



## WSDOT Standard Practice QC 3

### *Quality System Laboratory Review*

#### 1. Scope

This standard specifies requirements and procedures for the review of WSDOT Region Materials Laboratories and for Private Laboratories by the Quality Systems Laboratory Review Team. The elements of the On-site and/or Remote laboratory review may include the following:

- Review of the testing facility.
- Review of the equipment calibration/standardization/check/maintenance records.
- Review of the testing technician's training/certification/qualification records.
- Review of the equipment used to perform test procedures.
- Review of the technician performing the test procedures.
- Review of the most current and accessible test procedures to be performed.
- Review of associated manuals, test reports and calculations.
- Review of the Quality Management System (QMS).
- Review of AASHTO re:source accreditation.

#### 2. Referenced Documents

##### 2.1 AASHTO Standards

- R 18      Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- R 25      Standard Practice for Technician Training and Certification Programs
- R 61      Establishing Requirements for Equipment Calibrations, Standardizations, and Checks

##### 2.2 WSDOT Standards

*Materials Manual* M 46-01

[Construction Manual](#) M 41-01

[Standard Specifications for Road, Bridge, and Municipal Construction](#) M 41-10

*WSDOT Request for Proposal Technical Requirements for the Project under review*

### 3. Terminology

- 3.1 **AASHTO** – American Association of State Highway and Transportation Officials
- 3.2 **ASTM** – American Society for Testing and Materials
- 3.3 **Calibration** – a process that, under specified conditions, establishes metrological traceability by determining: (1) the relation between the quantity values provided by measurement standards and the corresponding indications from a measuring instrument or system, and (2) the resulting measurement uncertainty (Note 1).
- Note 1:** This definition for calibration and the following definitions for check, standardization, traceability, uncertainty, and verification of calibration are based on the definitions in R 61.
- 3.4 **Check** – A specific type of inspection and/or measurement performed on equipment and materials to indicate compliance or otherwise with stated criteria.
- 3.5 **Standardization** – A process that determines (1) the correction to be applied to the result of a measuring instrument, measuring system, material measure, or reference material when its values are compared to the values realized by standards; or (2) the adjustment to be applied to a piece of equipment when its performance is compared with that of an accepted standard or process.
- 3.6 **Maintenance** – A regularly scheduled preventive measure taken to preserve the effective working condition of test equipment
- 3.7 **Measurement Standard** – The embodiment of the definition of a given quantity, with a stated value and measurement uncertainty, used as a reference.<sup>2</sup> This term is often called “reference standard.”
- 3.8 **Metrological Traceability** – The property of a result of a measurement whereby it can be related to stated references, usually national or international standards, through a documented, unbroken chain of calibrations, each contributing to the measurement uncertainty.
- 3.9 **Quality Management System (QMS)** – The organizational structure, staff responsibilities, policies, standard operating procedures, processes, and records that assist the laboratory in achieving its quality objectives.
- 3.10 **Uncertainty** – A parameter associated with the result of a measurement that defines the range of the values that could be attributed to the measured quantity.
- 3.11 **WSDOT** – Washington State Department of Transportation
- 3.12 **WAQTC** – Western Alliance for Quality Transportation Construction
- 3.13 **ACI** – American Concrete Institute

#### 4. Significance and Use

- 4.1 This standard specifies procedures for reviewing laboratories for the purpose of determining the capability of the facility and its personnel to perform the necessary acceptance testing for WSDOT.

#### 5. Laboratory Requirements

##### 5.1 Facility and Equipment

- 5.1.1 Laboratory facilities shall adequately house and allow proper operation of all required equipment in accordance with the applicable test procedures.
- 5.1.2 The temperature and humidity of the laboratory shall meet the requirements of all test procedures performed in the laboratory.
- 5.1.3 The testing areas shall be clean and free of clutter.
- 5.1.4 The laboratory shall use testing equipment that meets the requirements of each test procedure.
- 5.1.5 Testing equipment for private laboratories and the State Materials Laboratory shall be calibrated/standardized/checked/maintained in accordance with the test procedure, appropriate sections of AASHTO R 18 and AASHTO R 61. WSDOT region and field laboratories testing equipment shall be calibrated/standardized/checked/maintained in accordance with the test procedure and Section 9-5 of the [Construction Manual M 41-01](#).
- 5.1.6 Documentation of equipment calibration/standardization/check/maintenance shall be maintained and available on-site during laboratory review.
- 5.1.7 Safety equipment will be available and maintained in proper working order.

##### 5.2 Technician Training and Evaluation

- 5.2.1 The laboratory shall only use personnel certified or method qualified in accordance with the appropriate sections of AASHTO R 18 and Section 9-5 of the [Construction Manual M 41-01](#).
- 5.2.2 The laboratory shall maintain records of training for each technician.
- 5.2.3 Laboratory technicians performing tests for Aggregate, Asphalt, or Soils compaction on WSDOT projects shall be certified in WAQTC requisite modules.
- 5.2.4 Laboratory technicians performing tests not associated with any module certification shall be method qualified as described in Section 9-5.4 of the [Construction Manual M 41-01](#).

5.2.5 A method qualification shall consist of a written and performance examination. The performance examination shall be evaluated using a checklist relating to the test procedure. The checklist and written exam shall be filed in the technician's training record.

**Note:** Private laboratories may use test procedure checklists from the WSDOT *Materials Manual M 46-01*, or may develop their own checklists similar to those found in the *Materials Manual*.

5.2.6 A method qualification can be for a maximum of five years or for private laboratories at a reduced frequency stated in the *Laboratory Quality Management System Manual (QMS)*.

5.2.7 An Independent Assurance (IA) evaluation will be performed a minimum of once per calendar year on all active testers.

### 5.3 Manuals and Records

5.3.1 Private laboratories shall have an up-to-date Laboratory Quality Management System Manual (QMS) on-site and meeting the requirements of AASHTO R 18.

5.3.2 All private laboratories QMS shall be available for use and understood by laboratory staff.

5.3.3 The laboratory shall maintain copies of standards as identified in the WSDOT *Materials Manual M 46-01* for the testing performed and shall ensure that the procedures are the most current and readily accessible to technicians performing the testing. Laboratory personnel shall also have access to the most current copy of the WSDOT [Construction Manual M 41-01](#).

**Note:** If an earlier version of the *Materials Manual* or [Construction Manual](#) is required by contract, the laboratory shall maintain an unaltered version of the required manual.

5.3.5 The laboratory must ensure Safety Data Sheets (SDSs) are readily accessible to all staff for any hazardous substances or products.

5.3.6 Test records are required to contain sufficient information to permit verification of any test report (original observations, calculations, derived data, and identification of personnel involved in the sampling and testing).

5.3.7 Amendments to reports must be made in the manner stated in the QMS and meet the requirements of AASHTO R 18.

5.3.8 The laboratory shall define the process used to ensure testers are performing the correct testing procedure according to the clients' contractual requirements (i.e., AASHTO, ASTM, WAQTC, or WSDOT test procedure as required by the contract).

- 5.3.9 Test reports are required to contain the following information:
- Identification of the report and date issued.
  - Description, identification, and condition of test sample.
  - Identification of the standard test method used and notation of all known deviations from, additions to, or exclusions from the test method.
  - Test results and other pertinent data required by the standard test method.
  - Name and address of the testing laboratory.
  - Name and address of the client or identification of the project.
  - Date of receipt of the test sample.
  - Date of test performance.
  - Name of tester performing the test.
  - Name of person accepting technical responsibility for test report.

## 6. Sampling

6.1 Test samples required for observation of test procedures shall be obtained by:

FOP for AASHTO R 90 – Sampling Aggregate Products

FOP for AASHTO R 97 – Sampling Asphalt Mixtures

FOP for WAQTC TM 2 – Sampling Freshly Mixed Concrete

## 7. Sample Preparation Requirements

7.1 Prior to the performance portion of the laboratory review, for the testing being performed, samples are required to be prepared as shown in [Table 1](#).

Table 1 Sample Preparation Requirements

Test Procedure	Test	Required Preparation
<b>Aggregate Tests</b>		
FOP for AASHTO T 27/11	Sieve Analysis of Fine and Coarse Aggregates	Have appropriate amount of the original sample reduced and dried to a constant mass.  *OPTIONAL: Have additional sample washed, dried, and ready for sieving. Retain all weights in order to do calculations.
FOP for AASHTO R 76	Reducing Samples of Aggregates to Testing Size	Have a minimum of 30 lbs dry material.
AASHTO T 84	Specific Gravity and Absorption of Fine Aggregates	Have approximately 1000 g of fine aggregate.
AASHTO T 85	Specific Gravity and Absorption of Coarse Aggregates	Have coarse aggregate meeting the minimum mass of test sample.
FOP for AASHTO T 176	Plastic Fines in Graded Aggregates and Soils by the Use of the Sand Equivalent Test	Have appropriate amount of #4 minus material prepared for the moisture conditioning process (do not moisten).  OPTIONAL: Have 2 additional prepared tins ready for introduction into the SE tube.
FOP for AASHTO T 255	Total Evaporable Moisture Content of Aggregate by Drying	Have a representative sample meeting the minimum sample mass.
FOP for AASHTO T 304	Uncompacted Void Content of Fine Aggregate	Have an appropriate size standard graded sample.  *OPTIONAL: Have additional sample weighed out and combined to the quantities identified in Table 1.
FOP for AASHTO T 335	Determining the Percentage of Fracture in Coarse Aggregate	Have a sample dried, sieved and reduced to appropriate test size for combined fracture determination.

Table 1 Sample Preparation Requirements

Test Procedure	Test	Required Preparation
<b>Concrete Tests</b>		
WSDOT FOP for AASHTO T 22	Compressive Strength of Cylindrical Concrete Specimens	Have 2 cylindrical concrete specimens.
WSDOT FOP for AASHTO T 106	Compressive Strength of Hydraulic Cement Mortar	Have 3 hydraulic cement mortar cube specimens.
AASHTO T 231	Capping Cylindrical Concrete Specimens	Have capping sulfur mortar heated to appropriate temperature and ready for capping (can use cylinders for T 22).
ASTM C1231	Use of Unbonded Caps in Determination of Compressive Strength of Hardened Cylindrical Concrete Specimens	Demonstrate if applicable (can use cylinders for T 22).
<b>Soils Tests</b>		
AASHTO T 89	Determining the Liquid Limit of Soils	Have sample prepared in accordance to step 11.1. of AASHTO procedure.
AASHTO T 90	Determining the Plastic Limit and Plasticity Index of Soils	Have sample prepared in accordance to step 5.2. of AASHTO procedure.
FOP for AASHTO T 99/T 180	Moisture-Density Relations of Soils	Prepare five representative samples of #4 or ¾" material at approximately 2 percent moisture already added to each sample starting at approximately 4 percent below optimum moisture of the material. Store in sealed containers.
AASHTO T 100	Specific Gravity of Soils	Have sample prepared in accordance to step 9. of AASHTO procedure.
AASHTO T 265	Laboratory Determination of Moisture Content of Soils	Have a representative sample meeting the minimum sample mass.
WSDOT Test Method T 417	Method of Test for Determining Minimum Resistivity and pH of Soil and Water	Have 100 g sample of natural #8 minus material for the pH test. Prepare the soil/ water slurry a minimum of 1 hr prior to test review.  Have a sample of # 8 minus material that is four times the volume of the soil box for the Resistivity test. Add 10% by weight of water to the sample and allow it to stand a minimum of 12 hrs in a waterproof container.
WAQTC TM 15	Method of Test for Compaction Control of Granular Materials	Have samples prepared in accordance to steps 7 and 8. of TM 15.

Table 1 Sample Preparation Requirements

Test Procedure	Test	Required Preparation
<b>Asphalt Mixture Tests</b>		
FOP for AASHTO T 30	Mechanical Analysis of Extracted Aggregate	Use sample from T 308. *OPTIONAL: Have additional sample washed, dried, and ready for sieving. Retain all weights in order to do calculations.
FOP for AASHTO R 47	Reducing Samples of Asphalt Mixtures to Testing Size	Have adequate amount of asphalt mixture to perform the following required testing; T 308, T 312, T 329, T 209 (approximately 30 lbs of mix is usually adequate). Have sample warm enough to separate.
FOP for AASHTO T 166	Bulk Specific Gravity ( $G_{mb}$ ) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens	Use sample from T 312. *OPTIONAL: Have a room temperature compacted specimen or core sample ready.
FOP for AASHTO T 209	Theoretical Maximum Specific Gravity ( $G_{mm}$ ) and Density of Asphalt Mixtures	Use reduced sample from R 47. *OPTIONAL: Have additional sample with particles separated and cooled to room temperature.
FOP for AASHTO T 308	Determining the Asphalt Binder Content of Asphalt Mixtures by the Ignition Method	Use reduced sample from R 47.
FOP for AASHTO T 312	Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyrotory Compactor	Use reduced sample from R 47. *OPTIONAL: Have additional sample heating at compaction temperature.
FOP for AASHTO T 329	Moisture Content of Asphalt Mixtures by Oven Method	Use reduced sample from R 47.
FOP for AASHTO T 331	Bulk Specific Gravity ( $G_{mb}$ ) and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method	Use sample from T 312. *OPTIONAL: Have a room temperature compacted specimen or core sample ready.



Table 1 Sample Preparation Requirements

Test Procedure	Test	Required Preparation
WSDOT Test Method T 720	Method of Test for Thickness Measurement for Asphalt Mixture Cores	Asphalt Mixture core obtained from WSDOT SOP 734.
WAQTC TM 15	Laboratory Prepared Asphalt Mixture Specimens	Representative aggregate from stockpiles used in JMF, dried to a constant mass. Aggregate samples prepared and heated to mixing temperature as recommended by binder supplier. Binder used in JMF mix design heated to mixing temperature as recommended by binder supplier (typically one quart container).
WSDOT SOP 730	Correlation of Nuclear Gauge Densities with Asphalt Mixture Cores	Verbal demonstration and completed worksheet/report reflecting calculated gauge correlation factor.
* <b>OPTIONAL</b> preparation may require verbal steps.		

## 8. Performance of Test Procedure

8.1 All technicians must be current in their WAQTC/ACI certifications or method qualifications.

8.2 The laboratory review team will evaluate the technician's testing proficiency using an approved WSDOT checklist.

**Note:** If certification or qualification is current and an IA audit has been performed in the last 12 months, this requirement may be considered satisfied and no further action is needed.

8.3 All equipment, used during the evaluation of the technician's proficiency, must be operational and have a current calibration sticker on the equipment.

8.4 When the test is complete, the reviewer will go over the checklist with the tester and point out any deficiencies that occurred during the performance of the test procedure.

## 9. Termination of Review

9.1 A laboratory review team member may choose to terminate the review of a procedure for the following reasons:

9.1.1 Equipment is non-operational or the wrong equipment is being used.

9.1.2 Tester is not qualified in the test procedure being reviewed.

9.1.3 Tester makes multiple major errors in the performance of the test.

9.2 The review of the laboratory may be terminated by the WSDOT Quality Systems Manager for the following reasons:

9.2.1 Facility is not adequate for the test procedures being reviewed.

9.2.2 Two or more testers fail during the proficiency portion of the review.

9.2.3 Documentation of qualification of testers or calibration of equipment is not available for review when team arrives.

## 10. Failure of Review

10.1 Rescheduling a review will require the following wait periods:

- First Failure – Minimum of one week wait to reschedule.
- Second Failure – Minimum of one month wait to reschedule.
- Third Failure – Minimum of one month wait and submittal of corrective action documentation. The documents submitted must state the concerns of the review team and the corrective action taken to solve the problem.

## 11. Laboratory Review Team Report

- 11.1 The Laboratory Review Team will review the facility, equipment, records, and testers compliance with the established requirements.
- 11.2 During the review, members of the team may:
  - 11.2.1 Have observations or recommendations for improvements to the performance of the test procedure or operation of test equipment. These will be noted on the final letter of qualification but does not require a response unless repeated in consecutive reviews.
  - 11.2.2 Have findings that can be addressed and resolved at the time of the on-site review.
  - 11.2.3 Have findings that require a written corrective action response.
  - 11.2.4 Have repeat findings that require a detailed written corrective action response that includes a root cause analysis.

## 12. Approval of Laboratory

- 12.1 A preliminary email will be prepared and sent to the laboratory within 30 days of the completion of the review.
    - 12.1.1 The preliminary email will only address "Findings" labeled "Corrective Action Required".
    - 12.1.2 The required corrective action must include a detailed explanation stating how the laboratory has resolved the finding and what measures have been taken to prevent this finding from reoccurring in the future. Substantiating evidence may be required along with detailed explanations in some circumstances.
    - 12.1.3 Once the preliminary email has been received, the laboratory will have 30 days to respond to all "Findings" labeled "Corrective Action Required."
  - 12.2 Once all corrective actions are received and accepted or if the laboratory had no findings requiring a response, a final letter of qualification will be issued. The final letter will address the following:
    - 12.2.1 All the elements of the on-site or remote review
    - 12.2.2 Results of review including all findings, observations and recommendations.
    - 12.2.3 Approved test procedures.
    - 12.2.4 Qualification Approval dates.
- Note:** For private laboratories, approval is only good for WSDOT projects identified on final letter of qualification.

- 12.3 If the laboratory review contained corrective action required findings, the laboratory may receive a conditional approval until the deficiencies are corrected or the review team may recommend that the laboratory be disapproved for all testing until the deficiencies are corrected to the satisfaction of the WSDOT Quality System Manager.
- 12.4 A Laboratory that presents a current AASHTO re:source Accreditation certificate specific to the project testing requirements; may be allowed to perform acceptance testing for up to two years with a satisfactory initial review by the Laboratory Review Team concurred with by the Asst. State Materials Engineer.