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Tennessee Department of Transportation Division of Materials and Tests

Laboratory Qualification Requirements (SOP 1-4)

Purpose- The purpose of this document is to establish the minimum qualifications for the Central Laboratory, Regional Materials and Tests Laboratories and Contractor and Material Supplier Field Laboratories used for the control, design, acceptance, verification, and/or assurance of materials and products.

Background- Federal regulations (23 CFR 637B) require that all laboratories used in the acceptance decision process be performed by qualified laboratories.

Policy- **Regional Laboratories**
Regional Materials and Tests laboratories qualifications will fall under the auspices of the AASHTO Accredited Central TDOT Laboratory. Regional Materials and Tests laboratories will be inspected annually by the Central Laboratory. During the inspection, the Central Laboratory verifies that the requirements of AASHTO R-18 are being followed. Annually, the regions lead technician testing competency will be evaluated by Central Laboratories staff through observation of the regional technician performing round robin/proficiency samples. This observation and analysis of results obtained shall ensure the technician is qualified to run tests.

Upon completion of the laboratory inspection, the Central Laboratory will complete and report findings to the Regions Management staff which shall report findings to Regional Materials and Tests laboratory management. Regional Materials and Tests laboratory management shall then respond with the proposed corrective actions to findings found to be nonconformities.

Field Laboratories
Contractor and Material Suppliers field laboratories must meet the minimum requirements specified in Section 106.06 of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction dated January 1, 2015, and all other applicable contract provisions.

In addition to the annual hot mix asphalt plant, concrete plant, and aggregate producing plant inspections conducted by the regions, all field laboratories must be inspected by regional staff, at a minimum, every two years to meet the requirements of Federal regulations (23 CFR 637B). The Regional Materials and Tests laboratories will be responsible for conducting and qualifying the field laboratories. The Central Laboratories will serve as reference during these inspections. All test equipment will be thoroughly reviewed and checked to assure proper tolerances and operability exists.

The Independent Assurance program will also serve as a routine opportunity to inspect the field lab test equipment and compare the test results to properly calibrated equipment. As specified in [SOP 1-2](#) (Independent Assurance Program), when comparing test results between acceptance and assurance samples, deviations exceeding the Normal Deviation Range must be reviewed.

When laboratory equipment does not perform as required, proper corrective action will be necessary, which may include the repair, replacement, or re-calibration of equipment.

The field laboratory must maintain a log of all equipment calibrations, correlations, and/or repair work. Field laboratory equipment should also be maintained in accordance with manufactures recommendations, or as necessary. Refer to Appendix A for maintenance procedures for the ignition furnace. The Contractor and Material Supplier will be issued an inspection report at the completion of the laboratory inspection. The Contractor and Material Supplier must make all corrective actions and reply in writing to the Regional Materials and Tests Supervisor what actions have been taken to rectify the finding. All corrective actions and written notification must be completed within 30 days of the inspection or the laboratory will be considered non-compliant with Subsection 106.06 of the Standard Specifications. At a minimum, the field laboratory equipment that shall be inspected by the Regional Materials and Tests laboratories for laboratory qualification is:

TYPE A FIELD LABORATORIES

Equipment	Reference	Requirement
Scales	106.06 AASHTO M-231	Accuracy within 0.1% of known weights at 5 points or more through the scale range.
Sieves and Screens	106.06 ASTM E11	Worn and torn screens need to be repaired or discarded.
Mechanical Sieve Shakers	106.06 AASHTO T-27, T-30	Approved by the Engineer
Ovens (or stove tops and hot plates when applicable)	SS 106.06 AASHTO Test Methods	Oven must maintain constant temperature of 230 (±9)°F. Stove tops and hot plates may be used to determine moisture conditions of aggregates.
Thermometers	106.06 ASTM E 1 ASTM E 77 ASTM E 2251	Thermometers should be checked against regional calibrated thermometers at 3 different temperature ranges, difference should be less than 2%.

TYPE B FIELD LABORATORIES

Equipment	Reference	Requirement
Scales	106.06 AASHTO M-231	Accuracy within 0.1% of known weights at 5 points or more through the scale range.
Sieves and Screens	106.06 ASTM E11	Worn and torn screens need to be repaired or discarded.
Mechanical Sieve Shakers	106.06 AASHTO T-27, T-30	Approved by the Engineer
Ovens	SS 106.06 AASHTO Test Methods	Oven must maintain constant temperature of 230 (±9)°F.
(2) Thermometers	106.06 ASTM E 1 ASTM E 77 ASTM E 2251	Thermometers should be checked against regional calibrated thermometers at 3 different temperature ranges, difference should be less than 2%. Must have a range 50 F to 400 F
(2) Vacuum Extractors Or (1) Vacuum Extractor and (1) ignition furnace	106.06 AASHTO T-164 Method E-II /ASTM D2172 AASHTO T308	Vacuum extractor shall have a minimum bowl capacity of 100 troy ounces. Supply an adequate amount of an approved solvent from the QPL and provide storage and disposal of the waste solvent in accordance with the regulations under the Tennessee Hazardous Waste Management Act. Adequate ventilation of the extractor is required see 106.06
Suspension Apparatus and Water Bath	106.06 AASHTO T-166	Approved by the Engineer to meet AASHTO T-166 requirements, water bath must be capable of maintaining a

		temperature of 77±1.8°F.
Maximum Theoretical Gravity (Rice) Determination	106.06 AASHTO T-209	Vacuum, with manometer or vacuum gauge, capable of maintaining 3.7 ±0.3 kPa (27.5 ± 2.5 mm Hg) of pressure for 15 (±2) minutes, mechanical shaker capable of releasing entrapped air.
LOI Muffler Furnace and Assayer's Fire Clay Crucible with Cover	106.06 407.03	The furnace shall be capable of maintaining a constant temperature of 950°C (1742°F) for the entire 8 hr. test cycle.
Moisture Susceptibility (Root – Tunnecliff)	407.03 ASTM D 4867	Water bath capable of maintaining 140±1.8°F for 24 hrs. and 77±1.8°F. Vacuum for specimen saturation, tensile splitting head, loading device.
Hot Plates	AASHTO T-245	Capable of maintaining a temperature within a range of ± 2.8°C (5°F) of the mixing or molding temperature.
Sampling and Quartering Equipment	ASTM D75 AASHTO R76	Shall be clean of deleterious buildup.
Miscellaneous: mixing tools, bowls, beakers, pans, pycnometers, flasks, etc...		Clean of material build up, debris, cracks, excessive wear, etc...
Suspension Apparatus and Water Bath	106.06 AASHTO T-166	Approved by the Engineer to meet AASHTO T-166 requirements, water bath must be capable of maintaining a temperature of 77±1.8°F.
Maximum Theoretical Gravity (Rice) Determination	106.06 AASHTO T-209	Vacuum, with manometer or vacuum gauge, capable of maintaining 3.7 ±0.3 kPa (27.5 ± 2.5 mm Hg) of pressure for 15 (±2) minutes, mechanical shaker capable of releasing entrapped air.
(4) 1000 ml beakers (glass/metal) (4) Glass Rods Wire Mesh screens	904.01 AASHTO T59 SOP 3-2	Testing at Contractor's lab only required for prime coat/tack coat material stored in a drop tanker/distributor for greater than 1 week. Materials less than a week old or materials stored in a storage tank to be tested at TDOT HQ lab.
Stackable 3" Dia sieve set (no. 20 and pan) Desiccator	904.01 AASHTO T59 SOP 3-2	Testing at Contractor's lab only required for prime coat/tack coat material stored in a drop tanker/distributor for greater than 1 week. Materials less than a week old or materials stored in a storage tank to be tested at TDOT HQ lab.

Concrete Testing Equipment

(Per Section 501, 604, and 615 of the Standard Specifications and the Sampling and Testing Schedule)

Equipment	Reference	Requirement
Slump Cone	AASHTO T-119	The cone shall be 12" H, 4" D top opening, and a 8" D bottom opening, allowable tolerances ±1/8", the top and bottom openings shall be parallel to each other, no material buildup, surfaces shall be smooth with no dents.
Air Content by the Volumetric Method (lightweight aggregate)	AASHTO T-196	The volumetric meter shall conform to those identified in T-196, bowl shall be machined smooth, and have pressure tight flanges.
Air Content by the Pressure Method	AASHTO T-152	The pressure meter shall conform to those identified in T-152.
Yield/Unit Weight	AASHTO T-121	Apparatus shall conform to T-121.
Cure Boxes/Water Baths	AASHTO T-23 AASHTO M-201	When applicable, cure boxes or water baths shall be capable of maintaining a temperature range of 60°F to 80°F in an environment that prevents moisture lost for initial curing. For final curing a temperature range of 73.5±3.5°F in an environment maintaining a relative humidity of at least

		95%.
Mallets	AASHTO test methods	Head shall be rubber or rawhide, 1.25±0.50 lbs.
Thermometer	ASTM E 77	Shall be capable of accurately measuring within 2%.
Tamping Rods	AASHTO test methods	Shall be a straight, 5/8" D, with a hemispherical tip, and at least 16" long. (4x8 concrete cylinder molds shall use 3/8" D with a 12" long rod)
Wheelbarrows/ Sampling Buckets		Equipment shall be clean and free of concrete buildup.
Compression Machines (Cylindrical Concrete Specimens)	AASHTO T-22	Shall meet the requirements of AASHTO T-22 and be capable of maintaining a constant pressure loading of 35±7 psi/sec.
Compression Machines (Concrete Pipe and Manhole Sections)	AASHTO T-280	RCP- Compression machines for three edge bearing tests shall be capable of applying a uniform linear load.

Appendix A: Maintenance of Ignition Furnace

- A.1. Maintenance should be performed on an ignition furnace at a minimum of once a month when the furnace is being actively used.
- A.2. Light Cleaning
1. Ensure the ignition furnace is in the powered off position and unplugged from the outlet.
 2. Open furnace chamber door to allow the furnace to totally cool before starting the cleaning process.
 3. Use compressed air to lightly blow out dust and ash residue from inside of room temperature chamber.
 4. Use compressed air to lightly blow out dust from the exhaust fan located at the top of the unit.
- A.3. Heavy Cleaning
1. Carefully remove the plate and ceramic tubes from the inside of the burn chamber.
 2. Remove screws holding front panel plate and release to the down position revealing the internal scale. This portion, if done correctly and not stuck from smoke residue, will slide out.
 3. Slide out scale and lightly blow compressed air, softly brush heavier build up or use a vacuum on lower setting. Use any combination of the three ensuring that no harm is brought to the internal wiring.
 4. Remove upper exhaust covering with a flat head screwdriver. There are no screws, cover should be able to be lifted off easily.
 5. Once exhaust is visible, lightly blow compressed air, softly brush heavier build up, use a vacuum on lower setting or use any combination of the three.
 6. For best results, remove exhaust with Phillip head screwdriver and blow compressed air from the air flow side of the exhaust fan. Caution, this is an extremely messy step, but may be necessary if burns are not uniform or at minimum once a year.
 7. Reverse these steps for proper sequence to return your ignition furnace to an operating state.
 8. It is recommended, at minimum, to check your scale with a calibrated weight after the cleaning process. A full calibration of the scale is preferred.