APPENDIX C: ISSA EQUIPMENT CALIBRATION PROCEDURE

D. Equipment Calibration

A mix design is proportioned by weight while the placement machines deliver materials by volume. Due to the differing nature of the measurements, it is essential that calibration be completed using the actual job materials. No machine should be allowed to work on a job without a proper calibration.

1. Calibration Theory

In slurry systems, all mix designs and formulations are based on the combined weight of **dry** aggregate and **dry** mineral filler (if used). Corrections for moisture in the aggregate could be necessary. To set the placement machine(s) to a given JMF and to produce a consistent material, accurate proportion information is critical. Setting the placement machine feed rates of aggregate, mineral filler, emulsified asphalt, water, and additive is critical to the successful application of a slurry system treatment.

Calibration is necessary to:
- Set a machine to a given job mix formula (JMF),
- Maintain mix design consistency on all placement equipment when using two or more placement machines on a project, and
- Establish a basis of data received from a given placement machine.

A proper calibration is predicated on:
- All weights based on the combined weight of **dry** aggregate and the weight of mineral filler (if used). The aggregate in the field or at the calibration site may include moisture, and the weights must be corrected to account for it.
- The emulsified asphalt and aggregate must be mixed in the desired proportions, which means calibrating to a common unit such as revolutions of the jackshaft, head pulley, or sprocket. The ISSA prefers to use the head pulley because the placement machines have an aggregate counter that is very accurate and readable at this location. Most contractors will typically refer to the rock counter or aggregate counter during calibration.
- A sufficient amount of the each materials must pass through the placement machine to allow more accurate results.

Calibration Procedures

Slurry seal / micro surfacing placement machines require calibration because the equipment does not mix in batches. Rather, current machines use a continuous feed of raw ingredients (aggregate, asphalt emulsion, fines, water and additive) to the front of the pugmill (mixing device), while a homogeneous mix of all these ingredients is continuously delivered to the spreader box from the back of the pugmill.

Continuous feed should not be confused with continuous paving. In a truck mounted operation, the materials are fed as a continuous feed of raw ingredients, and the placement machine places material until the paver is empty and then returns to the stockpile for refill.

In continuous paving operation, the materials are also fed as a continuous feed of raw materials, but the placement machine stays on the jobsite, while Mobile Support Units (also called nurse trucks or feeder trucks) bring the raw materials to the placement machine, thereby allowing the paving operation to be continuous.

Asphalt Emulsion Calibration Procedure
for
Positive Displacement Pumps

1. Connect the production emulsion pump output to a container.
2. Run the pump long enough to fill the connection hose with emulsion to ensure all runs are the same.
3. Zero the counter before each run.
4. Pump a large enough sample of emulsion on each of three runs to ensure the accuracy will be 2% or better. The sample size is calculated by dividing the accuracy of the scale by 2% (0.02).

   For example, if weighing the emulsion sample in a barrel on a platform scale with an accuracy of ± 1 pound, the minimum sample needs to be 50 pounds (1 lb/0.02).

   Determine the net weight for each run by weighing either the placement machine (on a truck scale) before and after the run or weighing the emulsion pumped (on a platform scale). Divide the net weight pumped by the number of counts of the rock/aggregate belt for the three test samples and record the pounds per count for each.
5. Average the pounds per count of the three runs.
6. The placement machine should deliever such volumetric consistency that the deviation for any individual emulsion run shall not exceed 2 percent of the mathematical average of three runs.
7. The average pounds per count results will be used in the gate setting calculations.

Dry Additive / Mineral Filler Calibration Procedure

1. Run the mineral filler auger long enough to ensure the auger is full of material.
2. Use a small pan or container to catch the mineral filler from the delivery auger before it is deposited in the mixer.
3. Zero the counter before each run.
4. Deliver a large enough sample of mineral filler on each of three runs to ensure the accuracy will be 2% or better. The sample size is calculated by dividing the accuracy of the scale by 2% (0.02).

   For example, if weighing the mineral filler sample on a platform scale with an accuracy of ± 0.1 pound, the minimum sample needs to be 5 pounds (0.1 lb/0.02).

   Determine the net weight for each run by weighing the mineral filler delivered. Divide the net weight delivered by the number of counts for the three test samples and record the pounds per count for each.
5. Average the pounds per count of the three runs.
6. The placement machine should deliever such volumetric consistency that the deviation for any individual mineral filler run shall not exceed 2 percent of the mathematical average of three runs.
7. Follow the procedure provided by the equipment manufacturer to set the mineral filler auger rate.

Aggregate Calibration Procedure

1. Test the moisture of the aggregate. Calculate the moisture factor.
2. Moisture factor is the percent (in decimal format) of moisture in the aggregate + 1.00.

> Example:
> Moisture is 5%, therefore the moisture factor is:
> 0.05 + 1.00 = 1.05 Moisture factor

3. Select and record three gate openings and prepare a graph comparing gate opening to pounds per count.
4. Oversized aggregate should be removed by screening prior to loading into the transport vehicle or placement machine. Weighing the aggregate should be completed after the screening operation. Set the aggregate counter to zero.
5. Run a large enough sample of material per gate setting to ensure the accuracy to be 2% or better. The sample size is calculated by dividing the accuracy of the scale by 2% (0.02).

   For example, if weighing the entire placement machine on a truck scale with an accuracy of ± 20 lbs (9 kg), the minimum sample needs to be 1000 lbs (454 kg) (20 lbs/0.02).

   Determine the net weight for each run by weighing either the placement machine before and after the run or weighing the aggregate conveyed. Divide the net weight conveyed by the number of counts of the rock/aggregate belt for three test samples for each of the three gate settings, and record the pounds per count for each.
6. The placement machine should deliver such volumetric consistency that the deviation for any individual aggregate delivery rate check-run shall not exceed 2 percent of the mathematical average of three runs.
7. Determine the average dry weight per count by dividing the average pounds per count for each gate setting by the moisture factor and plot the results to the graph. If a plotted straight line is not acquired on the graph, re-run the tests.
8. Determine the required pounds per count of aggregate by either of the following formulas:
   - Pounds per count of emulsion divided by the emulsion percentage required from the JMF.
   - Pounds per count of emulsion divided by [residual asphalt required from the JMF divided by percent residual asphalt in the emulsion].
9. Set gate to the required setting by finding the gate setting that corresponds to the required pounds per count on the plotted line on the graph.
10. To check the gate setting for accuracy, run a small amount of material past the gate to establish the flow and fill the gate.
11. Reset the rock/aggregate counter to zero.
12. Run material out of the machine and note the counts.
13. Determine the net weight. Determine the pounds per count calculated, then compare to the required pounds per count.

F. Field Calibration Procedure Worksheets

Job # _____   Unit # _____   Date _____

Aggregate Calibration

Minimum 50 counts of the Rock Belt counter per Sample (3 Samples Per Gate Setting)

GATE SETTING (Inches) 3	Full Weight LBS	Empty Weight LBS	Net Weight LBS (= Full - Empty)	No. of Counts	LBS per Count
Sample 1					
Sample 2					
Sample 3					

Avg Wet Agg. Lbs./Count _____   Moisture Factor _____   Dry Agg. Lbs./Count_____

GATE SETTING (Inches) 4	Full Weight LBS	Empty Weight LBS	Net Weight LBS (= Full - Empty)	No. of Counts	LBS per Count
Sample 1					
Sample 2					
Sample 3					

Avg Wet Agg. Lbs./Count _____   Moisture Factor _____   Dry Agg. Lbs./Count_____

GATE SETTING (Inches) 5	Full Weight LBS	Empty Weight LBS	Net Weight LBS (= Full - Empty)	No. of Counts	LBS per Count
Sample 1					
Sample 2					
Sample 3					

Avg Wet Agg. Lbs./Count _____   Moisture Factor _____   Dry Agg. Lbs./Count_____

Data must be entered in the Full Weight, Empty Weight, and Number of Counts Columns.
No additional data is needed.
*** Gate Settings and the Moisture Factor Must Be Adjusted per Calibration. ***
*** Moisture Factor = Moisture Content (in decimal) 0.____ +1.00 ***
*** DON'T FORGET TO ENTER DATE & UNIT NUMBER ***

Emulsion Calibration

Emulsion	Full Weight LBS	Empty Weight LBS	Net Weight LBS (= Full - Empty)	No. of Counts	LBS per Count
Sample 1					
Sample 2					
Sample 3					

Avg. Lbs / Count of Emulsion _____

Desired Emulsion % [_____]

Data must be entered in the Full Weight, Empty Weight, and Number of Counts Columns.
Desired emulsion percentage must also be entered.
*** DON'T FORGET TO ENTER DATE & UNIT NUMBER ***

Cement / Fines Calibration

Cement / Fines	Full Weight LBS	Empty Weight LBS	Net Weight LBS (= Full - Empty)	No. of Counts	LBS per Count
Sample 1					
Sample 2					
Sample 3					

Average Lbs / Count of Fines _____

Desired Cement % [_____]

(Must Type 0.__%)

*** Data must be entered in the Full Weight, Empty Weight, and Number of Counts Columns.
Desired Cement percentage must also be entered. ***
*** DON'T FORGET TO ENTER DATE & UNIT NUMBER ***