Oklahoma Highway Construction Materials Technician Advisory Committee

Guide to Key Elements of Performance Examinations

Introduction

This guide is designed to help applicants prepare for Oklahoma Highway Construction Materials Technician Program certification modules. The certification process requires applicants to perform specified sampling and/or testing procedures in the presence of an evaluator who determines whether or not the applicant has the skills and knowledge required to obtain consistent results that will compare closely with those obtained by other competent technicians. A critical feature of this process is an evaluation of the applicant's ability to properly perform certain elements of the procedure that are considered to be essential for obtaining consistent, accurate, and repeatable results. Below are lists of the types of physical and procedural "key elements" which an applicant is expected to know before attempting certification. It is important to understand that ***an applicant is expected to know quantities*** that are associated with these elements. For example, if a procedure specifies a temperature range, the applicant is expected to know the value of that range by memory without the aid of reference materials. In other words, if an evaluator asks for the required temperature of a water bath, the answer "About 71 degrees," would be incorrect. The correct answer might be "71 plus or minus one degree Fahrenheit." Verbal questions about temperatures, times, and other criteria are included in all performance examinations.

Material Sampling Methods

Many procedures describe a variety of methods for sampling materials depending on where in the production/construction process the material is sampled. Applicants are expected to know all methods described in a procedure. (For example, a technician seeking certification in Asphalt or Materials Sampling & Testing may have sampled asphalt only from a truck transport and from the roadway before compaction. Such a technician will still be required to know the proper procedure for sampling from a windrow, funnel device, and ***all other locations*** described in AASHTO T 168.)

Some key elements for sampling procedures are:

- method for selecting sample locations
- minimum sample size for tests anticipated
- method for reducing sample to testing size
- proper equipment required for collecting and reducing samples (A few examples: Fine aggregate sampling tubes must have what dimensions? Splitter must have how many chutes per side for coarse aggregate? For fine aggregate? What kind of container for liquid AC or emulsions? Release agent properties?)
- number and locations of sample increments
- method for assuring representative nature of sample (Examples: Sample taken for what depth? Top layer removed or included? Devices used to create barrier?)

Material Testing Methods
Materials test standards are generally divided into three sections - apparatus, procedure, and calculations. Applicants must be familiar with each of these areas.

Some key elements for testing procedures are:

- times
- temperatures
- tolerances (± °F, ± kg, ± mL, ± min or sec)
- equipment specifications (thermometer temperature range, scale accuracy, etc.)
- equipment inspection (Sieves cleaned? Correct container size and shape?)
- sequence of elements (steps in proper order)
- conditioning of sample prior to test (Sieve? Dry? Temperature?)
- response to special conditions (Absorption > 2%? Excessive moisture?)
- device calibration and settings
- calculations

During performance examinations, most tests are to be performed and completed just as they would be under actual field/lab conditions. Applicants are required to properly perform a procedure and to know all of its key elements in order to successfully certify as an RHCMT.

Pass/Fail criteria and the "Fourth Strike" rule.

Two chances to perform a procedure - If an applicant misses one or more key elements on a procedure, it is considered a strike. If the applicant misses fewer than three key elements, the evaluator shall tell the applicant which key elements were missed. If the applicant misses three or more key elements, the evaluator shall tell the applicant only that the attempt was failed and how many key elements were missed but not which ones were missed. After being informed that the attempt was unsuccessful, the applicant will be given an opportunity to review the standard and make a second attempt to perform the procedure. If a key element is missed on the second attempt, the applicant has failed to meet the requirement for that procedure.

One retest permitted for performance evaluations - If an applicant fails to meet the requirement for a procedure during the evaluation process (two attempts failed), a retest for that procedure is scheduled for a later date (neither less than 7 nor more than 60 days later) and the applicant continues the process with two strikes from that procedure. If a second procedure is failed (two attempts), the applicant has failed the module and must re-enroll at a later date. For the retest, the applicant gets only one opportunity to perform the procedure. If a key element is missed, the applicant has failed the module and must re-enroll.

The "Fourth Strike" rule - Missing one or more key elements on a procedure results in a strike. A successful second attempt means the applicant continues but now with "one strike." A failed second attempt means failure of that procedure (retest scheduled) and the applicant continues but now with "two strikes." Once an applicant receives a third strike, missing another key element in any procedure is considered the "fourth strike" and the applicant has failed the module and must re-enroll. For re-enrollments, the entire module must be repeated regardless of where in the process an applicant was when the module was failed.

More rules concerning the certification process are available in the official Board Rules which can be accessed via hyperlink from the home page of our web site at http://oktechcert.org.

Aggregates – Key Elements (Please Click for additional content)

This module is designed to equip technicians with the knowledge and skills required to perform critical tests on aggregate materials used in construction projects across Oklahoma. Participants will learn to conduct standard procedures such as sieve analysis to determine particle size distribution, fracture testing to assess aggregate durability, and sand equivalency testing to evaluate the cleanliness and quality of fine aggregates.

In addition to these core tests, the module covers other responsibilities and procedures required by current state and project specifications for aggregate materials. Emphasis is placed on understanding material properties, proper documentation, and compliance with quality control standards.

The course also features hands-on training using AASHTO sampling and testing procedures, giving students practical experience with field and laboratory equipment, sample preparation, and data interpretation. This training ensures technicians are fully prepared to perform aggregate testing accurately and in compliance with regulatory and industry standards.

1. AASHTO R 90
Sampling Aggregate Products (Fine and Coarse Aggregates)

- Covers procedures for sampling aggregates from:
    - Stockpiles
    - Conveyor belt discharge
    - Roadway locations

2. AASHTO R 76
Reducing Field Samples of Aggregate to Testing Size (Fine and Coarse Aggregates)

- Outlines methods for reducing bulk field samples to appropriate sizes for laboratory testing without changing particle size distribution.

3. AASHTO T 255
Total Moisture Content of Aggregate by Drying (Fine and Coarse Aggregates)

- Specifies procedures to determine the total moisture content by drying aggregate samples in an oven.

4. AASHTO T 11
Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

- Measures the amount of fine particles (silt/clay) in aggregates through washing, essential for cleanliness and performance assessment.

5. AASHTO T 27
Sieve Analysis of Fine and Coarse Aggregates

- Determines the particle size distribution of aggregates by sieving, a key test for grading and specification compliance.

Asphalt Materials – Key Elements (Please Click for additional content)

This advanced module provides an in-depth discussion of aggregate production, testing procedures, and methods for combining aggregates to meet project specifications. It covers all relevant Quality Control/Quality Assurance (QC/QA) testing standards, including AASHTO and Oklahoma Department of Transportation (ODOT) procedures. Specialized methods such as Superpave mix design and Texas gyratory compaction are also included.

Students will gain practical knowledge of how aggregate blends are formulated to achieve target gradations and performance characteristics required for asphalt and concrete applications. Emphasis is placed on understanding material variability, compliance with specifications, and proper sampling techniques.

Completion of the Aggregates module is strongly recommended before enrolling, as it provides the foundational knowledge necessary for success in this course.

With the exception of Construction Inspector Training classes, all training modules are specifically designed to prepare students for certification. Hands-on experience is a critical component of technician training; therefore, students will have the opportunity to practice each procedure using the actual equipment and supplies required by the applicable standards. Whenever possible, activities are conducted under conditions that closely replicate real-world field or laboratory environments to ensure readiness for certification and job performance.

1. OHD L-65
Sampling Asphalt Mixtures

- ODOT standard procedure that includes:
    - **R67**: Obtaining cores
    - **R97**: Sampling from truck transport
    - General field sampling of asphalt mixtures

2. AASHTO R 47
Reducing Samples of Hot Mix Asphalt to Testing Size Using a Mechanical Splitter

- Covers procedures for reducing HMA using a mechanical splitter:
    - Type A (chute-type splitter)
    - Type B (quartering method with pans)

3. OHD L-5
Testing Liquid Asphalt Cement (AC)

- Procedures for sampling and handling liquid asphalt materials.

4. OHD L-26 (Part 1 & 2)
Ignition Oven Method

- Determines asphalt binder content by burning off asphalt and calculating remaining aggregate mass.

5. AASHTO T 209
Maximum Specific Gravity of Bituminous Paving Mixtures (Rice Test)

- Determines the theoretical maximum specific gravity (Gmm) of asphalt mixtures.

6. AASHTO T 30
Mechanical Analysis of Extracted Aggregate

- Performs sieve analysis on aggregates extracted from asphalt mixtures to determine gradation.

7. AASHTO T 176 (Parts 1 & 2)
Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test

- Measures cleanliness of fine aggregate by detecting clay-like materials.

8. OHD L-14 / AASHTO T 166
Bulk Specific Gravity of Compacted Asphalt Mixtures

- Applies to both **roadway cores** and **lab-molded specimens** to determine density.

9. OHD L-14 Method 2
In-Place Density Using Nuclear Gauge (Nuc Gage)

- Measures field density of asphalt pavement using a nuclear density gauge.

10. OHD L-45
Specific Gravity and Unit Weight Using Vacuum Sealing Method

- Alternative method to determine the bulk specific gravity of compacted asphalt samples using vacuum sealing.

11. AASHTO T 312
Superpave Gyratory Compactor

- Compacts asphalt specimens for volumetric mix design using Superpave method.

12. ASTM D 8225
IDEAL-CT (Cracking Tolerance Index)

- Measures cracking resistance of asphalt mixtures under monotonic loading – performance-based test for intermediate temperature cracking.

Concrete Materials (Includes ACI Extension) – Key Elements (Please Click for additional content)

This module provides comprehensive coverage of Portland Cement Concrete (PCC) as it relates to both paving and structural construction projects. Topics include all critical phases of concrete handling, such as production, transportation, placing, curing, and field/laboratory testing to ensure material performance and compliance with specifications.

Students will explore the fundamentals of concrete **mix design**, including the selection and proportioning of materials to achieve desired strength, durability, and workability. The course also addresses the role of **admixtures**, **cement fineness**, **batching methods**, and techniques for making **trial mix adjustments** to optimize concrete performance under varying jobsite conditions.

A major focus is placed on AASHTO procedures for sampling and testing fresh and hardened concrete, ensuring students are fully prepared to conduct quality control and quality assurance testing in the field. Hands-on training with industry-standard equipment allows students to practice sampling, slump testing, air content measurement, temperature checks, unit weight determination, and strength testing procedures. This practical experience is essential for certification and successful application in real-world concrete construction environments.

1. AASHTO R 60
Sampling Freshly Mixed Concrete

- Describes procedures for obtaining representative concrete samples from various delivery methods.

2. AASHTO T 309
Temperature of Freshly Mixed Hydraulic-Cement Concrete

- Measures the temperature of fresh concrete at the time of placement or testing.

3. AASHTO T 119
Slump of Hydraulic Cement Concrete

- Determines the consistency/workability of fresh concrete using the slump cone method.

4. AASHTO R 100
Making and Curing Concrete Test Specimens in the Field

- Provides procedures for field preparation and curing of test cylinders or beams to ensure accurate strength results.

5. AASHTO T 121
Density (Unit Weight), Yield, and Air Content of Fresh Concrete

- Measures the weight per cubic foot of concrete, calculates yield, and determines air content using gravimetric methods.

6. AASHTO T 152
Air Content of Freshly Mixed Concrete by the Pressure Method

- Commonly used on normal-weight concrete; uses a **Type B pressure air meter** to determine air content.

7. AASHTO T 196
Air Content of Freshly Mixed Concrete by the Volumetric Method

- Alternative to pressure method; best for lightweight aggregate concrete.

8. AASHTO T 22
Compressive Strength of Cylindrical Concrete Specimens

- Measures the compressive strength of standard concrete cylinders after curing (typically 7, 14, or 28 days).

9. Type B Air Meter Calibration

- Ensures the **Type B pressure air meter** is functioning accurately by performing calibration checks as per manufacturer or procedural guidelines.

Materials Sampling & Testing – Key Elements (Please Click for additional content)

This comprehensive course is specifically designed for construction inspectors seeking to earn their Materials Sampling & Testing certification. It provides in-depth instruction and hands-on training in the proper procedures for sampling and testing construction materials, with a primary focus on concrete.

The curriculum thoroughly covers all tests outlined in the Concrete Materials section, ensuring that students are well-versed in industry-standard practices. In addition, the course includes training in Random Sampling techniques and key AASHTO (American Association of State Highway and Transportation Officials) procedures, including R 90 (Sampling of PCC), R 67 (Sampling Bituminous Materials), R 97 (Sampling Aggregate Products), and T 310 (In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods).

Students will also become familiar with the Oklahoma Department of Transportation (OHD) testing standards, including OHD L 5 (Sampling Fresh Concrete) and OHD L 14, Method II (Sampling and Testing Aggregates). By the end of the course, participants will be prepared to confidently perform required tests in the field and meet the certification requirements for materials sampling and testing.

With the exception of the Construction Inspector Training classes, training modules focus on preparing students for certification. It is essential for new technicians to gain hands-on experience with the equipment and supplies needed for each standard. Each student should have opportunities to practice procedures under conditions that closely simulate field or laboratory environments, as practically possible in an educational setting.

1. AASHTO R 90
Sampling Aggregates

- Procedures for sampling fine and coarse aggregates from stockpiles, conveyor belts, and roadways.

2. AASHTO R 60
Sampling Freshly Mixed Concrete

- Field procedures to obtain representative samples of fresh concrete.

3. OHD L-65
Sampling Asphalt Mixtures

- Includes methods for sampling from truck transport, cores, and roadway placements.

4. AASHTO T 310
In-Place Density and Moisture of Soils by Nuclear Methods

- Determines soil compaction and moisture content using a nuclear gauge (shallow depth).

5. OHD L-5
Sampling Liquid Asphalt (AC)

- Proper procedures for sampling liquid asphalt binders.

6. OHD L-14 (Asphalt)
Nuclear Density of Asphalt Pavement

- Measures in-place density of asphalt layers using a nuclear gauge.

7. AASHTO T 152
Air Content of Fresh Concrete by Pressure Method

- Measures air content using the **Type B pressure meter**, suitable for normal-weight concrete.

8. **Pressure Meter Calibration

- Ensures the **Type B pressure air meter** is properly calibrated and accurate.

9. AASHTO T 196
Air Content by Volumetric Method (Roll-a-Meter)

- Used for lightweight or highly air-entrained concrete mixtures.

10. AASHTO T 119
Slump of Hydraulic Cement Concrete

- Assesses concrete consistency and workability in the field.

11. AASHTO R 100
Making and Curing Concrete Cylinders in the Field

- Instructions for preparing, handling, and curing test cylinders for compressive strength testing.

12. AASHTO T 309
Temperature of Fresh Concrete

- Measures the temperature of fresh concrete at time of sampling or placement.

13. AASHTO T 121
Unit Weight (Density), Yield, and Air Content of Concrete

- Determines the weight per cubic foot and yield of concrete, with air content by gravimetric method.

14. AASHTO T 22
Compressive Strength of Cylindrical Concrete Specimens

- Test method for breaking concrete cylinders to determine compressive strength.

Profilograph Operator – Smoothness Testing Equipment (Please Click for additional content)

A two-day class instructing students in the proper assembly, operation, and maintenance of contemporary smoothness testing equipment. Covers specifications, ODOT special provisions, and interpretation of test results.

Technicians must demonstrate proficiency in the following key areas related to operating the profilograph (or other smoothness testing devices):

1. Machine Assembly

- Properly assemble the profilograph according to manufacturer specifications.
- Ensure all components are secure and functional (frame, wheels, sensors, electronics, etc.).

2. Entering Settings

- **Input job-specific parameters including:**
  - Project number
  - Lane ID
  - Test start/end stations
  - Filter settings (e.g., blanking band width)
  - Units of measurement (inches, mm, etc.)

3. Vertical Verification

- Verify vertical sensor calibration using a certified reference block or shim.
- Ensure accuracy of the vertical displacement readings.
- Check for zero drift and recalibrate as needed.

4. Bounce Test

- **Perform bounce or "dead wheel" test to:**
  - Ensure the profilograph is stable
  - Identify excessive wheel rebound or erratic sensor readings
- **This confirms vertical dampening and mechanical integrity.**

5. Horizontal Calibration

- Verify and adjust horizontal encoder or odometer calibration.
- Compare measured distances against a certified distance (e.g., 100-ft tape test).
- Update calibration constants if out of tolerance.

6. Speed and Line Control

- Operate the profilograph at the correct testing speed (as recommended by manufacturer or spec, usually walking speed).
- Maintain consistent path and alignment in the test lane.
- Avoid weaving or drifting from the intended test line.

7. Data Exporting

- **Properly download/export profile data for analysis.**
- **Ensure data files are:**
    - Labeled with correct job information
    - Saved in correct formats (CSV, proprietary formats, PDF reports)
    - Transferred to QC/QA or agency systems as required

Soils Mechanics – Key Elements (Please Click for additional content)

This module introduces the fundamental soil tests commonly used in earthwork construction quality control programs. It emphasizes the importance of soil characterization and proper testing techniques in ensuring the stability and performance of soil-based structures.

Key topics include compaction quality control procedures, which are essential for achieving the required soil density and strength, as well as methods for soil modification to improve workability and engineering properties. The course also covers detailed instruction in standard laboratory and field test procedures, including:

- **Atterberg Limits** (Liquid Limit, Plastic Limit, and Plasticity Index) for evaluating soil consistency and classification
- **Compaction testing** using Proctor methods to determine optimal moisture content and maximum dry density
- **Relative density** testing for cohesionless soils
- **In-place density methods**, including sand cone and nuclear gauge testing, to assess compaction in the field

Students will gain both theoretical knowledge and hands-on experience with the equipment and procedures required for each test, preparing them for certification and effective performance in soil quality control roles.

1. AASHTO T 87
Dry Preparation of Disturbed Soils and Soil-Aggregate Samples for Test

- Describes drying, pulverizing, and sieving of soil samples before testing.

2. AASHTO T 88
Particle Size Analysis of Soils

- Determines soil gradation (sand, silt, clay content) using sieve and hydrometer methods.

3. AASHTO T 89
Determining the Liquid Limit of Soils

- Measures the moisture content at which soil changes from a plastic to a liquid state.

4. AASHTO T 90
Determining the Plastic Limit and Plasticity Index of Soils

- Determines the moisture content at which soil becomes plastic and calculates the plasticity index.

5. ASTM D1140
Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing

- Measures the percentage of fines in soil through wet washing.

6. AASHTO T 99
Moisture–Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 in) Drop (Standard Proctor Test)

- Establishes the relationship between moisture content and dry density for compaction.

7. AASHTO T 224
Correction for Coarse Particles in the Soil Compaction Test

- Adjusts density and moisture values when large aggregate is present in soil samples.

8. AASHTO T 85
Specific Gravity and Absorption of Coarse Aggregate

- Determines specific gravity and absorption values for coarse aggregate used in soils or base material.

9. AASHTO T 310
In-Place Density and Moisture of Soil and Soil–Aggregate by Nuclear Methods (Shallow Depth)

- Measures compaction and moisture of soil layers using a nuclear gauge.

10. AASHTO T 272
Family of Curves – One Point Method

- Estimates a compaction curve using one point of data and a known family of curves.

11. AASHTO M 145
Classification of Soils and Soil–Aggregate Mixtures for Highway Construction Purposes

- Classifies soils based on gradation and Atterberg limits using the AASHTO system.

Construction Inspector Training (No certifications for these discipline.)

To ensure our technicians are fully prepared to meet industry standards, hands-on training is essential. While the Construction Inspector Training classes lay the foundation, it is the practical experience with equipment and supplies that truly solidifies their skills. Providing each student with opportunities to practice procedures in conditions that closely mimic real-world field or laboratory environments will empower them to perform confidently and competently in their roles.

- **ACIT Asphalt Construction Inspector Training**
- **AMD1 Asphalt Mix Design Level 1**

AASHTO T 84 – Specific Gravity and Absorption of Fine Aggregate

- **Purpose:** Determines the bulk, apparent, and SSD (Saturated Surface-Dry) specific gravity of fine aggregates (typically sand).
- **Importance:** Used in asphalt and concrete mix design to determine volumetric properties and calculate VMA (Voids in Mineral Aggregate).

AASHTO T 85 – Specific Gravity and Absorption of Coarse Aggregate

- **Purpose:** Measures specific gravity (bulk, SSD, and apparent) and absorption for coarse aggregates (gravel or crushed stone).
- **Importance:** Critical for calculating mix proportions and volumetric parameters in asphalt and concrete designs.

AASHTO T 304 – Uncompacted Void Content of Fine Aggregate (Fine Aggregate Angularity)

- **Purpose:** Evaluates the angularity and texture of fine aggregates by measuring the void content in a standardized cylinder.
- **Importance:** High angularity typically implies better interlock and friction in asphalt mixtures, improving stability and resistance to rutting.

ASTM D 4791 – Flat, Elongated, or Flat and Elongated Particles in Coarse Aggregate

- **Purpose:** Determines the percentage of flat, elongated, or flat-and-elongated particles in coarse aggregate.
- **Importance:** Excessive flat or elongated particles can negatively affect the strength and workability of asphalt and concrete mixes.

OHD L-18 – Determining Fractured Faces of Coarse Aggregate

- **Purpose:** Assesses the percentage of coarse aggregate particles with one or more fractured faces.

- **Importance:** Fractured faces indicate angularity and better bonding with asphalt, improving mixture strength and performance.

AASHTO T 283 – Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage (Moisture Susceptibility)

- **Purpose:** Measures the moisture susceptibility of asphalt mixtures by evaluating the tensile strength ratio (TSR) of conditioned vs. unconditioned samples.
- **Importance:** Helps identify potential stripping (loss of adhesion between asphalt binder and aggregate) and ensures durability under moisture exposure.

OHD L-44 – Permeability of Asphalt Mixtures

- **Purpose:** Measures the rate at which water can permeate through compacted asphalt samples.
- **Importance:** High permeability can lead to moisture damage and reduced pavement life; used to assess mix density and compaction quality.

- **AMD2 Asphalt Mix Design 1&2**
- **BCIT Bridge Construction Training**
- **EWIC Earthwork Inspector Course**
- **PCCP Portland Cement Concrete Pavement**

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