NEW GUIDELINES FOR SPREADER CALIBRATION

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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

Why Calibrate?

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

What is Calibration?

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

What Equipment, Materials and Tools Do I Need to Calibrate Snow and Ice Control Materials Spreading Equipment?

Calibration Accuracy of Spreaders – A Completed Research Project

Report and Calibration Guide Available at:

www.clearroads.org
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 VARIABIES
- 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**

<table>
<thead>
<tr>
<th>Gate Opening</th>
<th>Pounds Discharged per Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 100 200 300 400 500 600</td>
</tr>
</tbody>
</table>
CALIBRATING GROUND 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 to 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

<table>
<thead>
<tr>
<th>Set Discharge Rate, Lbs./mi.</th>
<th>Test Speed, mph</th>
<th>Test Time, seconds</th>
<th>Target Discharge, Lbs.</th>
<th>OK RANGE, LBS.</th>
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<tr>
<td>200</td>
<td>25</td>
<td>73</td>
<td>100.4</td>
<td>97.3 – 105.5</td>
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<tr>
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<td>25</td>
<td>49</td>
<td>102.1</td>
<td>98.0 – 106.3</td>
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<td>36</td>
<td>100</td>
<td>96.0 – 104.0</td>
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<td>600</td>
<td>20</td>
<td>30</td>
<td>100</td>
<td>96.0 – 104.0</td>
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</table>

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

<table>
<thead>
<tr>
<th>Discharge Rate (pounds/mile)</th>
<th>Application Rate, pounds per lane-mile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of lanes being treated</td>
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</tr>
</tbody>
</table>

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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