


**NEW GUIDELINES FOR SPREADER CALIBRATION**

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**Calibration Accuracy of Spreaders – A Completed Research Project**



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Report and Calibration Guide Available at :

[www.clearroads.org](http://www.clearroads.org)

**What is Clear Roads?**

- National pooled fund research program focused on winter highway operations
- Rigorous testing of winter maintenance materials, equipment and methods
- Emphasis on field testing, practical applications and usable results



**WHAT IS CALIBRATION?**

**To: Determine, Check, and Rectify the Graduation of any Measuring or Dispensing Device, Relative to a Known Standard**

**WHY CALIBRATE?**

- To Know What You are Doing
- \$
- To Know the Effects of Operational Changes (Along With Good Record Keeping)
- Environmental Responsibility

**WHAT EQUIPMENT, MATERIALS AND TOOLS DO I NEED TO CALIBRATE SNOW AND ICE CONTROL MATERIALS SPREADING EQUIPMENT?**

### Stuff Necessary for Calibration (1)

- **Accurate (Calibrated) Scales for Weighing Solid Materials and Calibrated Liquid Measuring Containers for Liquid Materials**
- **Solid Materials collection Devices Menu (do not need all)**
  - Plastic Tub
  - Tarp
  - Pails
  - Wheel Barrow
  - Mason's Mixing Tub

### Stuff Necessary for Calibration (2)

- Level
- Scale platform
- Stopwatch or Clock With a Minute Hand
- Calculator
- Knowledge of How To Estimate Partial Shaft Revolutions

### Stuff Necessary for Calibration (3)

- Provision for Removing Tested Material
- Shovels and Brooms
- Marking Devices (Markers or Scribes)
- Solvent and Rags



**CONTROLLING  
VARIABLES**

- Product Delivery
- Product Consistency
- Truck/Spreader Hydraulic System
- Amount of Material Discharged during Calibration
- Speed/Rate Discharge Dynamics

**CONTROLLING VARIABLES**  
ctd.

- Flight Bars
- Calibration Equipment
- Methodology for Determining Speed and Rate Constants for Controllers

**PRODUCT DELIVERY  
VARIABLES**

- Tunneling
- Chunks
- Inconsistent Delivery to Auger, Spinner or Gate

**PRODUCT VARIABILITY**

- Gradation
- Moisture Content
- Chinking
- Compaction
- Blending Ratios

**TRUCK/SPREADER  
HYDRAULIC SYSTEM  
VARIABLES**

Temperature of Hydraulic Fluid

System Pumping Capacity

**AMOUNT OF MATERIAL  
DISCHARGED DURING  
CALIBRATION VARIABLE**

There Must be a “Sufficient” Amount  
of Material Discharged During  
Calibration to Represent the Process

### CALIBRATION TEST EQUIPMENT AND METHODS VARIABLES

- Accuracy of Weighing Equipment
- Shaft Rotation Measurement Techniques/Devices
- Time Measuring Devices
- Volumetric Measuring Devices

### VOLUMETRIC MEASUREMENT

- Make Sure Devices have a Uniform Cross Section and Integral Bottom

### SPEED AND DELIVERY CONSTANTS VARIABLES

- Measured Distance
- Starting and Stopping Distance Measurements and Discharges
- Minimum Measured Distance
- Minimum Amount of Material Discharged
- Discharge Speeds Tested

### TYPES OF SOLID MATERIALS CONTROLLERS

- Manual
- Ground Speed



### GROUND SPEED CONTROLLERS

- Two types of ground-speed controllers:
  - open-loop
  - closed-loop
- Open-loop system uses a truck speed sensor to adjust auger or belt speed for desired application rate
- Closed-loop system uses both a truck speed sensor and an auger or belt speed sensor to control the application rate



### FUNDAMENTAL CALIBRATION CONCEPTS

- Having a Control System **Does Not** Guarantee Accurate delivery to the road
- The Controller is Part of a **System** that Must be Totally Compatible
- The Most Sophisticated System is of Little Value Unless it is Calibrated over the Range of Speeds and Discharge rates Normally Used

### CALIBRATING MANUAL SOLID MATERIALS

DATA NEEDED:

1. Shaft Revolutions per Minute at Each Conveyor Speed Control Setting
2. Amount of Material Discharged per Shaft Revolution
3. Gate Opening

**Fill in Chart**

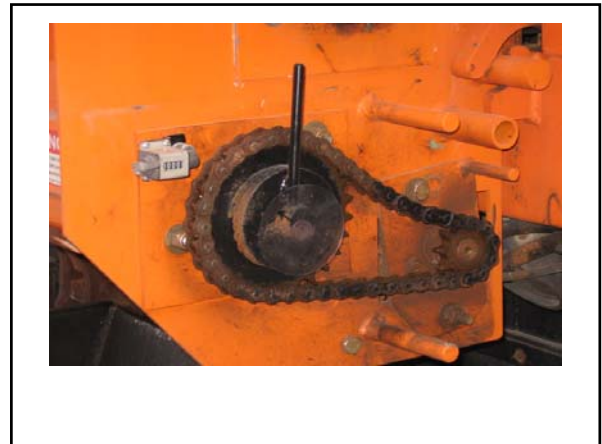
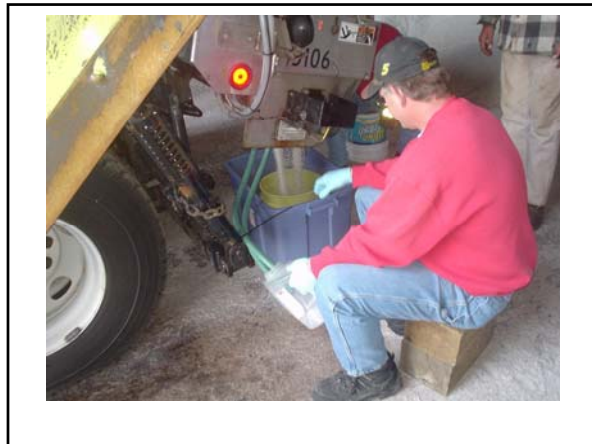
**CALIBRATION CHART**

Agency: \_\_\_\_\_  
 Location: \_\_\_\_\_  
 Truck No.: \_\_\_\_\_ Spreader No.: \_\_\_\_\_  
 Date: \_\_\_\_\_ By: \_\_\_\_\_

Control Setting	Shaft RPM (Hatched)	Discharge Rate (Lbs./Min)	POUNDS DISCHARGED PER MILE																	
			5 mph x 12.00	10 mph x 6.00	15 mph x 4.00	20 mph x 3.00	25 mph x 2.40	30 mph x 2.00	35 mph x 1.71	40 mph x 1.50	45 mph x 1.33									
1																				
2																				
3																				
4	5	20	100	1200	600	400	300	240	200	171	150	133								
5																				
6																				
7																				
8	20	20	400	4800	2400	1600	1200	960	800	684	600	533								
9																				
10																				
11																				

*SAMPLE CALCULATIONS*





**CALIBRATING GROU ND  
SPEED CONTROLLED  
SYSTEMS**

Two “Constants” have to be Determined :

- Speed
- Rate

### **SPEED CONSTANT**

- Speed Simulator (Speedometer Compatible)
- Traversing a Known Distance
- Jacking Rear of Truck and Running at Desired Speeds (Safety Sensitive Procedure)

### **RATE CONSTANT**

Determine the Amount of Material being Discharged per Shaft Revolution of the Drive Motor (As Indicated by the Electronic Sensor)

### **CALIBRATING LIQUID AND PREWETTING SYSTEMS**

#### Types of Systems

- Fixed Output (Limited Control)
- Gravity Output (Limited Control)
- Proportional Control
- True Ground Speed Control

### **RECOMMENDED PROCEDURES**

- About the Same as Solid Materials
- Be Very Careful to Make Sure Conditions Downstream of the Pump are Constant
- Pressure Sensitive Nozzles May be the Only True Method of Control

### **CALIBRATION HAND AND OTHER TYPES OF SOLID MATERIAL SPREADERS (1)**

1. Spread out a Tarp Large Enough the Collect the Full Width of Material Dispensed by the Spreader.
2. At the Normal Operating Speed, Run the Spreader across the Tarp While Dispensing Material ( Do Not Use Prewetted Material).

### **CALIBRATION HAND AND OTHER TYPES OF SOLID MATERIAL SPREADERS (2)**

3. Measure the Area of the Material on the Tarp in Square Feet.
4. Weigh the Material that is on the Tarp in Pounds. (NOTE: an Accurate Low Capacity Scale is Required)
5. Determine the Application Rate (Pounds Per Square Foot) by Dividing the Result of 4. By the result of 3..
6. Multiply 63360 by the Result of 5. This will be the Application Rate in Pounds per Lane Mile.



## ASSURING ACCURATE CALIBRATIONS

- Method Variables
- Equipment Variables
- Product Variables
- Truck, Controller and Delivery System Variables

## METHOD VARIABLES

- Manufacturer's Recommendations are Usually a Good Starting Point
- Clear Roads Calibration Guide
- Salt Institute for Manual Systems

## MINIMUM WEIGHT IN A "CATCH" TEST

- About 100 Pounds
- Make Sure you Observe the Delivery Stream for Continuity

## TESTING EQUIPMENT VARIABLES

All Testing Equipment Should be Calibrated or Checked for Accuracy

- Scales
- Liquid or Volumetric Measuring Containers
- Distance Measuring Devices

## PRODUCT VARIABLES

Use at Least ½ Truckload or Tank of "Representative" Material

- Gradation
- Moisture Content
- Composite ratios
- Screened to Eliminate Chunks Larger than Gate Opening



### Truck, Controller and Delivery System Variables

- Warm Truck and Hydraulic System
- Tailgate Spreaders Tested at Box Height Used on the Road
- Gate Openings “Straight”
- Disable any Controller Programming that Fully opens Valves when Starting
- Use Power Switch on Controller to Stop and Start Material Flow (if it does not change)

### VERIFICATION TESTING

Set Discharge Rate, Lbs./mi.	Test Speed mph	Test Time, seconds	Target Discharge, Lbs.	OK RANGE, LBS.
200	25	73	100.4	97.3 – 105.5
300	25	49	102.1	98.0 – 106.3
500	20	36	100	96.0 – 104.0
600	20	30	100	96.0 – 104.0

### WHILE CALIBRATING

YOU MUST  
PAY ATTENTION TO  
BUSINESS

### OPERATIONAL APPLICATION RATE VARIABLES

- Gate or Orifice Opening that Delivers Material to the Spinner
- Conveyor or Auger Speed
- Number of Lanes Being Treated

### DISCHARGE RATE AND APPLICATION RATE

Discharge Rate (pounds/mile)	Application Rate, pounds per lane-mile		
	Number of lanes being treated		
	1	2	3
100	100	50	33
200	200	100	67
300	300	150	100
400	400	200	133
500	500	250	167
600	600	300	200
700	700	350	233
800	800	400	267

### Application of Snow and Ice Control Materials



### Roadway Elements

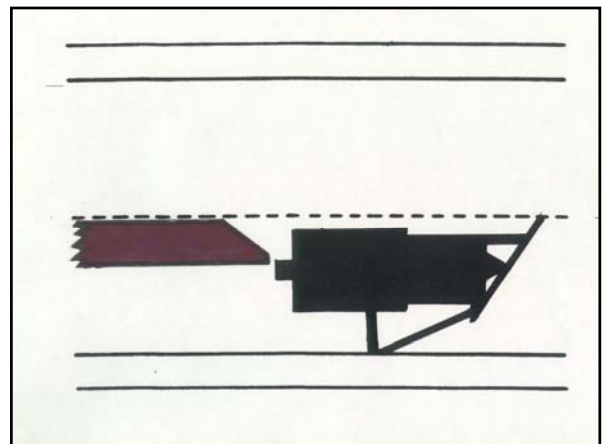
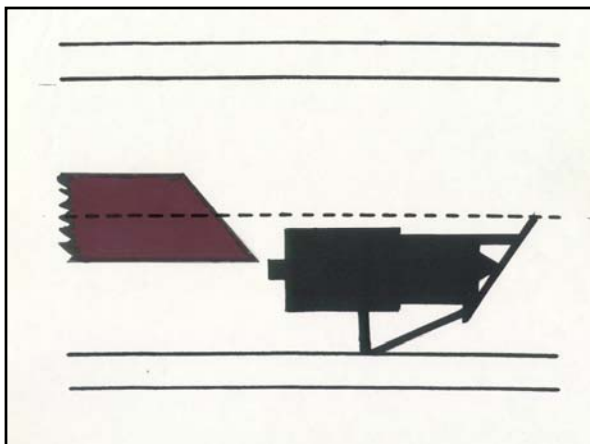
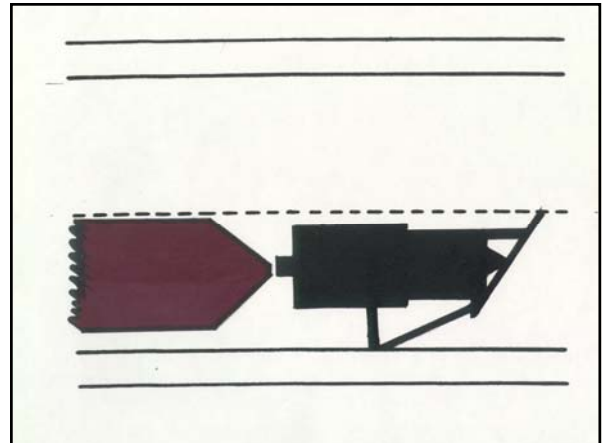
- Two-lane, two-way highways
- Multi-lane highways
- Parking areas and walkways
- Hills, curves, and intersections

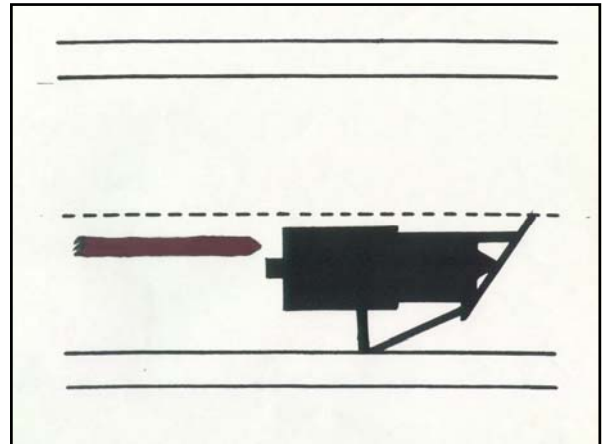
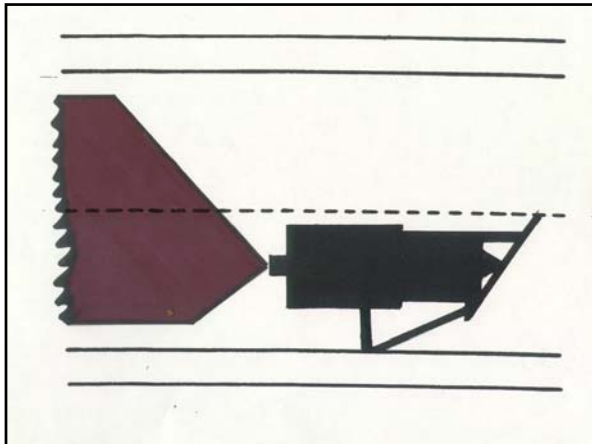
### Roadway Elements ctd.

- Bridges
- Strong crosswinds
- Curves
- Change in jurisdiction

### Spread Pattern Control

- Spinner Speed
- Drop Location on Spinner
- Deflectors / Skirts
- Direction of Spinner Rotation





### Worst Case Scenarios



### QUESTIONS ???

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