

# CNST-1660: MATERIAL TESTING

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## Cuyahoga Community College

### Viewing: CNST-1660 : Material Testing

**Board of Trustees:**

10/26/2023

**Academic Term:**

Fall 2024

**Subject Code**

CNST - Construction Engineering Tech

**Course Number:**

1660

**Title:**

Material Testing

**Catalog Description:**

Application of standard procedures for sampling and testing construction materials. Students will use laboratory equipment to test conditions of asphalt, concrete, and soil in relationship to stated material specifications, and then record testing results for analysis by supervisory personnel.

**Credit Hour(s):**

2

**Lecture Hour(s):**

1

**Lab Hour(s):**

2

## Requisites

**Prerequisite and Corequisite**

MATH-0955 Beginning Algebra or qualified math placement, and CNST-1290 Construction Print Reading, or concurrent enrollment.

## Outcomes

**Course Outcome(s):**

Perform standard construction industry practices for sampling and testing of freshly mixed asphalt.

**Objective(s):**

1. Select and wear appropriate personal protective equipment for sampling and testing of asphalt.
2. Identify and discuss potential hazards for specified sampling and testing of asphalt.
3. Utilize plans and specifications to identify locations on site where asphalt will be used.
4. Discuss and demonstrate standard procedures for sampling of asphalt mixes and components.
5. Explain and demonstrate standard procedures for preparing an asphalt mix samples.
6. Calibrate and maintain testing equipment used for standard industry Level 1 sampling and testing of asphalt mixes and components.
7. Perform field and laboratory testing of asphalt mixes and components.
8. Communicate results of asphalt sampling and testing in a written report following standard industry reporting requirements.

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**Course Outcome(s):**

Perform standard construction industry practices for sampling and testing of freshly mixed concrete.

**Essential Learning Outcome Mapping:**

Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

**Objective(s):**

1. Select and wear appropriate personal protective equipment for sampling and testing of concrete.
  2. Identify and discuss potential hazards for specified concrete sampling and testing.
  3. Utilize plans and specifications to identify locations on site where concrete will be placed.
  4. Discuss and demonstrate standard procedures for sampling of concrete mixes and components.
  5. Explain and demonstrate standard procedures for preparing, storage, and transportation of concrete mix samples.
  6. Calibrate and maintain testing equipment used for standard industry Level 1 sampling and testing of concrete mixes and components.
  7. Perform field and laboratory testing of asphalt mixes and components.
  8. Communicate results of sampling and testing in a written report following standard industry reporting requirements.
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**Course Outcome(s):**

Perform standard construction industry practices for sampling and testing of soil samples.

**Objective(s):**

1. Select and wear appropriate personal protective equipment for sampling and testing of soils.
  2. Identify and discuss potential hazards for specified soil sampling and testing.
  3. Utilize plans and specifications to identify locations on site from which soil samples need to be tested.
  4. Discuss and demonstrate standard procedures for sampling of soil samples.
  5. Explain and demonstrate standard procedures for preparing soil samples.
  6. Calibrate and maintain testing equipment used for standard industry Level 1 sampling and testing of concrete mixes and components.
  7. Perform field density testing of soil samples.
  8. Perform laboratory testing of soil samples.
  9. Communicate results of sampling and testing in a written report following standard industry reporting requirements.
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**Methods of Evaluation:**

1. Laboratory assignments
2. Written laboratory assignments
3. Quizzes
4. Class participation
5. Instructor observation/evaluation of student lab exercise performance
6. Final Examination

**Course Content Outline:**

1. Personal and Worksite Safety
  - a. Personal protective equipment (PPE) for material sampling and testing
  - b. Worksite hazards for materials sampling and testing
2. Plans and Specifications
  - a. Checking job specifications to determine sampling needs
  - b. Identification of locations on site for sampling
3. Sampling of Asphalt Mixes and Components
  - a. Documenting sampling locations
  - b. Sampling procedures to obtain samples
  - c. Labeling sample origin and material
4. Asphalt Mix Sample Preparation
  - a. Reducing/splitting samples to test size.
  - b. Conditioning the samples for testing by temperature.
  - c. Labeling the prepared samples
5. Field and Laboratory Testing of Asphalt Mixes and Components
  - a. Field density tests of compacted asphalt mixes
  - b. Aggregate gradation tests
  - c. Asphalt content tests of asphalt mixes

- d. Determination of the moisture content of asphalt mixes.
  - e. Determination of the moisture content of aggregates.
  - f. Maximum theoretical specific gravity and density tests of asphalt mixes
  - g. Bulk specific gravity tests of compacted asphalt mixes
  - h. Fractured face tests of aggregates
6. Sampling of Concrete Mixes and Components
- a. Sample collection and labeling
    - i. Plastic concrete
    - ii. Mix components
    - iii. Masonry units (e.g. block or brick)
  - b. Documentation
    - i. Source of samples (e.g. aggregates or plastic concrete)
    - ii. Placement location for plastic concrete
    - iii. Mix information
7. Concrete Mix Sample Preparation, Storage, and Transportation
- a. Preparing sample for strength testing.
  - b. Transporting plastic concrete samples to on-site testing location.
  - c. Wet sieving plastic concrete.
  - d. Site curing samples.
  - e. Transporting hardened concrete samples to the laboratory
  - f. Lab curing prepared specimens.
  - g. Reducing samples to appropriate testing size for various tests
    - i. Slump
    - ii. Strength
    - iii. Air content
    - iv. Temperature
8. Field and Laboratory Testing of Concrete Mixes and Components
- a. Determining temperature of plastic concrete.
  - b. Time limits for testing
  - c. Slump tests
  - d. Determining air content
    - i. Pressure method.
    - ii. Volumetric method
    - iii. Gravimetric method
  - e. Determining unit weight
  - f. Aggregate gradation tests
  - g. Moisture content tests
  - h. Compressive strength tests of concrete cylinders
9. Sampling of Soils
- a. Obtaining samples
  - b. Documenting sample locations
  - c. Transporting samples back to lab
  - d. Identifying type of materials of samples
  - e. Logging sample or I.D. the sample for lab testing (i.e., tracking)
10. Soils Sample Preparation
- a. Reducing to test size
  - b. Drying
  - c. Weighing
  - d. Processing through sieve.
  - e. Moisture-conditioning
11. Field Density Testing
- a. Identifying where to take the test
  - b. Determining the number of tests
  - c. Identifying type of material
  - d. Documenting test location
  - e. Documenting results.
  - f. Documenting limitations
  - g. Performing assigned field density test

12. Laboratory Testing of Soils
  - a. Atterberg limit tests
  - b. Proctor tests
  - c. Sieve analysis
  - d. Perform Washed -No. 200 sieve
  - e. Perform moisture content test.
13. Communication of Results
  - a. Collecting required test data for reports
  - b. Documenting field observations
  - c. Completing test forms and related reports
  - d. Reporting results to supervisor
  - e. Assessing reasonableness of results
14. Equipment Calibration and Maintenance
  - a. Verify lab testing equipment is calibrated for Level I tests.
  - b. Verify field testing equipment is calibrated for Level I tests.
  - c. Verify equipment operation for Level I tests

## Resources

American Concrete Institute. (2016) *Concrete Fundamentals*, Farmington Hills, MI.

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American Concrete Institute. (2017) *Concrete Field Testing Technician-Grade I*,

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National Institute for Certification in Engineering Technologies. (2017) Level 1 Content Outline. *Construction Materials Testing-Asphalt Certification*,

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National Institute for Certification in Engineering Technologies. (2017) Level 1 Content Outline. *Construction Materials Testing-Concrete Certification*,

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National Institute for Certification in Engineering Technologies. (2017) Level 1 Content Outline. *Construction Materials Testing-Certification Soils*,

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Occupational Safety and Health Administration. (2022) *OSHA 29 CFR 1926: Safety and Health Regulations for Construction*,

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## Resources Other

American Concrete Institute. 2023. <https://www.concrete.org/>

NICET. 2023. <https://www.nicet.org/>

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