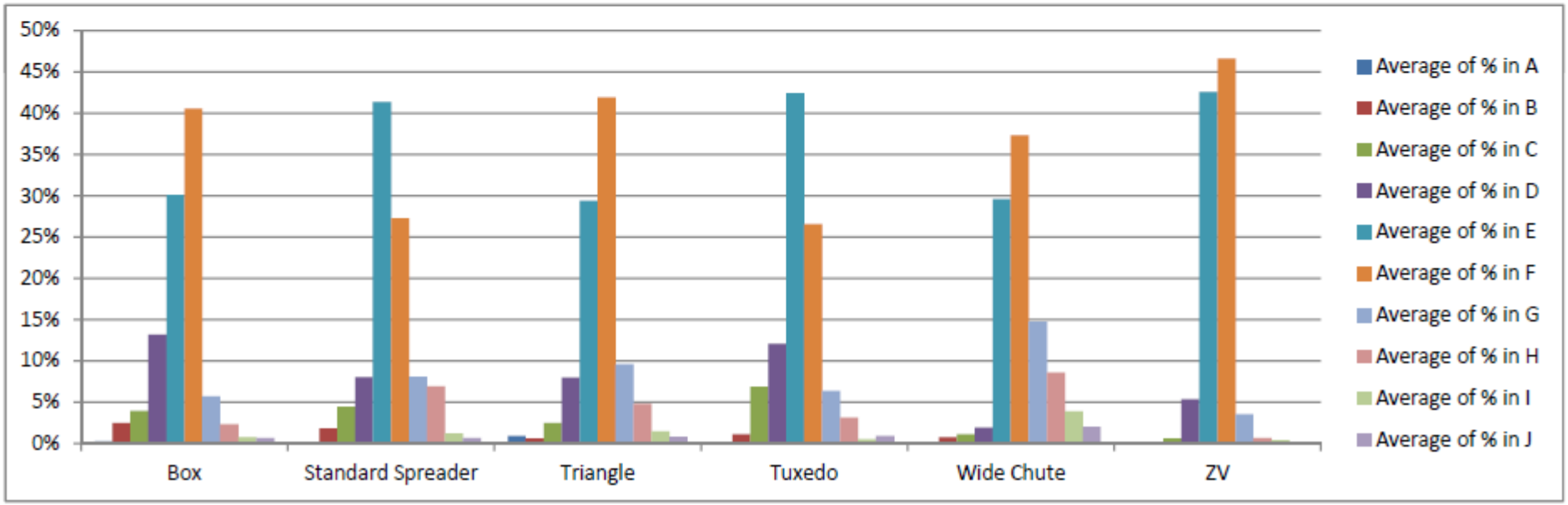
Row Labels	Average of % in A	Average of % in B	Average of % in C	Average of % in D	Average of % in E	Average of % in F	Average of % in G	Average of % in H	Average of % in I	Average of % in J	% variation between grids (larger means tighter group)
Box	1%	1%	5%	15%	25%	25%	15%	5%	4%	4%	93%
Standard Spreader	0%	0%	2%	8%	15%	29%	23%	12%	5%	6%	98%
Triangle	0%	2%	5%	9%	19%	28%	21%	9%	6%	1%	97%
Tuxedo	1%	2%	3%	10%	20%	20%	23%	15%	6%	1%	87%
Wide Chute	1%	4%	8%	10%	14%	15%	20%	13%	9%	6%	58%
ZV	0%	1%	2%	6%	22%	56%	9%	3%	1%	0%	163%





Speed	(All)
Prewet Rate	30.00

Row Labels	Average of % in A	Average of % in B	Average of % in C	Average of % in D	Average of % in E	Average of % in F	Average of % in G	Average of % in H	Average of % in I	Average of % in J	% variation between grids (larger means tighter group)
Box	0%	2%	4%	13%	30%	41%	6%	2%	1%	1%	136%
Standard Spreader	0%	2%	4%	8%	41%	27%	8%	7%	1%	1%	131%
Triangle	1%	1%	2%	8%	29%	42%	10%	5%	1%	1%	137%
Tuxedo	0%	1%	7%	12%	42%	27%	6%	3%	0%	1%	135%
Wide Chute	0%	1%	1%	2%	30%	37%	15%	9%	4%	2%	129%
ZV	0%	0%	1%	5%	43%	47%	4%	1%	0%	0%	170%



Nontraditional RWIS

- Inexpensive
- DYI install
- Pavement temp and basic atmospheric data
- Reports 1/min and available online