Colorado Procedure – Laboratory 5101-15

Standard Method of Test for

Verification of Laboratory Equipment Used to Test Bituminous Mixtures

1. SCOPE

1.1 This method of test covers the verification of laboratory equipment used to test bituminous mixtures and provides documentation that the verification has been done as per AASHTO R 18- 01.

2. REFERENCED DOCUMENTS

2.1 *Colorado Procedures:*

CP 31 Sieve Analysis of Aggregates.

CP 44 Bulk Specific Gravity and Percent Relative Compaction of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens.

CP 51 Determining the Maximum Specific Gravity of HMA.

CP-L 5106 Resistance to Deformation of Bituminous Mixtures by Means of Hveem Apparatus.

CP-L 5109 Resistance of Compacted Bituminous Mixture to Moisture Induced Damage.

CP-L 5115 Standard Method for Preparing and Determining the Density of Bituminous Mixture Test Specimens Compacted by the Superpave Gyratory Compactor.

CP-L 5120Determination of the Asphalt Binder Content of Bituminous Mixtures by the Ignition Method.

2.2 CDOT Laboratory Inspection Manual Procedures:

HMA – 1 Standardization of Low Temperature Oven or Freezer

HMA – 2 Superpave Gyratory Compactor Mold Check

HMA – 3 Superpave Gyratory Compactor Ram Head Check

HMA – 4 Troxler Gyratory Compactor True Mold Angle Check

HMA – 5 Troxler Gyratory Compactor Pressure Check

HMA – 7 Troxler Gyratory Compactor Height Calibration and Rotation Check

HMA – 8 Vacuum System Check

HMA – 9 Standardization of Water Baths

HMA – 10 Stabilometer Check

HMA – 11 United Press Load Cell Check

G-1 Verification of Balance

G-2 Standardization of Oven Temperature

G-3 Calibrated Thermometer Check

G-4 Standardization of Liquid-in-Glass / Digital Thermometers

A-1 Sieve Check

A-2 Sieving Adequacy Check

2.3 *AASHTO Standards:*

T 30 Mechanical Analysis of Extracted Aggregate.

T 209 Theoretical Maximum Specific Gravity (Gmm) and Density of Hot Mix Asphalt.

T 312 Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor.

2.4 *ASTM Standards:*

E 11 Specification for Woven Wire Test Sieve Cloth and Test Sieves.

C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates.

3. APPARATUS

3.1 *Thermometers* - Conforming to the requirements of ASTM E 1. The thermometers shall be capable of reading 77°F by 0.2°F, 140°F by 0.2°F, 230°F by 0.5°F, 275°F by 0.5°F, 300°F by 0.5°F, 325°F by 0.5°F.

3.2 *Vernier Caliper (or other measuring device*) - capable of measuring 0 to 6 inches in increments of 0.001".

3.3 *Dial Gauge* - capable of measuring 1 inch in increments of 0.001".

3.4 *Height calibration spacer and performance verification kit* - for the Troxler Superpave Gyratory Compactor.

3.5 *Stopwatch or timer* - with certificate of calibration.

3.6 *Verified weights* - traceable to the National Bureau of Standards.

3.7 *Inside diameter micrometer* - capable of measuring 100 mm in increments of 0.01 mm.

3.8 *Comparator* - with reticles for examining sieves finer than No. 4.

3.9 *Manometer* - free of air bubbles.

4. EQUIPMENT VERIFICATION

4.1 The CDOT Laboratory Inspection Manual has worksheets to aid with verifications.

4.2 Conduct verifications and calibrations as per the following table:

Table 1: General Equipment & Asphalt Equipment

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EQUIPMENT	PROCEDURE	REQUIREMENT	INTERVAL
Balances	Outside Certified Contractor or G-1	Calibration or Check	12 Mo.
Compression Testing Machine, Load Cells	Outside Certified Contractor or HMA-11	Check	12 Mo.
Superpave Gyratory Compactor: Ram Pressure, Angle of Gyration, Frequency of Gyration, LVDT or Height Calibration	HMA-4, 5, 7	Check	12 Mo.
Superpave Gyratory Compactor, Ram Head and Base Plate	HMA-2 & 3	Check	12 Mo.
Mechanical Shakers	A-2	Check	12 Mo.
Sieves	A-1	Check	12 Mo.
Superpave Molds	HMA-2	Check	12 Mo.
Ovens	G-2	Standardization or Check	12 Mo.
Low Temperature Oven & Freezer	HMA-1	Standardization or Check	12 Mo.
Water Bath	HMA-9	Standardization or Check	12 Mo.
Test Thermometers	Outside Certified Contractor or G-3 & G-4	Check	12 Mo.
Vacuum / Pressure Measurement Devices	Outside Certified Contractor or HMA-8	Check	12 Mo.
Vacuum System	HMA-8	Check	12 Mo.
Ignition Oven Internal Scale	Outside Certified Contractor or G-1	Calibration or Check	12 Mo.
Stabilmeter Followers, Calibration Cylinders	HMA-10	Check	12 Mo.

Appendix A, CP-L 5101

Routine Maintenance Recommendations For Superpave Gyratory Compactors

Follow the maintenance schedule in Table 1 for optimum equipment performance and decreased machine wear. Consult manufacturer maintenance guide in operations manual for complete details.

Table 1: Superpave Gyratory Compactor Maintenance

FREQUENCY	ITEM	TROXLER 4140 A & B	PINE AFGC125X	PINE AFG1	COMMENTS
Daily	Ram Head/Ram Foot	Clean with degreaser		Anti-Seize Lubricant	Easier to clean when hot.
Daily	Molds	Clean with degreaser			Easier to clean when hot.
Daily	Mold Base Plate/ Mold Top	Clean with degreaser	Lubricate with Molybdenum di-sulfide powder	Clean	Easier to clean when hot. Make sure area where base plates and mold make contact is clean.
Daily	Support Ring and Cam Followers	Clean & Grease with Magnalube			Clean with dry clean cloth.
Daily	Carriage Base Plate		Lubricate with Molybdenum di-sulfide powder		
Daily	Compaction Chamber/		Clean	Clean	
Daily/Per Cycle	Turn Table	Use Clean Dry Cloth			Do not use degreaser. Clean every cycle if fines fall on table after each compaction.
Every 5 hours	Mold Rollers		Grease with Molybdenum di-sulfide Mobilgrease Special		
Initial 5 hours/ Every 25 hours	Ball Screw Bearings, Ball Screws, Actuator Bearings and Carriage Base bearing		Grease with Molybdenum di-sulfide Mobilgrease Special	Grease	
Every 25 hours	Fixed Ring Surface		Oil (SAE 30)		
Every 25 hours	Mold Clamp Pivot and Mold Top Clamps			Anti-Seize Lubricant	
Every 80 hours	Brake Disk	Clean with degreaser			Use clean dry cloth.

Table 1: Superpave Gyratory Compactor Maintenance (Continued)

FREQUENCY	ITEM	TROXLER 4140 A & B	PINE AFGC125X	PINE AFG1	COMMENTS
Every 80 hours	Chamber shafts	Grease with Magnalube			
Every 80 hours	Loading Head and Thrust Bearing	Clean & Grease with Magnalube			
Every 80/ 100 hours	Drive chain	Check Tension	Oil (SAE 30) and check tension		Lubricate chain with Magnalube if needed.
Every 100 hours	Ram Key		Lubricate with Molybdenum di-sulfide powder		If key is worn rotate to use unworn side.
Every 500 hours	Ram	Add Grease			
Every 500 hours	Rotation Gear Box	Change Oil			
Every 1000 hours	System	Contact Troxler for overhaul			Done by Manufacturer
Every 1000 hours	Carriage Base Drive Reducer		Gear oil ISO Grade 460		
	Hydraulic Power Pack		Automatic Transmission Fluid		

Appendix B, CP-L 5101

Equipment Calibration and Standardization Recommendations For Flexible Pavement Equipment

Follow the best practices in Table 1 for more reliable equipment calibrations and standardizations. All of the information in Table 1 is not required but considered best practices and goes above what is required to ensure more accuracy when calibrating and standardizing equipment.

Table 1: Equipment Calibration and Standardization Best Practices

ITEM	COMMENTS
Balances	1. Make sure balances are cleaned and leveled. 2. Make sure balances are not rubbing or touching anything, such as suspension wires or sample holders touching bulk chamber walls.
Compression Testing Machine, Load Cells	1. Recommend testing different load cells against each other before calibration. 2. Recommend taking at least one reading from load cell or at least until pressure values from load cell stabilize. Pressure values drift down after a few readings (For Troxlers).
Superpave Gyratory Compactor: Verify Ram Pressure, Angle of Gyration, Frequency of Gyration, LVDT	1. Recommend always doing height calibration first especially when switching Ram Heads. 2. Make sure when verifying the angle with the TMA, it is squared and straight with the compactor. 3. Do not adjust pressure on gyratory compactors to match external load cell if pressure is within specification. Have compactor serviced if pressure is out of specification when it is set to proper compactor pressure.
Superpave Gyratory Compactor (continued), Verify Ram Head, Base Plate and Cam Followers	1. For the most accurate measurement, it is recommended to take the Ram Head off of the compactor. 2. Although this verification is only required every 12 months, frequently checking Ram Head diameters during the construction season is recommended when Ram Heads are close to being out of the specified range. 3. The grooves in cam followers should be no more than 0.012” deep. If so, replace.
Mechanical Shakers	1. Make sure sample for sieve adequacy is of appropriate size as not to over load the sieves.

Table 1: Equipment Calibration and Standardization Best Practices (Cont.)

ITEM	COMMENTS
Sieves	1. When measuring sieve openings make sure the calipers are straight and parallel with the wires.
Molds, Superpave	1. A dial bore gauge is a better piece of equipment than calipers for measuring mold diameter. 2. Make sure device used for measuring is perpendicular to plane of measurement. 3. Although this verification is only required every 12 months, frequently checking mold diameters during the construction season is recommended when molds are close to being out of the specified range.
Ovens	1. Recommend checking temperature of various shelves where samples are to be placed. 2. Recommend using pan or beaker of sand to stick thermometer to keep temperature fluctuations down from opening and closing doors.
Test Thermometers	1. Quite often shipping thermometers can cause them to take on bubbles in the liquid. Be sure to check for bubbles in the mercury on a regular basis and especially upon receiving thermometers after shipping.
Vacuum System	1. Verify regularly that oil is free of water and examine desiccating crystals. 2. Check the manometer to make sure it is free of air bubbles.
Stabilometer, Molds, Followers, Calibration Cylinders	1. Check condition of stabilometer diaphragm. If membrane is dry and cracked replace.