Recommend Approval: Assistant Division Chief — Date 12-17-12; Division Chief — Date 12/17/12	Maryland Department of Transportation State Highway Administration Office of Materials Technology MARYLAND STANDARD METHOD OF TESTS	
Approved: Director — Date 01/17/13	CALIBRATING CONCRETE MOBILE MIXERS	MSMT 558

SCOPE:

This procedure is used to calibrate concrete mobile mixers so that the designed mixes will remain uniform throughout the project. It is recommended that this procedure be repeated several times a year since the consistency and quality of cement is subject to change.

MATERIALS AND EQUIPMENT:

1. Scale - capacity of at least 200 lb.

2. Metal container with handles, of 30 gal capacity (a trash can may be suitable for this use).

3. Yield Box (specially constructed yield test boxes, one quarter cubic yard capacity, are provided with each new Concrete-Mobile unit).

4. Stopwatch accurate to one second.

5. Graduated container, with a 2 qt capacity, accurate to 1 ounce.

TEST PROCEDURE:

CEMENT FEED COUNT CALIBRATION

1. Place a deflector in the bottom of the mixer to deflect all cement discharged into the container when the mixer is in the upright position. Make sure aggregate bins are empty and clean.

2. Set the mobile mixer to run at the proper operating speed according to the operating speed meter (OSM) for the machine being calibrated. Set cement feeder at 100 percent.

3. Prime the entire length of the conveyor belt by running about two bags of cement into a container. The cement discharged from the machine during this priming run should be discarded and not counted as part of the calibration.

4. Record the weight of a cleaned 30 gal container on Worksheet I.

5. Reset the cement meter register to zero and place the 30 gallon container at the end of the conveyor belt. Run out a convenient amount of cement 100 - 150 lb then record the count on Worksheet I.

6. Weigh the container with cement to the nearest 1 lb and record on Worksheet I.

7. Repeat Steps 5 & 6 a total of five times to approximately the same count as the first run. Record the results. Total the weight, plus the counts then divide the adjusted weight by the total count to determine the "weight per count" of the cement delivered.

SAND AND STONE CALIBRATION

1. Disengage the cement feeder clutch. Ensure that the aggregate bins and conveyor belt are clean.

2. Load the material to be used in the appropriate bin (at least 3/4 full). Ensure that the other bin is completely empty.

3. Determine the percentage of moisture in the sand and stone and record. The material should contain normal moisture (5 percent for sand, 2 percent for stone).

4. Select at least two dial settings within the following operating ranges:

Sand - 3.0 to 8.0
Stone - 4.5 to 9.0

5. Set the aggregate gates at the highest setting and prime the belt. Make three calibration runs at the same gate opening. Be sure to operate at the same speed throughout calibration.

6. Record all information required on Worksheet II.

7. Repeat Steps 4, 5 and 6 at chosen dial settings.

8. Plot points on the graph and connect points with a straight line. Re-prime the conveyor belt when the gate setting is changed.

YIELD TEST

This test will verify that the correct yield is being produced by the combination of mix design proportions specified, the particular kinds of materials being used, or the calculations that produce dial settings. Perform yield testing at time of delivery and after calibration of the machine.

1. Ensure that all components of the mobile mixer are functioning properly.

2. Run the yield test without the extension chutes attached to the mixer since some of the

concrete produced will cling to the chutes, causing an under yield. Use extension chutes when producing concrete at all other times to minimize segregation.

3. Use Worksheet III to find the Meter Count Reading for one cubic yard of the mix being produced. Divide by 4 to give the count for a quarter yard.

4. Place the yield box directly behind the mobile mixer, under the discharge end, so that it will catch all of the concrete discharged.

5. Ensure that the mobile mixer is properly set up to produce the mix being checked. Swing the mixer chute away from the yield box and begin producing concrete.

6. If flow settings are correct and concrete is being discharged at a steady rate, simultaneously disengage both the mixer and conveyor controls. Swing the mixer chute over the yield box.

7. Start the mixing action, being careful to actuate both the conveyor and the mixer simultaneously. Continue the mixing action until the meter register shows the exact count for one-quarter cubic yard. At that instant, disengage both the main conveyor and the mixer controls.

8. If too much concrete is being produced, the box is overfilling, or too little concrete is being produced to fill the box level, make minor adjustments in the mix settings to obtain the proper yield. Adjustments should be made in increments of 0.1 on the Stone Dial, up or down as required. Perform tests as outlined above for each change.

9. Check the mix design to make sure that the total amount of aggregate and cement add up to the following to produce one cubic yard of mixed concrete.

(a) Approximately 32 ft^3 for grout (sand mix),

(b) Approximately 34 ft^3 using ¼ - _ in. crushed stone, gravel, or bank run material,

(c) Approximately 36 - 37 ft^3 for ¾ in. crushed stone or gravel.

10. When the proper mix settings to produce the required yield are determined, make a permanent record of the new settings on Worksheet III to ensure that future mixes are properly proportioned.

11. If yields are off substantially and cannot be compensated for by making minor adjustments, the most likely causes are as follows:

(a) Mix design settings are for materials other than those being used.

(b) Mix design information is not correct, i.e. - sand and stone weights used are incorrect. Laboratory analysis may be necessary.

(c) Mix settings have been erroneously calculated.

(d) Mix designs have been prepared either to over yield or under yield.

(e) Yield test procedures are not being followed carefully.

(f) There may be a mechanical malfunction of the equipment. Make mechanical checks as detailed in the operator's manual.

EXPLANATION FOR DESIGN DIAL SETTINGS

Completion of the Mix Design Dial Setting worksheet provides all the information for setting up the mobile mixer to produce a given mix. It is necessary that the materials required be calibrated before completing the worksheet.

Admixture Quantities

The amount of admixture required per cubic yard of concrete is usually given as part of the mix design information. It may be stated as a number of ounces of admixture per cubic yard, number of ounces per hundredweight (100 lb) of cement, or number of ounces per bag of cement (94 lb).

If the admixture requirement is not stated as ounces per cubic yard, determine that quantity by dividing the cement content of the mix design (lb of cement per cubic yard) by either 100 lb or 94 lb, depending on how the admixture requirement is given. Then multiply the result by the number of ounces required per 100 lb or per bag.

Sand and Stone Dial Settings

The bulking characteristics of sand can cause a difference in the flow rate of the material if it contains a high percentage of moisture. It is important that the sand that is used for calibration, as well as the sand that is used to produce the concrete, be within the moisture content range of 3 to 6 percent. If the sand is outside this range, it will be necessary to either make an adjustment or to recalibrate with this sand.

Because the weight of free moisture is subtracted from the aggregate weight during calibration, the aggregate calibration graphs represent saturated, surface-dry material (SSD). Material weights for

most mix designs are given as SSD. Therefore, the lb per count numbers for the worksheet can be read directly from the graphs.

Perform aggregate calibration at the proper operating speed with the cement feeder at 100 percent. If it is necessary to use an alternate cement feeder speed, plot graphs for alternate speeds from Worksheet II data without recalibrating the machine.

Water Dial Settings

Determine the amount of water contained in the sand, stone, and admixture solution so that it can be subtracted from the mix water requirements.

Moisture contained in sand averages about 5 percent and averages about 2 percent in stone, under normal conditions. Determine the actual moisture content when conditions are different from the above.

WORKSHEET I

SP MODEL CONCRETE-MOBILE WITH TWO-SPEED CEMENT FEEDER

UNIT SERIAL NUMBER:_____ DATE CALIBRATED:_____

Review the information on cement feeder speed to determine when it is necessary to use another cement feeder speed. Then follow these steps:

A - PERFORMED CALIBRATION AT [_____] % CEMENT FEEDER SPEED.

RUN	WEIGHT OF CONTAINER & CEMENT		WEIGHT OF EMPTY CONTAINER		WEIGHT OF CEMENT	EXACT COUNTS	EXACT SECONDS
1		-		=			
2		-		=			
3		-		=			
4		-		=			
5		-		=			
TOTAL		A				B	

Determine "weight per count"
_____(A)/_____(B)=_____ (X) "weight per count" (post to worksheet III)

When run at proper operating speed, there is a constant number of counts per minute for any of the various two-speed cement feeder speeds.

GEAR _____ AIR PRESSURE _____ OPERATING SPEED _____

LIQUIDS							
TYPE	GAGE READING	CONTAINER & LIQUID	EMPTY CONTAINER	LIQUID WEIGHT	EXACT SECONDS	1 MIN	1 YD
FLOW							
FLOW							
FLOW							
FLOW							

WORKSHEET II

UNIT SERIAL NUMBER:_____ DATE CALIBRATED:_____

Perform field calibration of sand and stone with mixer running at proper operating speed according to OSM.

Select dial setting within the operating range and check one.

DIAL SETTING	WEIGHT OF CONTAINER AND AGGREGATE	WEIGHT OF EMPTY CONTAINER	WEIGHT OF AGGREGATE MOISTURE	WEIGHT OF FREE WATER	WEIGHT OF S.S.D. AGGREGATE	EXACT COUNTS	AVERAGE WEIGHT PER COUNT
SAND							
					AVG.		
					AVG.		
					AVG.		
STONE							
					AVG.		
					AVG.		
					AVG.		

NOTE: Post avg. weight per count on graph

WORKSHEET III

SP-100 MIX DESIGN DIAL SETTINGS

MIX DESIGN IDENTIFICATION:

MATERIAL FOR 1 CUBIC YARD OF CONCRETE

		SOURCE	TYPE	SIZE
CEMENT	(A)_____ lbs			
SAND	(B)_____ lbs			
STONE	(C)_____ lbs			
WATER	_____ lbs / 8.33 = (D)_____ U.S. Gallons			
ADMIX #1	(E)_____ oz per cu.yd.			
ADMIX #2	(F)_____ oz per cu.yd.			

NOTE: Basic calculation to be based on proper operating speed according to OSM with two-speed cement feeder. (If an individual calibration is made at another setting, indicate cement feeder speed _____)

BASIC DATA FROM CEMENT FEED CALIBRATION (WORKSHEET I)

UNIT SERIAL NUMBER:_____ DATE CALIBRATED:
WEIGHT OF CEMENT PER COUNT:_____(X) COUNTS PER MINUTE:_____(Y)

BASIC CALIBRATIONS

_____(A)/ _____ (X) = _____ (G) COUNTS PER CUBIC YARD
_____(G)/ _____ (Y) = _____ (H) MINUTES PER CUBIC YARD

SAND AND STONE DIAL SETTINGS

Read dial setting

from graph

_____(B)/_____(G) =_____(J) lbs SAND PER COUNT
_____(C)/_____(G) =_____(K) lbs STONE PER COUNT

WATER FLOW SETTING

_____(B) x _____ % OF WATER IN SAND =_____ lbs OF WATER
_____(C) x _____ % OF WATER IN STONE =_____ lbs OF WATER

WATER IN ADMIX (normally 15 lbs for 2 admixes) = _____ lbs OF WATER
TOTAL = _____ lbs OF WATER

_____ (D) - _____ (L) =_____(M) gallons add water needed per cubic yard
_____ (M) / _____ (H) =_____(P) gallons add water needed per minute