Calibration Why & How

TEAM KENTUCKY®
TRANSPORTATION CABINET

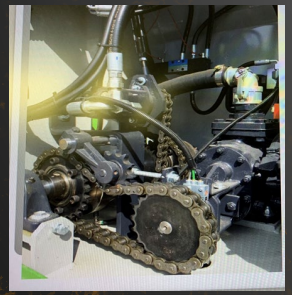
Before Calibration Begins

- Approved Mix Design
  - Have mix design in hand for calibration
  - If a double micro need leveling & surface design
- Pretest Microsurfacing Sand
  - Gradation
    - Supplemental Specifications 804.04.05
  - Sand Equivalent
- Certification that scales have been calibrated
- Walk around equipment looking for any fluid leaks
- Ensure that Microsurfacing sand has been run through screener
- Moisture test on Microsurfacing Sand

Microsurface

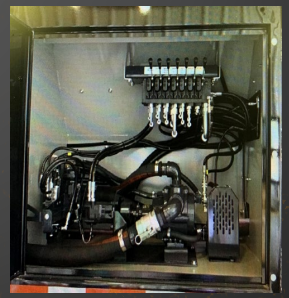
Mechanical Microsurfacing Machine

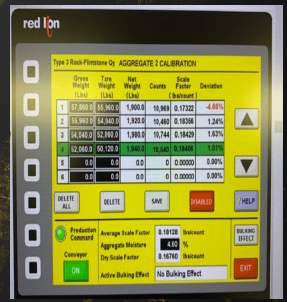
- Runs on a jackshaft
  - Jackshaft keeps aggregate & emulsion pump in the same ratio
- Adjustable gates
  - Achieve proper mix design
  - Lower gate increases % of emulsion
  - Raise gate decrease % of emulsion
- Use proper calibration sheet



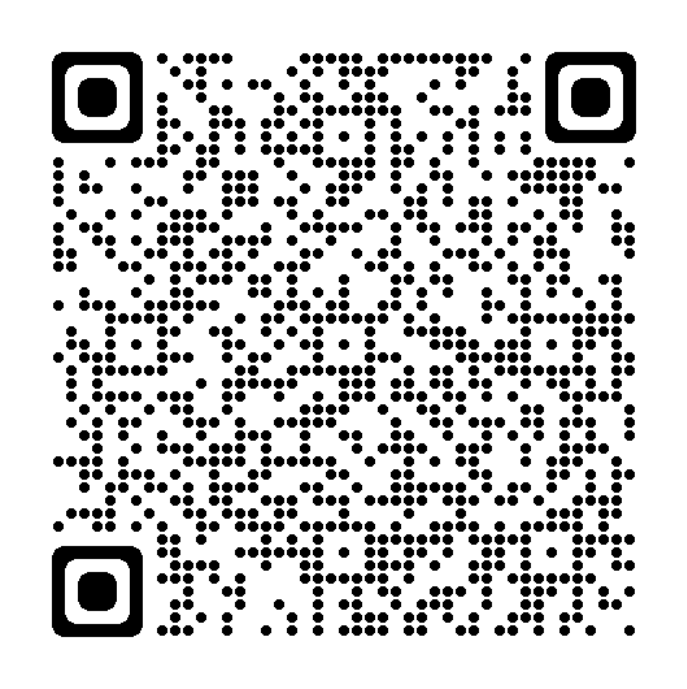
Electronic Microsurfacing Machine

- Uses a computer controlled hydraulic motor to separately control aggregate belt and emulsion pump.
- Computer maintains ratios of aggregate and emulsion.
- Radar keeps machine applying proper application
- Calibrate radar
- Use proper calibration sheet.





What A Link on Construction for Preventive Maintenance Resources



Calibration of Mechanical Paver

Emulsion

- 3 Readings
  - Start weight & Ending Weight
  - Start counts & Ending counts
  - Aggregate count
- All 3 readings within 2%

Microsurfacing Calibration Work Sheets

Unit No. _____ RPM _____ Date _____

I. Emulsion Calibration

Minimum of 50 Aggregate Counts

Trial	A Starting Weight	B Ending Emulsion Weight	C Net Emulsion Weight (B - A)	D Starting Emulsion Count	E Ending Emulsion Count	F Net Emulsion Count (E - D)	G Aggregate Count	H Emulsion lbs per Emul Count (C ÷ F)	I Emulsion lbs per Agg Count (C ÷ G)	J Within 2% Error Count for Emulsion ((H-H_1)÷H_1)×100
1	0	106	106	0	3074	3074	690	0.034482759	0.034482759	0.1
2	0	104	104	0	3017	3017	680	0.034471329	0.034471329	0
3	0	107	107	0	3108	3108	700	0.034427284	0.034427284	0.1
			Average Emulsion			Average (S)	Average Ag Count	Average (H_1)	Average (I)	
			105.666667			3066.33333	690	0.034460457	0.153140097	

Calibration of Mechanical Paver

Aggregate

- Put in % Moisture
- 3” Gate Setting 3 Readings
  - Start weight & Ending Weight
  - Start counts & Ending counts
  - All 3 readings with 2%
- 4” Gate Setting 3 Readings
  - Start weight & End weight
  - Start counts & End counts
  - All 3 reading within 2%
- 5” Gate Setting 3 Readings
  - Start weight & Ending Weight
  - Start counts & Ending counts
  - All 3 reading within 2%

II. Aggregate Calibration

% Moisture in Agg. In Decimal: 0.04 + 1.00 = Moisture Factor[1]: 1.04

	A	B	C	D	E	F	G	H
Agg. Gate Setting inches	Starting Weight	Ending Weight	Net Weight	Starting Aggregate Counts	Ending Aggregate Counts	Number of Aggregate Counts	Aggregate Lbs per Agg Count	Within 2% Error count
3			(B - A)			(E - D)	(C÷F)	$((C-G_1)\div G_1)\times 100$
1	0	272	272	0	310	310	0.877419355	0.8
2	0	275	275	0	314	314	0.875796178	0.6
3	0	255	255	0	297	297	0.858585859	1.4
							Average (G_1)	
							0.870600464	

Average Agg. Wt. per Agg. Count (G_1) _____ ÷ Moisture Factor[1] _____ = Dry Agg. Wt./Agg. Count (Y_1) 0.837115831

Page 1

	A	B	C	D	E	F	G	H
Agg. Gate Setting inches	Starting Weight	Ending Weight	Net Weight	Starting Aggregate Counts	Ending Aggregate Counts	Number of Aggregate Counts	Aggregate Lbs per Agg Count	Within 2% Error count
4			(B - A)			(E - D)	(C÷F)	$((C-G_2)\div G_2)\times 100$
1	0	352	352	0	311	311	1.131832797	1.5
2	0	352	352	0	305	305	1.154098361	0.5
3	0	354	354	0	305	305	1.160655738	1
							Average (G_2)	
							1.148862299	

Average Agg. Wt. per Agg. Count (G_2) 1.148862299 ÷ Moisture Factor[1] _____ = Dry Agg. Wt./Agg. Count (Y_2) 1.104675287

	A	B	C	D	E	F	G	H
Agg. Gate Setting inches	Starting Weight	Ending Weight	Net Weight	Starting Aggregate Counts	Ending Aggregate Counts	Number of Aggregate Counts	Aggregate Lbs per Agg Count	Within 2% Error count
5			(B - A)			(E - D)	(C÷F)	$((C-G_3)\div G_3)\times 100$
1	0	430	430	0	301	301	1.428571429	0.2
2	0	430	430	0	303	303	1.419141914	0.4
3	0	440	440	0	308	308	1.428571429	0.2
							Average (G_3)	
							1.425428257	

Calibration of Mechanical Paver

Cement

- 3 Readings
  - Start weight & Ending Weight
  - Start counts & Ending counts
- All 3 readings within 2%

Page 2

III. Cement Calibration

Cement	A Starting Weight	B Ending Weight	C Net Weight	D Start Cement Count	E End Cement Count	F Number of Cement Counts	G Cement Lbs per Cem. Count	H Within 2% Error count
			(B - A)			(E - D)	(C÷F)	$((C-G_1)\div G_1)\times 100$
1	0	9.9	9.9	0	706	706	0.014022663	1
2	0	10.1	10.1	0	714	714	0.014145658	0.1
3	0	10.2	10.2	0	713	713	0.01430575	1
							Average (G_1)	
							0.014158024	

Calibration of Mechanical Paver

Water

- 3 Readings
  - Start weight & Ending Weight
  - Start counts & Ending counts
- All 3 readings within 2%

IV. Water Calibration

	A	B	C	D	E	F	G	H
Water	Starting Weight	Ending Weight	Net Weight	Start Water Reading	End Water Reading	Number of Gallons	Water Gal per Gal Count	Within 2% Error count
			(B - A)			(E - D)	(C÷F)	$((C-G_1)\div G_1)\times 100$
1	0	35	35	0	412	412	0.084951456	1.3
2	0	33	33	0	395	395	0.083544304	0.4
3	0	32	32	0	385	385	0.083116883	0.9
							Average (G_1)	
							0.083870881	

Calibration of Mechanical Paver

Now what do I need a mix design for?

Put in the % Emulsion per Mix Design.

Where you Say !

Determine the gate setting that will be used by plotting a graph. The vertical axis will be scaled and labeled as the Dry Aggregate Weight per Aggregate Count and the horizontal axis is the gate setting. Plot three points on the graph by using the different gate settings that was used during calibration along with the corresponding dry aggregate weight per aggregate count. Draw a straight line to connect the three points.

From the mix design obtain the percent of emulsion that will be used for the mixture. On the vertical axis draw a horizontal line from the value calculated from the average weight of emulsion per emulsion count that was determined during the emulsion calibration and is labeled as Average (S) divided by the emulsion percentage from the mix design in decimal form.

	Emulsion P.C.	0.153140097	(I)	%Emulsionper design	0.117	(P)	I/P	1.308889715

Once the horizontal line touches the straight line, draw a vertical line down to determine the aggregate gate setting that will be used.

Calibration of Mechanical Paver

NOW WHAT the *@**

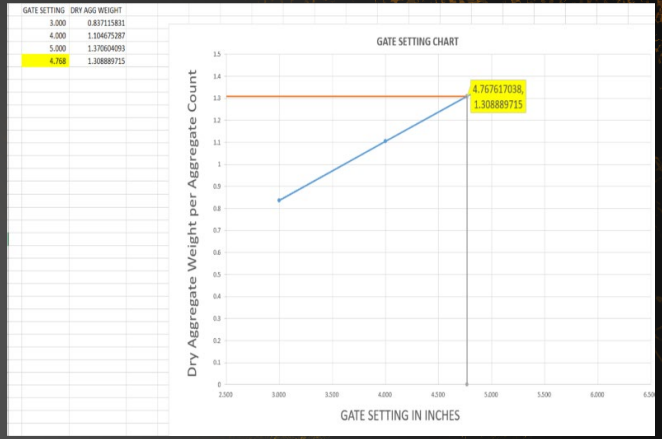
Go to the Graph tab at the bottom

Now the spreadsheet has graphed your Calibration information!

BAM!!! Now you know your gate setting!

Thanks Greg!

GATE SETTING	DRY AGG WEIGHT
3.000	0.837115831
4.000	1.104675287
5.000	1.370604093
4.768	1.308889715



Calibration of Mechanical Paver

When Calibrated drop a pile of mix.

MICRO SURFACING / SLURRY SEAL DESIGN

TERRY ASPHALT MATERIALS INC

Job Identifiers: Campbell County
KYTC 222025

Project No. / Contract ID:

Customer Strawser Construction

Job Mix Formula

Component	Amount
Aggregate	100%
Cement	1.0% ± 0.5%
Tot. water (wc, agg moist. 3%)	9.0% ± 1.0%
Emulsion	11.7% ± 0.5%
Residual	7.8% ± 0.3%
Additive	0% ± 0.04%

Aggregate data

Supplier: Hanson Plum Run
Type: Type II

Sieve	% Passing	Spec
3/8 in.	100%	100
No. 4	97%	90-100
No. 8	72%	60-80
No. 16	47%	40-75
No. 30	31%	25-50
No. 50	21%	15-30
No. 100	15%	10-21
No. 200	11.1%	5-15

Quant eff of moist
6%-98.3 lbs/cu. ft.
5%-95.3 lbs/cu. ft.
5%-91.1 lbs/cu. ft.
5%-88.0 lbs/cu. ft.
4%-85.7 lbs/cu. ft.
5%-83.1 lbs/cu. ft.
6%-85.9 lbs/cu. ft.

Soundness	LA Abrasion	Sand Eqv
1.9	28	75

Moisture%
3%

Emulsion data

Supplier: Terry Asphalt
Type: CQS-1HP

Test on emulsion	Result	Spec
Residual solids, pct.	66.7	62.0 min.
Storage stability, pct.	0.8	1 max
Particle charge	Positive	Positive
Viscosity, Saybolt, 25°C, sec.	40	20 - 100
Sieve, pct.	0.00	0.10 max

Test on residue	Result	Spec
Penetration, 25°C, dmm	53	40-90
Ductility, 25°C, cm	82	40 min
Elastic recovery, 10°C, pct.	60	45 min
Solubility in TCE, pct.	99.8	97.5
Softening point, °C	63	60°C min.

Mixture performance data

Test		Result @ 7.8%		Spec
Mix time @ 77F (25C), TB113		160 seconds		Ctrl to 120 Sec. Min.
Mix time @ 104F (40C), TB113		45 seconds		Ctrl to 35 Sec. Min.
Cohesion @ 30min, TB139		14 N kg-cm		12 kg-cm Min.
Cohesion @ 60min, TB139		21 N kg-cm		20 kg-cm or NS Min.
Wet stripping test, TB114		99%		Pass (90% Minimum)
WTAT 1 hour, TB100		130 g/m2		538 g/m2 Max
WTAT 6 day, TB100		395 g/m2		807 g/m2 Max
Lateral displacement, TB147		0.92%		5% Maximum
Excess asphalt/sand adhesion, TB109		21 g/ft2		50 g/ft2 Maximum
Schulze-Breuer and Ruck, TB144		1.1 g		2.0 g max

Designed by: B. Behrens
QA Technician

5/31/2022

Calibration of Electronic Paver

Emulsion

- 3 Readings
  - Start weight & Ending Weight
  - Start counts & Ending counts
- All 3 readings within 2%

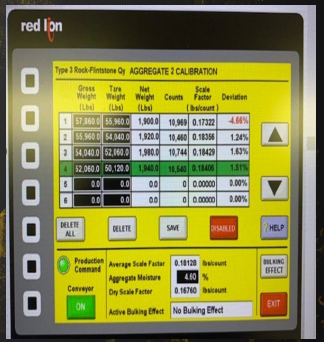
Microsurfacing Calibration Work Sheets

Unit No. _____ Date _____

RPM _____

Emulsion Calibartion

	A	B	C	D	E	F	G	H
Agg. Gate Setting inches	Starting Weight	Ending Weight	Net Weight	Starting Emulsion Counts	Ending Emulsion Counts	Number of Emulsion Counts	Emulsion Lbs per Count	Within 2% Error count
			(B - A)			(E - D)	(C÷F)	((C-G_1)÷G_1)×100
1			0			0	0	#DIV/0!
2			0			0	0	#DIV/0!
3			0			0	0	#DIV/0!
							Average (G_1)	
							0	



Calibration of Electronic Paver

Aggregate

- % Moisture
- 3 Readings
  - Start weight & Ending Weight
  - Start counts & Ending counts
- All 3 readings within 2%

II. Aggregate Calibration

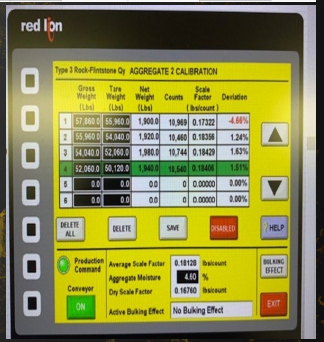
% Moisture in Agg. in Decimal | +1.00=Moistue Factor | 1

Agg. Gate Setting inches	A Starting Weight	B Ending Weight	C Net Weight	D Starting Aggregate Counts	E Ending Aggregate Counts	F Number of Aggregate Counts	G Aggregate Lbs per Agg Count	H Within 2% Error count
			(B - A)			(E - D)	(C÷F)	$((C-G_2)\div G_2)\times 100$
1			0			0	#DIV/0!	#DIV/0!
2			0			0	#DIV/0!	#DIV/0!
3			0			0	#DIV/0!	#DIV/0!
							Average (G_2)	
							#DIV/0!	

Average Agg. Wt. per Agg. Count (G_2) | #DIV/0! | ÷ Moisture Factor¹ | 1 | Dry Agg.Wt./Agg.Count(Y3) | #DIV/0!

Agg. Gate Setting inches	A Starting Weight	B Ending Weight	C Net Weight	D Starting Aggregate Counts	E Ending Aggregate Counts	F Number of Aggregate Counts	G Aggregate Lbs per Agg Count	H Within 2% Error count
			(B - A)			(E - D)	(C÷F)	$((C-G_3)\div G_3)\times 100$
1			0			0	#DIV/0!	#DIV/0!
2			0			0	#DIV/0!	#DIV/0!
3			0			0	#DIV/0!	#DIV/0!
							Average (G_3)	
							#DIV/0!	

Average Agg. Wt. per Agg. Count(G_3) | #DIV/0! | ÷ Moisture Factor¹ | 1 | Dry Agg.Wt./Agg.Count(Y3) | #DIV/0!



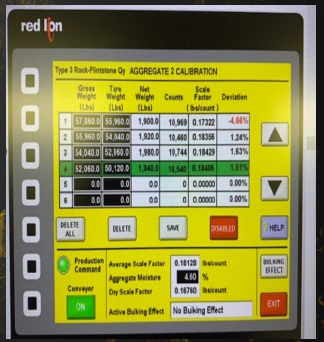
Calibration of Electronic Paver

Cement

- 3 Readings
  - Start weight & Ending Weight
  - Start counts & Ending counts
- All 3 readings within 2%

III. Cement Calibration

	A	B	C	D	E	F	G	H
Cement	Starting Weight	Ending Weight	Net Weight	Start Cement Count	End Cement Count	Number of Cement Counts	Cement Lbs per Cem. Count	Within 2% Error count
			(B - A)			(E - D)	(C÷F)	$((C-G_1)\div G_1)\times 100$
1			0			0	#DIV/0!	#DIV/0!
2			0			0	#DIV/0!	#DIV/0!
3			0			0	#DIV/0!	#DIV/0!
							Average (G_1)	
							#DIV/0!	



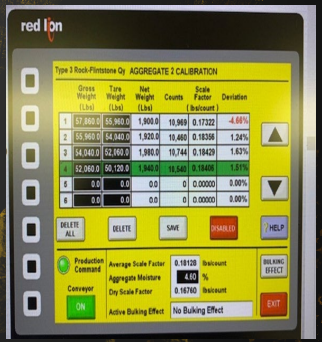
Calibration of Electronic Paver

Water

- 3 Readings
  - Start weight & Ending Weight
  - Start counts & Ending counts
- All 3 readings within 2%

IV. Water Calibration

Water	A Starting Weight	B Ending Weight	C Net Weight	D Start Water Reading	E End Water Reading	F Number of Gallons	G Water Gal per Gal Count	H Within 2% Error count
			(B - A)			(E - D)	(C÷F)	$((C-G_1)\div G_1)\times 100$
1			0			0	#DIV/0!	#DIV/0!
2			0			0	#DIV/0!	#DIV/0!
3			0			0	#DIV/0!	#DIV/0!
							Average (G_1)	
							#DIV/0!	



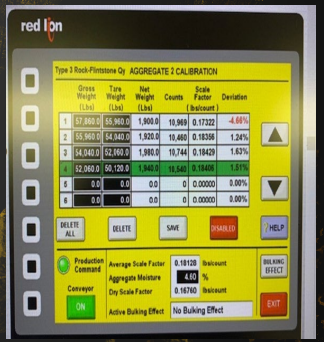
Calibration of Electronic Paver

Distance (That's Different)

- 3 Readings
  - Measured Distance
  - Counts
- All 3 readings within 2%

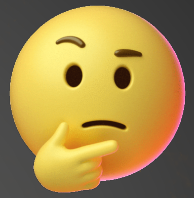
Why Micro Machine runs on Radar

Distance Calibration				
	Minimum of 500' perferred 1000'			
	Distance			
	Measured Feet	**Counts**	**Inches /Count**	**Deviation**
1			#DIV/0!	#DIV/0!
2			#DIV/0!	#DIV/0!
3			#DIV/0!	#DIV/0!
4				
5				
6				
			Average	
			#DIV/0!	



When Should You Recalibrate

- Replace emulsion pump
- Replace water pump
- Additive pump
- Replace aggregate belt or skirting
- Replace tips to pug mill
- Change mix design



Troubleshooting Microsurface

Debonding

- Any petroleum fluids on pavement
- Dirt on roadway
- Vegetation growing in roadway
- Aggregate falling in front of box under paver
- No tack used on asphalt surface
- Traffic on microsurface too soon
- Dragging Box Out

Raveling

- Slight amount is common
  Leveling Course will ravel more than Surface Course
- Cooler Temperatures
- Microsurface not being placed at proper thickness (too thin)
- Traffic allowed on mat too soon
- Rain before final cure is achieved

Troubleshooting Microsurface

- Washboard Texture
  - Paving too fast
  - Rubber strike off needs adjustment
- Cure Time Too Fast
  - Excessive cement
  - No enough additive
  - High ambient/pavement temperatures
  - Emulsion Temperature too hot
  - Too little water
  - Not Fogging pavement with water in front of spreader box
  - Too many fines in Microsurfacing sand

Troubleshooting Microsurface

- Cure Time Too Slow
  - Insufficient Mineral Filler(Cement)
  - Too much additive
  - Too much water
  - Emulsion formulated for different temperature range
- Surface Mat Inconsistencies
  - Paving too fast
  - Running material to light
  - Aggregate rolling over crack seal
  - Oversize Material
  - Excessive liquids floating emulsion to top
  - Chevron Pattern
    - No Cement
    - Spreader box too low

Troubleshooting Microsurface

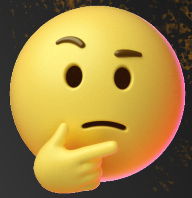
- Emulsions for Microsurface
  - Early Spring & Late Fall can separate
    - Stringy material in mat
  - Temperature cause & effects
    - 75 degrees and below
      - Emulsion can separate or fall apart
    - 125 degrees
      - Emulsion can cause microsurface to break too fast

Troubleshooting Microsurface

- Microsurface Completed 8/15/2018
- Picture Taken March 16, 2023

- Cost of repair
  - 17,556’ x 4’ = 70,224 sq’
  - 70,224 sq’ / 9 = 7803 sq yards
  - 7803 x 110 = 430 tons Asphalt
  - 430 tons of Millings
  - Striping
  - Now 2 joints
  - Public Complaints

Calibration of Distributor



Why???? & How

- What to check
  - Nozzle size, angle of nozzles & bar height
  - Temperature of material
  - Application rate
- Now What
  - Get puppy pads, carpet padding or geotextile fabric
  - Gorilla tape
  - Refrigerant scale
  - Small mop bucket
  - Garbage bags
  - Gloves
  - Covers for boots

Calibration of Distributor

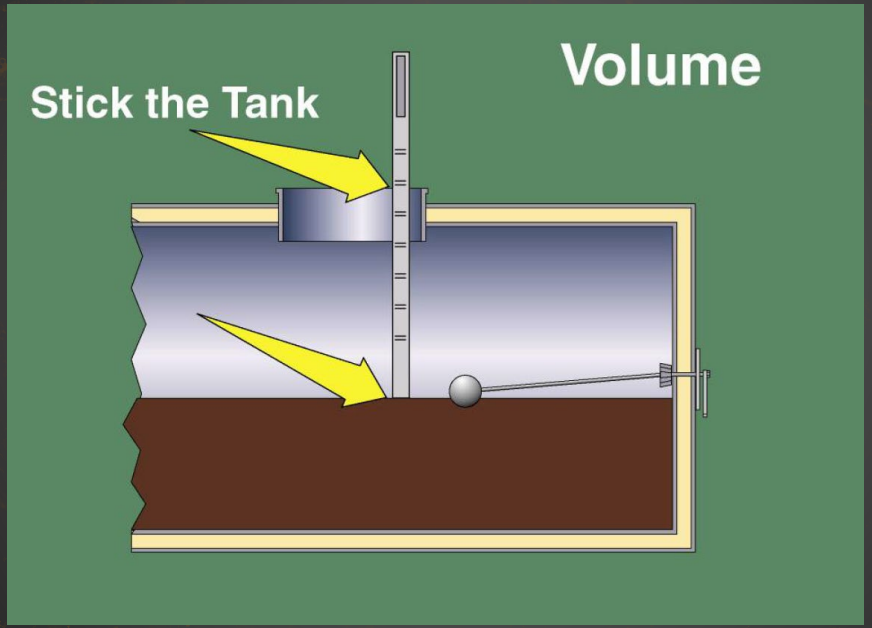
- Have the Bill of Lading (Green sheet)
  - Need pounds per gallon off sheet
  - Enter the pounds per gallon onto spreadsheet
  - Also enter the application rate in gallons per square into the spreadsheet
- Tare weight
  - Weight of bucket with garbage bag, gloves and whatever pad you use dry
  - Enter weight into spreadsheet
- Measure Sample pad
  - Enter that measurement in inches into spreadsheet
- Lay down and secure pad
- Have distributor spray over pad
  - Pickup pad and place it and your gloves in the bucket
  - Enter the weight

This will calculate the actual application rate

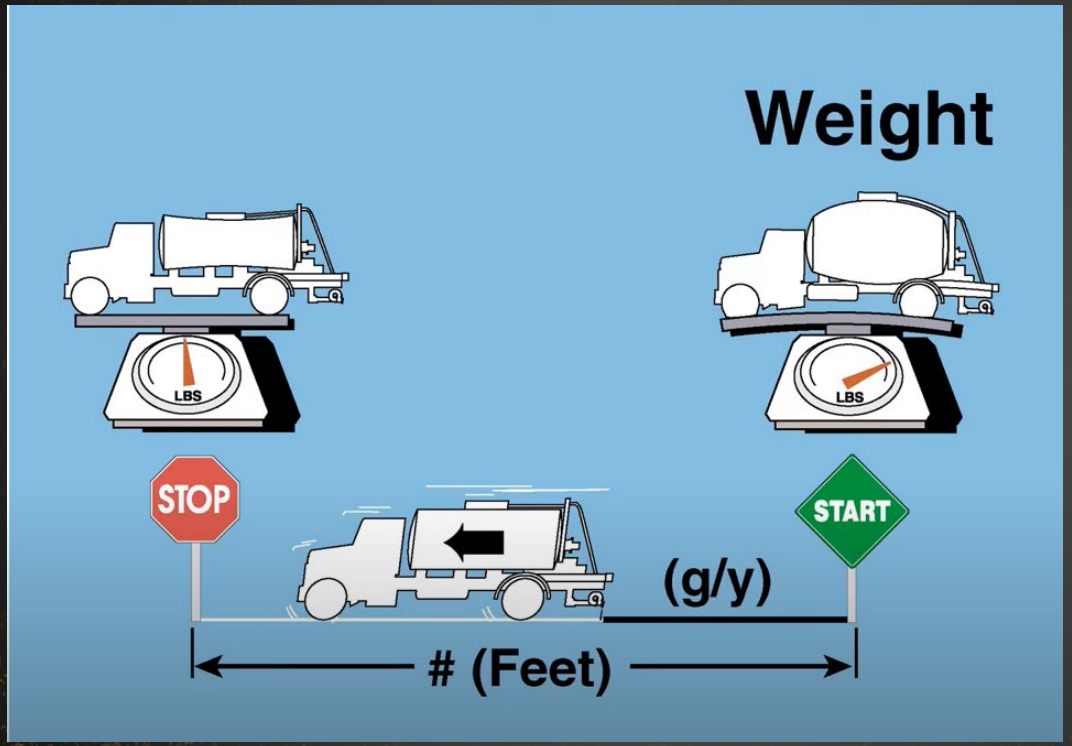
Verify Calibration of Distributor

	Theoretical Application Rate
	Lbs. per gallon (found on "green sheet" (bill of lading)
	Rate of Application in gallons per square yard
	Lbs. per square yard
	Calculated Emulsion Sample Weight
	Weight of Sample (Lbs)
	Tare Weight of Pad (Lbs)
	Weight of Sample minus Tare (Lbs)
	Calculated Sample Pad Dimensions
	Length (inches)
	Width (inches)
	Sq Yards of Sample Pad
	Actual Emulsion Sample Weight
	Line 4 Lbs. per square yard
	Line 16 Square Yards of Sample Pad
	Lbs per Sample Pad
	Actual Vs Theoretical
	Line 11 Actual Weight of Sample Minus Tare
	Line 21 Theoretical Weight of Sample Pad
#DIV/0!	% of Deviation Between Theoretical & Actual
	Confirmed Application Rate
#DIV/0!	Gallons per square yard

Calibration of Distributor



Calibration of Distributor



Questions???