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Effective 6 June 2025

CECW-EC

Engineering and Design

Materials Testing Laboratories and Validation

FOR THE COMMANDER:

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Purpose. This engineer regulation prescribes the responsibilities, policies, and procedures for laboratories performing materials testing, investigations, evaluations, and analytical services in support of design, construction, and operation of civil works, military, and support-for-other programs.

Applicability. This regulation is applicable to all U.S. Army Corps of Engineers commands having responsibilities for the planning, design, construction, and operation of civil works, military, and support-for-others programs. The applicable construction materials for laboratory testing include soils, rock, aggregates, concrete, and asphalt.

Distribution Statement. Approved for public release; distribution is unlimited.

Proponent and Exception Authority. The proponent of this regulation is the Headquarters, United States Army Corps of Engineers, Engineering and Construction Directorate. The proponent has the authority to approve exceptions or waivers to this regulation that are consistent with controlling law and regulations. Only the proponent of a publication or form may modify it by officially revising or rescinding it.

* This regulation supersedes ER 1110-1-8100, dated 31 December 1997 and ER 1110-1-261, dated 15 June 1999. ER 1110-1-8100 ● 6 May 2025



SUMMARY of CHANGE

ER 1110-1-8100

Materials Testing Laboratories and Validation

Changes in this major revision, dated 6 May 2025 include:

- Section 7a, changed "technical expertise and staffing" to "Material Testing Center technical expertise and staffing" to clarify who's staffing is being examined.
- Section 7a, changed "the Materials Testing Center performing materials testing" to "coordination of the Material Testing Center with the laboratory performing materials testing."
- The following language has been added into section 7c "The Material Testing Center performs materials testing and maintains certified technicians who are knowledgeable testing requirements. This qualifies them to perform inspections."
- Section 8, implied that reports were only kept if Headquarters requests or requires. For clarification, the following change was made "for Headquarters, United States Army Corps of Engineers review if requested or required" to "for when Headquarters, United States Army Corps of Engineers review is requested or required."
- Section 9d (1) changed, "The required American Concrete Institute certifications" to "The minimum required American Concrete Institute certifications" since a higher certification such as Concrete Laboratory Testing Technician Level 1 or 2 includes the listed tests for Concrete Strength Testing Technician.
- Section 9d (3) stated that "technicians performing the tests must meet the personnel qualifications required in the testing standard". For clarification, the following change was made "(3) For materials testing standards not listed above, technicians performing the tests must meet the personnel qualifications compliant with minimal Materials Testing Center requirements and with minimal requirements listed in practices, such as American Society for Testing and Material's: D3740, C1077, C1093, and D3666 where applicable."
- Removed paragraph addressing unit pricing.
- Section 13 was added to document alternate evaluation procedures for use of non-validated laboratories for Districts outside of the United States and its territories.

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1. Purpose

This engineer regulation (ER) prescribes the responsibilities, policies, and procedures for validation of laboratories performing materials testing, investigations, evaluations, and analytical services in support of design, construction, and operation of civil works, military, and support-for-other programs. Validated laboratories will ensure quality data is collected, producing a quality product.

2. Distribution statement

Approved for public release; distribution is unlimited.

3. References

See Appendix A.

4. Records management (recordkeeping) requirements

The records management requirement for all record numbers, associated forms, and reports required by this publication are addressed in the Army Records Retention Schedule. Detailed information for all related record numbers is located on the U.S. Army Corps of Engineers (USACE) Records Management Site https://usace.dps.mil/sites/INTRA-CIOG6/SitePages/Records-Management.aspx. If any record numbers, forms, and reports are not current, addressed, and/or published correctly, see DA Pam 25-403 for guidance.

5. Associated publications

This section contains no entries.

6. Policy

All United States Army Corps of Engineers (USACE) materials laboratory testing must be performed by a USACE-validated laboratory. The Materials Testing Center (MTC) and all USACE materials laboratories must maintain validated testing facilities, which include Division, District, and project-specific laboratories. All USACE District offices are strongly encouraged to use USACE resources for materials testing, investigations, evaluations, and analytical services in support of project investigation, design, construction, operation of civil works, military, and support-for-others programs.

7. Responsibilities

a. Headquarters U.S. Army Corps of Engineers Geotechnical, Geology, and Materials Community of Practice. The Headquarters, United States Army Corps of Engineers Geotechnical, Geology, and Materials Community of Practice (HQUSACE GG&M CoP) will review and audit the MTC on a two-year cycle or as deemed necessary. This audit will examine the capabilities and related workload level to determine the adequacy of MTC technical expertise and staffing. Feedback will also be provided regarding problems experienced by the laboratories. GG&M CoP may form a laboratory steering committee (LSC) to provide centralized program oversight, review, and coordination of the MTC with the laboratory performing materials testing. The LSC will monitor laboratory performance, fiscal accountability, quality, and responsiveness.

b. U.S. Army Engineer Research Development Center. The Engineering Research Development Center (ERDC) must provide management oversight of the MTC to include providing sufficient budget for training, staffing, and equipment to maintain validation. ERDC must ensure the Director of the MTC is a structural, geotechnical, or equivalent engineer with a minimum of five years of materials testing experience and possess a Professional Engineer license in the United States.

c. Material Testing Center. The MTC, on behalf of GG&M CoP, will:

(1) Manage and maintain certified technical experts, for conducting the material testing and laboratory validation program.

(2) Establish a training program to provide training and certification for laboratory validation inspectors.

(3) Maintain a list of certified laboratory validation inspectors to inspect and validate laboratories providing services to USACE projects. Inspectors can reside in any organization across the enterprise.

(4) Coordinate with validation inspectors and laboratories requiring validation.

(5) Maintain a list of laboratory validation status and host it on a public website.

(6) Send notice of certification of validation to the requesting laboratory and associated District.

(7) Maintain all laboratory inspection records for four years from date of inspection or as otherwise deemed necessary.

d. Laboratories. All USACE laboratories must be under the direction of a licensed professional engineer with a minimum of five years of experience in materials testing. It is the responsibility of each laboratory to:

(1) Provide materials testing in support of planning, design, construction, and operation of civil works, military, and support-for-others programs.

(2) Perform high-quality work per American Association of State Highway and Transportation Officials (AASHTO) R18 and American Society for Testing and Materials (ASTM) E329.

(3) Maintain USACE laboratory validation.

e. Major Subordinate Commands. It is the responsibility of the Major Subordinate Commands (MSCs) to assure the conformance of this regulation.

f. Districts. It is the responsibility of Districts to:

(1) Verify that any laboratories utilized by the District, Architect/Engineer, or construction contractor are validated per this Engineering Regulation.

(2) Establish a Quality Assurance program to verify the accuracy of contracted laboratory results.

8. Laboratory validation

a. Validation of the Material Testing Center. Concrete and concrete materials capabilities at the MTC will be inspected at least every two years by the Cement and Concrete Reference Laboratory (CCRL) of the National Institute of Standards and Technology (NIST). The soil capabilities at the MTC will be inspected at least every two years by the AASHTO resource. CCRL and AASHTO inspection reports will be kept and maintained on file at the MTC for a minimum of four years. When requested or required, MTC must provide GG&M CoP with a digital copy of said inspection reports for review.

b. Validation of all laboratories. Validation of materials testing will be:

(1) Performed by a USACE GG&M CoP certified validation inspector. Validators may not validate their own laboratories.

(2) Performed prior to testing. Any testing prior to validation will be subject to scrutiny and results may be rejected.

(3) Performed at least every two years after initial validation.

(4) Project-specific labs require site-specific inspection and validation. When satellite laboratories (except for stand-alone facilities in remote locations) are under the supervision of a permanent, parent lab, the quality management system of the parent will apply to the satellite.

c. Validation procedures. Validation of all materials testing laboratories must be performed by the USACE GG&M CoP certified inspector. Validation may be accomplished by one of the following processes:

(1) *Inspection*. Inspection must be performed by a USACE GG&M CoP certified validation inspector per ASTM E329.

(2) Audit. A laboratory may be validated by auditing if it has been accredited by the CCRL or AASHTO within the past two years per ASTM E329. The audit must be performed by an USACE GG&M CoP certified validation inspector. Inspection by an USACE GG&M CoP certified validation inspector may be required after auditing if one or more of the critical testing procedures required in the project specification was not

included in the CCRL or AASHTO Materials Reference Library inspection report, or if there is any concern that the laboratory may not be able to provide required services.

d. Laboratory location. The validation of a laboratory is site-specific and cannot be transferred or carried over to a facility at a different location, except for satellite laboratories as noted above.

e. Validation report. After validation of a laboratory, the MTC will report the findings to the District/Lab requesting the validation and maintain copies of the validation report for four years after the validation or longer as deemed necessary.

f. Revalidation. If there are questionable results or if the conditions or locations of the laboratory change, a reinspection and revalidation may be required. Revalidation of a lab can be requested at any time by the District/Laboratory and will be performed at the discretion of the MTC.

g. Validation suspension or revocations. Failure to respond to requirements from the MTC or AASHTO resource, within a given time frame, may result in the suspension or revocation of all or part of the validation.

(1) In the case of suspension of specific test methods, other methods still validated within the same laboratory validation may continue to be conducted. Any suspended method may not be conducted until all issues are resolved to the satisfaction of the MTC. In the case of evidence-based nonconformance of a laboratory to ASTM standards, suspension of a laboratory's validation or individual methods may be issued with no warning.

(2) After revocation, it is at the discretion of the MTC whether laboratories applying for revalidation will need to complete an onsite inspection, at the cost of the laboratory or the contractor, whichever is appropriate.

9. Standards of acceptability

a. Aggregate, concrete, bituminous materials, soil, and rock. Laboratories will be validated for compliance with the latest version of ASTM E329, the latest version of Engineering Manual (EM) 1110-2-1906, or applicable project specifications. Testing will follow all current ASTM standards, unless otherwise specified by USACE or the MTC. In the case of more than one acceptable test procedure within a given ASTM standard, the ASTM preferred method will be used, unless otherwise directed by the District or MTC in writing.

b. Steel and other construction materials. Laboratories will be validated for capabilities to perform tests required by project requirements and for compliance with ASTM E329.

c. Proficiency Sampling Program. Laboratories are required to enroll and participate in an approved Proficiency Sampling Program (PSP) that includes methods of testing to be validated. Examples of approved programs include AASHTO Resource,

CCRL, Construction Materials Engineering Council, and others. The MTC reserves the right to approve or disapprove a chosen program or approve an alternative to this requirement.

d. Technician certifications required for USACE laboratory validation.

(1) Any laboratory requesting validation will be required to present current American Concrete Institute (ACI) certifications. Technicians assigned to conduct any tests listed below will have current corresponding certifications. The laboratory will have a minimum of two technicians that possess each required certification. The minimum required ACI certifications, along with the testing methods covered by each, are as follows:

(a) Aggregate Testing Technician Level 1 – ASTM D75, C702, C117, C127, C128, C136, C566, and C40.

(b) Aggregate/Soils Base Testing Technician – ASTM D75, C702, D421, D4318, D2216, D698, and D1557.

(c) Concrete Strength Testing Technician – ASTM C617, C1231, C39, and C78.

(d) Concrete Field-Testing Technician Grade 1 – ASTM C172, C1064, C143, C138, C231, C173, and C31.

(2) Proof of enrollment/payment for a certification testing event will not be accepted for validation. Only final ACI certifications of the technicians performing the testing will be accepted.

(3) For materials testing standards not listed above, technicians performing the tests must meet the personnel qualifications compliant with minimal MTC requirements and with minimal requirements listed in practices, such as ASTM D3740, C1077, C1093, and D3666, where applicable.

10. Special tests and investigations

Where tests, analyses, and investigation needs are outside the capabilities of the MTC and Civil Works Laboratories, other laboratories may be used, provided those laboratories are authorized and/or certified to perform those specific tests per a published and industry-recognized standard.

11. Materials testing report

a. General. Reports of laboratory test results must include calculations, explanations of testing procedures used, and, where appropriate, any interpretations of test results.

b. Acceptance tests. A report on acceptance tests for a construction material must indicate whether the material meets the specification requirements. Laboratories do not

have the authority to approve or disapprove material. Approval is dictated by project specifications.

12. Safety and health

All materials testing laboratories must comply with EM 385-1-1 and ER 385-1-1.

13. Outside the continental United States alternative evaluation

a. While formal validation, as described by other sections of this ER is preferred, an alternative evaluation can be performed by Districts outside of the continental United States (U.S.) and its territories to allow use of non-validated laboratories. Per Unified Facilities Criteria (UFC) 1-200-01, 104.11, "An alternative material, design, or method of construction may be approved where the Building Official/Authority Having Jurisdiction (BO/AHJ) finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, UFC, or Facilities Criteria (FC), and that the material, method, or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code, UFC, or FC in quality, strength, effectiveness...."

b. For Districts outside of the U.S. and its territories, the BO/AHJ must evaluate and document in writing that the alternative methods and procedures (such as selection of a non-USACE-validated laboratory) are appropriate, and that the laboratory is qualified to produce test results with sufficient quality to meet the project's objectives. Reach back support for this evaluation is available from the MTC, as needed. Laboratories approved using this alternative evaluation should provide documented evidence per the contract specifications that the laboratory is producing quality results with adequate controls to meet the project's objectives (for example, review of PSPs, updated quality manual, etc.) throughout the duration of project construction.

Appendix A References

Unless otherwise indicated, all U.S. Army Corps of Engineers publications are available on the USACE website at <u>https://publications.usace.army.mil</u>. Army publications are available on the Army Publishing Directorate website at <u>https://armypubs.army.mil</u>. American Society for Testing and Materials (ASTM) publications are available at <u>https://www.astm.org/products-services/standards-and-publications.html</u>.

American Association of State Highway and Transportation Officials (AASHTO) R18

Standard Recommended Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories (https://www.appliedtesting.com/standards/aashto-r18-quality-management-system-forcmt-laboratories)

ASTM C31

Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C39

Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

ASTM C40

Standard Test Method for Organic Impurities in Fine Aggregates for Concrete

ASTM C78

Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)

ASTM C117

Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C127

Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate

ASTM C128

Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate

ASTM C136

Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM C138

Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

ASTM C143 Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C172

Standard Practice for Sampling Freshly Mixed Concrete

ASTM C173

Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C231

Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C566

Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying

ASTM C617

Standard Practice for Capping Cylindrical Concrete Specimens

ASTM C702

Standard Practice for Reducing Samples of Aggregate to Testing Size

ASTM C1064

Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

ASTM C1231

Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Cylindrical Concrete Specimens

ASTM D75

Standard Practice for Sampling Aggregates

ASTM D421

Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants

ASTM D698

Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))

ASTM D1557

Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))

ASTM D2216

Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D4318

Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM E329

Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

DA Pam 25-403

Guide to Recordkeeping in the Army

ECB 2021-5 (Revision 1)

Interpretation of UFC 1-200-01, Delegation of Building Official/Authority Having Jurisdiction (BO/AHJ) Responsibilities, and Waiver/Exemption/Equivalency Approvals

EM 1110-2-1906 Laboratory Soils Testing

EM 385-1-1 Safety and Health Requirements Manual

ER 385-1-1 Industrial Hygiene Program

UFC 1-200-01 DoD Building Code (<u>https://www.wbdg.org/ffc/dod.</u>)

Glossary of Terms

<u>Term</u>	Definition
AASHO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ARIMS	Army Records Information Management System
ASTM	American Society for Testing and Materials
BO/AHJ	Building Official/Authority Having Jurisdiction
CCRL	Cement and Concrete Reference Laboratory
EM	Engineering Manual
ER	Engineering Regulation
ERDC	(USACE) Engineer Research & Development Center
FC	Facilities Criteria
GG&M CoP	Geotechnical, Geology, and Materials Community of Practice
HQUSACE	Headquarters, U. S. Army Corps of Engineers
LSC	Laboratory Steering Committee
MSC	Major Subordinate Command
MTC	Material Testing Center
NIST	National Institute of Standards and Technology
PSP	Proficiency Sampling Program
RRS-A	Records Retention Schedule—Army
UFC	Unified Facilities Criteria
U.S.	United States
USACE	United States Army Corps of Engineers