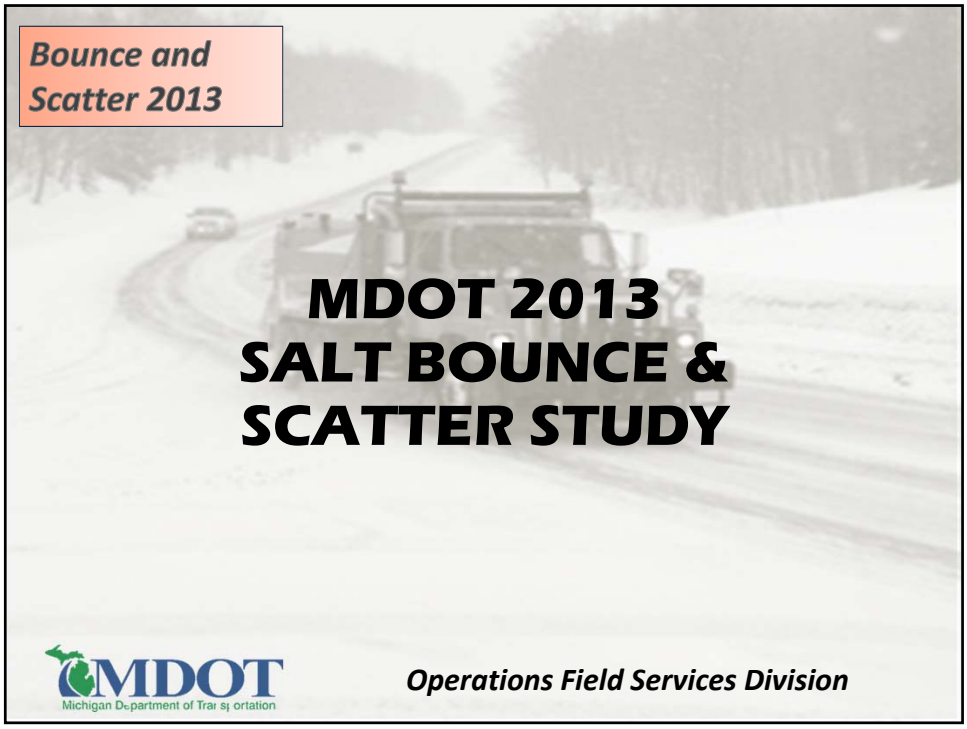
Bounce and
Scatter 2013
MDOT 2013
SALT BOUNCE &
SCATTER STUDY
MDOT
Michigan Department of Transportation
Operations Field Services Division


Bounce and
Scatter 2013
Presenters
Justin Droste, P.E. Roadway Operations Engineer
Mark Crouch, Roadway Operations Coordinator
Matt Pratt, Roadway Operations Coordinator
MDOT
Michigan Department of Transportation
Operations Field Services Division

Bounce and Scatter 2013

Agenda

- Introduction
  - 2012 Study Recap
  - Goals for 2013 Study
- Considerations
- Distribution Systems Tested
- Data Analysis/System Performance
- Conclusions & Impacts on MDOT Operations
- Poster Display

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MDOT Statistics

- 31,791 lane miles
- 330 snowplows
- Average winter expense is $80 MILLION
- 5-year average salt usage is 570,000 Tons
- Current average price of salt is $45/ton

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2012 Study Recap

- Tested 25, 35, and 45 mph speeds
- Treated Salt vs. Untreated Salt
- Rear cross conveyors and Y-chute delivery systems

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2012 Study Recap

- **Truck Speed effects Salt Bounce and Scatter the most** *(25 mph speeds retained the most salt in target zone by far)*
- **Treated salt scatters less than untreated salt** *(Confirmed results from 1970's MDOT study)*
- **Rear cross conveyor slightly outperformed Y-chute delivery system**

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2013 Bounce and Scatter Study Goals

Determine if improved delivery systems can provide acceptable B&S at speeds faster than 25 mph.

- **Observe effect boots have on B&S** *(various heights)*
- **Assess performance of advanced delivery systems** *(Slurry Generator and Zero Velocity)*

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Considerations/ Systems Tested

Mark Crouch, Roadway Operations Coordinator

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Considerations….

- Repeated each test scenario 3 times to obtain an average
- All testing performed during the summer months without traffic
- Hottest day of year!

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Test Location

US-31 in Benton Harbor, Michigan

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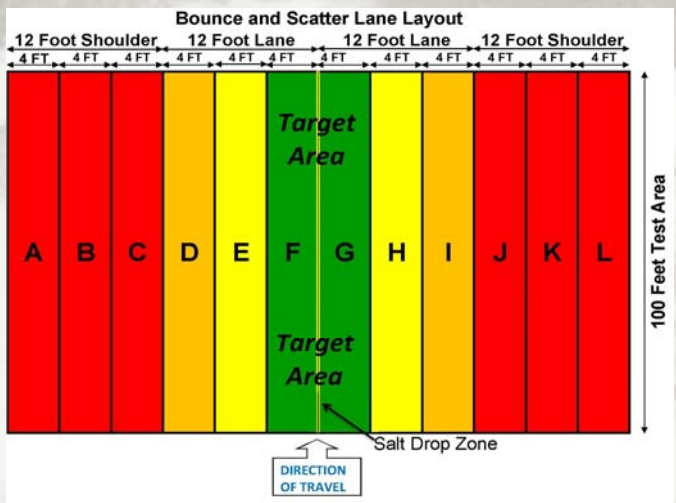
Grid Layout



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Radar Trailer

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How Salt Was Collected

Close Up of Collection Lanes

Complete Group Effort

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How Salt was Weighed and Recorded

New Weighing Process

Digital Table Scale

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2012 Delivery Systems Tested

Y-Chute

Rear Cross Conveyor

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2013 Y-Chute at Different Heights

Y-Chute

One Inch Height

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2013 Y-Chute at Different Heights

Six Inch Height

Twelve Inch Height

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2013 Advanced Delivery Systems

Salt Slurry

Zero Velocity

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Data Analysis/ System Performance

Matt Pratt, Roadway Operations Coordinator

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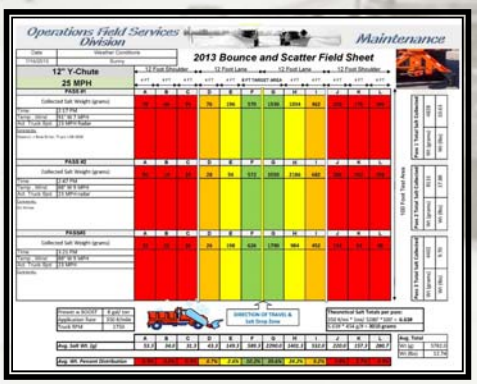
Field Data Sheet



- 3 passes made for each scenario with averaged results
- Weights were recorded in grams
- Expected total weight collected at 350 lb. rate is 6.63 lbs. per pass
- Converted weights to percentages for better comparison

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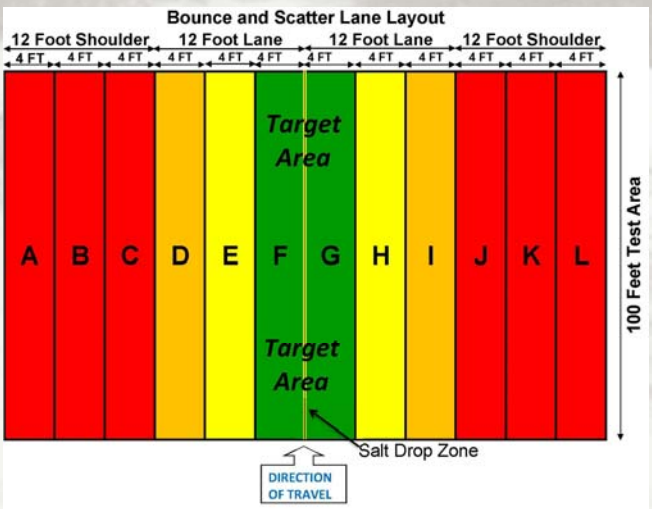
Grid Layout



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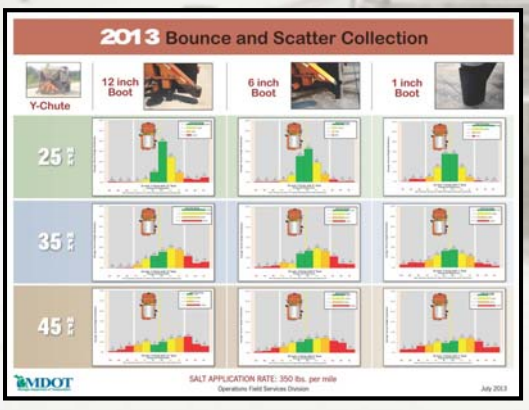
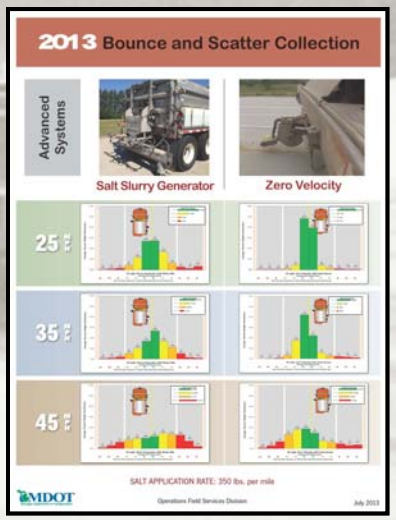
Graphical Results





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Single Point Effectiveness Rating

- Viewing collection graphs provides general idea of performance
- Want to provide simple overall assessment for comparison (Single Point Value)
- Single point effectiveness based on "Total Percent By Group" data on graphs.

100% Effective	67% Effective	33% Effective	0% Effective

$$Overall\ Effectiveness = (\%\ Green) + \frac{2}{3} * (\%\ Yellow) + \frac{1}{3} * (\%\ Orange)$$

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Bounce and Scatter 2013

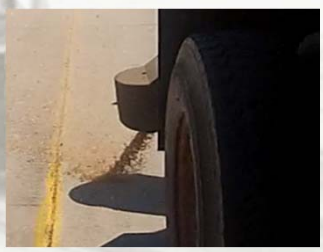
Single Point Effectiveness Rating

Year	Test Scenario	Overall Effectiveness
2013	25 mph; Zero Velocity with Auto Sense	0.93
2013	35 mph; Zero Velocity with Auto Sense	0.82
2013	25 mph; 6" Boot Y-Chute	0.78
2013	25 mph; 1" Boot Y-Chute	0.77
2013	25 mph; Slurry Generator with Water	0.76
2013	25 mph; 12" Boot Y-Chute	0.71
2013	35 mph; Slurry Generator with Water	0.68
2013	35 mph; 1" Boot Y-Chute	0.57
2013	45 mph; Zero Velocity with Auto Sense	0.57
2013	35 mph; 6" Boot Y-Chute	0.54
2013	35 mph; 12" Boot Y-Chute	0.53
2013	45 mph; 6" Boot Y-Chute	0.46
2013	45 mph; Slurry Generator with Water	0.45
2013	45 mph; 1" Boot Y-Chute	0.44
2013	45 mph; 12" Boot Y-Chute	0.40

Bounce and Scatter 2013

Boot Performance

- 1” boot and 6” boot performed roughly the same for each tested speed.
- Without a boot (12” test), material would drop beyond the end of the Y-Chute.
- The single point effectiveness improved approximately 5% by adding a boot 1” to 6” off the ground.



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Slurry Generator Performance

- 35 mph Slurry Generator performed slightly below lowest 25 mph speed
- Unit tested was limited in its abilities to perform according to manufacturer’s specs
- Slurry Generator should be able to maintain acceptable scatter patterns at 35 mph if properly setup
- Acceptable scatter patterns are not maintained at 45 mph

Year	Test Scenario	Overall Effectiveness
2013	25 mph; Zero Velocity with Auto Sense	0.93
2013	35 mph; Zero Velocity with Auto Sense	0.82
2013	25 mph; 6" Boot Y-Chute	0.78
2013	25 mph; 1" Boot Y-Chute	0.77
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Zero Velocity Performance

- 25 mph and 35 mph Zero Velocity were the top two performers
- Zero Velocity effectiveness tested the same or better than Y-Chutes with boots at next slowest speed
- Acceptable scatter patterns are maintained at 35 mph, but NOT at 45 mph
- To meet performance standards, Zero Velocity spreaders must be utilized according to manufacturer's settings

Year	Test Scenario	Overall Effectiveness
2013	25 mph; Zero Velocity with Auto Sense	0.93
2013	35 mph; Zero Velocity with Auto Sense	0.82
2013	25 mph; 6" Boot Y-Chute	0.78
2013	25 mph; 1" Boot Y-Chute	0.77
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2013 Conclusions

Performance standard threshold set near level of lowest performing 25 mph speed

- **Slurry Generator meets criteria at 35mph** *(not 45 mph)*
- **Zero Velocity at 35 mph out-performed all other systems at 25 mph** *(Did not meet criteria at 45 mph)*
- **Boots alone do not meet criteria for standard systems at 35 mph** *(Does decrease B&S by 5%)*

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B&S Impacts on MDOT Operations

New for Winter 2013/2014:

- **Improved salt application rate table.**
- **Maintenance advisory pertaining to "Best Practices for Applying Deicing Materials".**

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New Salting Table

MDOT WINTER MAINTENANCE APPLICATION RATES: (SOLIDS)

Recommended Treatment Parameters

AIR TEMP	PAVEMENT TEMPERATURE	WEATHER CONDITION	POUNDS PER 2 LANE MILE: PRE WET SALT *	POUNDS PER 2 LANE MILE: SAND	ACTIONS & APPLICATION RECOMMENDED
RISING	⇧ ABOVE 30° ⇩	SNOW	150	NOT RECOMMENDED	PLOW, TREAT HAZARDS ONLY
		FREEZING RAIN	150	NOT RECOMMENDED	APPLY AS NEEDED
DROPPING		SNOW	150-300	NOT RECOMMENDED	PLOW & APPLY AS NEEDED
		FREEZING RAIN	150-300	NOT RECOMMENDED	APPLY AS NEEDED
RISING	⇧ 25° to 30° ⇩	SNOW	150-300	NOT RECOMMENDED	PLOW & APPLY AS NEEDED
		FREEZING RAIN	150-300	NOT RECOMMENDED	APPLY AS NEEDED
DROPPING		SNOW	150-300	NOT RECOMMENDED	PLOW & APPLY AS NEEDED
		FREEZING RAIN	300-350	400	APPLY AS NEEDED
RISING	⇧ 20° to 25° ⇩	SNOW / FREEZING RAIN	150-300	400	PLOW & APPLY AS NEEDED
		SNOW	225-300	NOT RECOMMENDED	PLOW & APPLY AS NEEDED
DROPPING		FREEZING RAIN	300-350	400	APPLY AS NEEDED
RISING	⇧ 15° to 20° ⇩	SNOW	225-300	NOT RECOMMENDED	PLOW & APPLY AS NEEDED
		FREEZING RAIN	300-350	500-750	APPLY AS NEEDED
DROPPING		SNOW / FREEZING RAIN	350	500-750	PLOW & APPLY AS NEEDED
	BELOW 15°	SNOW	NOT RECOMMENDED	NOT RECOMMENDED	PLOW, TREAT HAZARDS AS NEEDED

FROST: 15° & RISING: TREAT BY ANTI-ICING (BRINE 20-40 GAL/LnMi) OR 15° & FALLING: PRE WET SALT @ 150lt/LnMi.

WIND CONDITION: PLOW, TREAT (TROUBLE SPOTS ONLY) @ 200-400lt/LnMi.

* Note: Salt should be treated with 7-10 gallons of a liquid chloride product. Rates shown account for a 25 mph truck operating speed, but also apply for trucks equipped with Zero Velocity or Slurry Generator operating up to 35 mph.

Updated August 2013

http://inside.michigan.gov/sites/mdot/highways/ops/maintenance/winternet/Documents/New%20Salt-Sand%20Application%20Rate%20Chart.pdf

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Best Practices Advisory

Maintenance Advisory

MA 2013-01
August 27, 2013

From Mark Geib, Engineer of Operations Field Services Division

Best Practices for Applying Deicing Materials

MDOT
Operations Field
Services Division
8333 Lansing Road
Lansing, MI 48917

Questions regarding this advisory should be directed to:

Tim Croze
Engineer Manager
Region Support
Phone:517-322-3394
CrozeT@michigan.gov

Justin Droste
Roadway Operations
Engineer
Phone:517-636-0518
DrosteJ@michigan.gov

Due to increasing costs and growing environmental concerns regarding the use of deicing materials for winter maintenance operations, it is critical we do everything possible to reduce the use of these materials, while still providing adequate levels of service. A major component of reducing the amount of deicing material required is conducting operations in ways that limit the amount of material that bounces and scatters off the roadway during application. The 2012 MDOT Salt Bounce and Scatter Study concluded that using pre-wet salt and applying deicing materials at slower speeds significantly increases the amount of material that stays on the roadway. Incorporating these practices into MDOT's winter operations program will ensure that as much deicing material as possible remains on the roadway and within the target area (4' on either side of the centerline), where it is most effective.

In order to keep the most deicing material on the roadway during the application process, the following guidelines should be followed *(for all MDOT maintenance facilities beginning with the 2013/2014 season)*:

1. The truck's speed should operate between 20-25 mph while applying deicing material. Every effort should be made to maintain as slow a speed as possible while applying deicing material.

   Justified exceptions to this practice may include:
   - Peak hours on high-speed roads
   - Trucks equipped with technology that limits salt scatter, such as zero-velocity spreaders, slurry generators, etc. Based on results from the 2013 MDOT Salt Bounce and Scatter Study, these advanced systems should not operate faster than 35 mph.
   - Other circumstances approved by the Region Engineer

2. All salt applied to a roadway should be pre-wet with a liquid chloride product. Rates of pre-wetting should be between 7 to 10 gallons per ton of untreated salt (salt slurry will require more, per manufacturer's recommendations). Salt can be treated at the stockpile, by the truckload, or at the point of application on the truck.

3. For all material delivery systems that allow it, a "boot" sleeve system, which decreases the amount of drop between the spreader and pavement, should be utilized (between 1-6 inches for a loaded truck). This decreases bounce and scatter, but not enough to maintain acceptable efficiencies at speeds above 25 mph.

4. The updated MDOT salt application rate chart should be followed. The chart has been revised to reflect the use of pre-wet salt at slower truck speeds.

MDOT maintenance facility supervisors must submit written plans for their facility to their Associate Region Engineer of Operations by October 1st of each year, detailing intended actions for implementation. Exceptions to these guidelines must be justified in writing on a case-by-case basis (example: per snow route). Consolidated action plans for each region should be submitted to the Engineer of Operations Field Services by October 15th of each year.

http://www.michigan.gov/documents/mdot/MA_2013-01_Best_Practices_for_Applying_Deicing_Materials_432480_7.pdf

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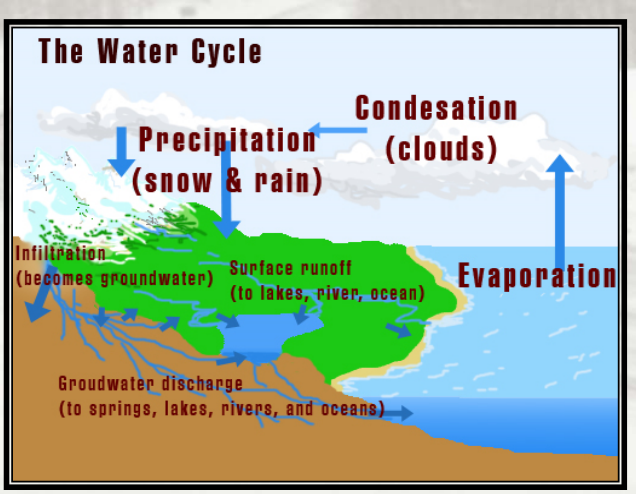
Environment



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Environment

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Environment

The U.S. Government has thresholds for pollutants

Federal Chronic Standard for Chlorides: 230 mg/l = 1 teaspoon salt in 5 gallons water

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Environment

1 tandem load of salt can easily contaminate 8 million gallons of water

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Bounce and Scatter 2013

Acknowledgements

- The Operations Field Service Staff
- The Southwest Region Staff
- The Coloma Maintenance Garage
- The Paw Paw Central Repair Facility
- The Southwest Region YDMP Students

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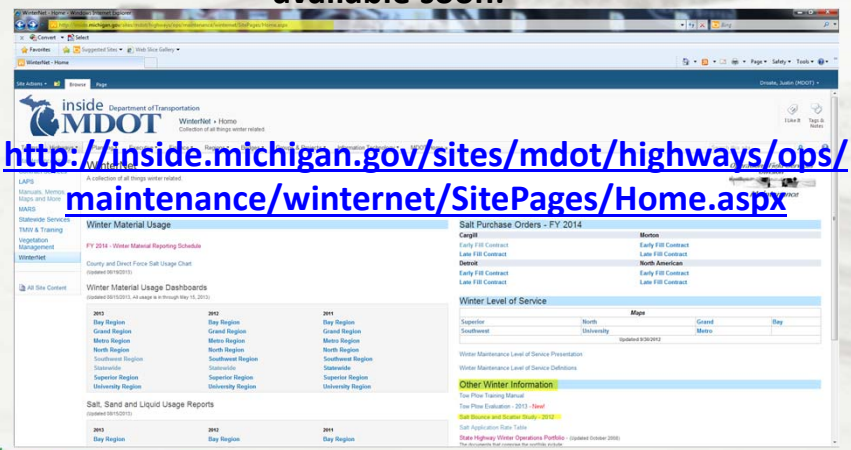
Access to Findings

A copy of the 2013 Salt Bounce and Scatter Report will be available soon:



http://inside.michigan.gov/sites/mdot/highways/ops/maintenance/winternet/SitePages/Home.aspx

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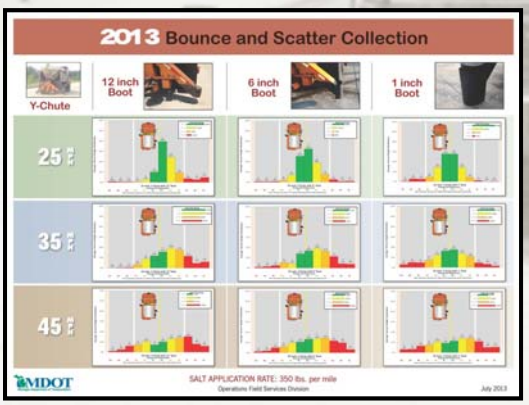
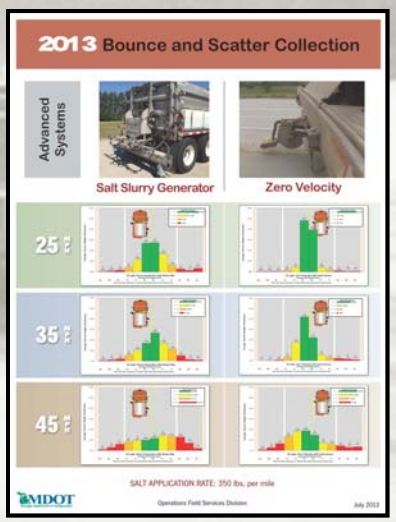
Posters





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Questions?

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