

NIST HANDBOOK 150-5
2005 Edition

National
Voluntary
Laboratory
Accreditation
Program

CONSTRUCTION
MATERIALS
TESTING

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Foreword

The NIST Handbook 150 publication series sets forth the procedures, requirements, and guidance for the accreditation of testing and calibration laboratories by the National Voluntary Laboratory Accreditation Program (NVLAP). The series is comprised of the following publications:

- NIST Handbook 150, *NVLAP Procedures and General Requirements*, which contains the general procedures and requirements under which NVLAP operates as an unbiased third-party accreditation body;
- NIST Handbook 150-xx program-specific handbooks, which supplement NIST Handbook 150 by providing additional requirements, guidance, and interpretive information applicable to specific Laboratory Accreditation Programs (LAPs) under NVLAP.

The program-specific handbooks are not standalone documents, but rather are companion documents to NIST Handbook 150. Each program-specific handbook tailors the general criteria found in NIST Handbook 150 to the specific test methods, calibrations, or types of tests or calibrations covered by a LAP.

NIST Handbook 150-5, *NVLAP Construction Materials Testing*, presents the technical requirements and guidance for the accreditation of laboratories under the NVLAP Construction Materials Testing LAP. The 2005 edition incorporates changes resulting from the release of the newest editions of ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*, and NIST Handbook 150, as well as editorial improvements. The 2005 edition of NIST Handbook 150-5 supersedes and replaces the 1994 edition.

The handbook was revised with the participation of technical experts in the field of construction materials testing and was approved by NVLAP. The following significant changes have been made to this handbook with respect to the previous edition:

- all references to applicable international guides and standards have been updated;
- on-site assessment checklists and the test method selection list are no longer included as appendices in order that they may be provided as separate documents, which may be updated at intervals different than the handbook;
- the body of the handbook has been restructured, where appropriate, to conform with internationally accepted rules for the structure and drafting of standards, to promote ease of use and understanding.

This handbook is also available on the NVLAP web site (<http://www.nist.gov/nvlap>).

Questions or comments concerning this handbook should be submitted to NVLAP, National Institute of Standards and Technology, 100 Bureau Drive, Stop 2140, Gaithersburg, MD, 20899-2140; phone: 301-975-4016; fax: 301-926-2884; e-mail: nvlap@nist.gov.

Introduction

The Construction Materials Testing laboratory accreditation program (LAP) began in 1978 as the Concrete LAP. The program gradually expanded beyond concrete testing to include other testing areas such as admixtures, aggregates, cement, geotextiles, road and paving materials, soil and rock, and steel materials.

NVLAP accreditation is based on the evaluation of a laboratory's technical qualifications and competence for conducting specific standard test methods in construction materials testing. Test methods that relate to this program may be developed by a trade, professional, governmental, or standards-writing organization.

Accreditation is available to any laboratory (including commercial, manufacturer, university, and federal, state, and local government laboratories) that tests in accordance with standard construction materials test methods. A foreign-based laboratory may also be accredited by NVLAP if the laboratory meets the same requirements as domestic laboratories and pays any required additional fees associated with conducting the on-site assessment.

To be granted accreditation, a laboratory shall satisfy the NVLAP requirements contained in NIST Handbook 150 and this handbook.

1 General information

1.1 Scope

1.1.1 NIST Handbook 150-5 specifies technical requirements and provides guidance for NVLAP accreditation of laboratories that provide construction materials testing. This handbook supplements the NVLAP procedures and general requirements found in NIST Handbook 150.

1.1.2 This handbook, NIST Handbook 150, and the NIST Handbook 150 Checklist constitute the collective body of requirements that must be met by a laboratory seeking NVLAP accreditation for Construction Materials Testing.

1.1.3 This handbook is intended for information and use by accredited construction materials testing laboratories, assessors conducting on-site assessments, laboratories seeking accreditation, other laboratory accreditation systems, users of laboratory services, and others needing information on the requirements for NVLAP accreditation under the Construction Materials Testing (CTS) LAP.

1.2 Organization of handbook

The numbering and titles of the first five clauses of this handbook match those of NIST Handbook 150. The primary subclauses in clauses 4 and 5 (e.g., 4.1, 4.2, etc.) are also numbered and titled to correspond with those of NIST Handbook 150, even when there are no requirements additional to those in NIST Handbook 150.

1.3 Program description

1.3.1 This accreditation program is designed to satisfy the requirements of contractors, state and local governments, and federal agencies specifying accreditation for construction materials testing laboratories.

1.3.2 Accreditation is available for standard test methods in the areas of admixtures, aggregates, cement, concrete, geotextiles, road and paving materials, soil and rock, steel materials and other areas as deemed necessary.

1.3.3 Test methods for which a laboratory may seek accreditation are listed in the Construction Materials Testing Test Method Selection List, which is periodically updated and available from NVLAP. Other test methods may be added to the program upon request, if they are found to be appropriate by NVLAP.

1.4 References

The following documents are referenced in this handbook. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) shall apply within one year of publication or within another time limit specified by regulations or other requirement documents.

— NIST Handbook 150, *NVLAP Procedures and General Requirements*

— IEEE Standard 1012, *IEEE Standard for Software Verification and Validation*

— ASTM C125, *Standard Terminology Relating to Concrete and Concrete Aggregates*

— ASTM C219, *Standard Terminology Relating to Hydraulic Cement*

1.5 Terms and definitions

For the purposes of this handbook, the terms and definitions given in NIST Handbook 150, the terms and definitions given in the standards for which the laboratory seeks accreditation, and the terms and definitions given in ASTM C125 and ASTM C219 apply.

1.6 Program documentation

1.6.1 General

NVLAP assessors use NVLAP checklists to ensure that each laboratory receives an assessment comparable to that received by others. Checklists assist assessors in documenting the assessment to the NVLAP requirements found in NIST Handbook 150 and this handbook. Checklists contain definitive statements or questions about all aspects of the NVLAP criteria for accreditation, and form part of the On-Site Assessment Report (see NIST Handbook 150). The current version of each checklist is available from the NVLAP web site at <<http://www.nist.gov/nvlap>>.

1.6.2 NIST Handbook 150 Checklist

All NVLAP programs use the NIST Handbook 150 Checklist (formerly called the General Operations Checklist), which contains the requirements published in NIST Handbook 150. The checklist items are numbered to correspond to clauses 4 and 5 and annexes A and B of NIST Handbook 150.

1.6.3 NIST Handbook 150-5 Checklist

The NIST Handbook 150-5 Checklist (also referred to as the CTS Program-Specific Checklist) addresses the requirements specific to construction materials testing. The checklist items are numbered to correspond to clauses 4 and 5 of NIST Handbook 150-5.

1.6.4 Test Method Review Summary

The assessor uses the Test Method Review Summary to review the laboratory's ability to perform the standard test methods for the Acoustical Testing Services program. The review of the test methods by the assessor ranges from observing tests to having laboratory staff describe the test procedures. The assessor notes on the Test Method Review Summary the depth into which each part of the test method was reviewed (Observed Test, Examined Apparatus, Walked/Talked Through Test, Listened to Description of Procedures).

1.6.5 NVLAP Lab Bulletins

NVLAP Lab Bulletins are issued to laboratories and assessors, when needed, to clarify program-specific requirements and to provide information about program additions and changes.

2 LAP establishment, development and implementation

This clause contains no information additional to that provided in NIST Handbook 150, clause 2.

3 Accreditation process

3.1 General

3.1.1 This clause discusses the assessment and accreditation process for laboratories in the Construction Materials Testing LAP.

3.1.2 An overview of the laboratory accreditation process is provided in NIST Handbook 150, clause 3, and includes information pertaining to application for accreditation; on-site assessment; proficiency testing; accreditation decision; granting accreditation; renewal of accreditation; changes to scope of accreditation; monitoring visits; and suspension, denial, revocation, and voluntary termination of accreditation.

3.1.3 The assessment process consists of a NVLAP review of the application and laboratory management system documentation and an on-site assessment visit.

3.1.4 NVLAP management may consider a pre-assessment on-site visit to better define the laboratory's requested scope of accreditation. In such cases, the pre-assessment costs will be charged to the laboratory in addition to the actual On-Site Assessment Fee.

3.2 Management system review

3.2.1 When NVLAP receives the application and management system documents, one or more NVLAP assessors are assigned to review the management system documentation. The assessor(s) will review the documents to ensure they cover all aspects of the management system related to quality and, if followed, satisfy the requirements in this handbook and NIST Handbook 150, and the requirements of the test standards for which the laboratory seeks accreditation. Prior to conducting the on-site assessment, the NVLAP assessor(s) may request a copy of the laboratory's quality manual and cross-reference documentation that verifies that all the requirements of NIST Handbook 150 are addressed in the management system documentation.

3.2.2 During the review, a NVLAP assessor may identify nonconformities and require changes to the management system so that it meets the requirements. A NVLAP assessor may ask for additional management system documents related to quality.

3.3 On-site assessment

3.3.1 When the management system review has been completed and nonconformities resolved, NVLAP schedules the on-site assessment.

3.3.2 The on-site assessment will take place at the laboratory site. The NVLAP assessor(s) typically conduct(s) the on-site assessment over a two- to three-day time period. The assessment time may be longer depending on the number of test methods for which a laboratory is accredited. Efforts will be made to minimize disruption to the normal working routines during the assessment. The NVLAP assessor(s) will need time and workspace to complete assessment documentation during his/her time at the laboratory site.

3.3.3 The laboratory shall have its facilities and equipment in good working order and be ready for examination according to the requirements identified in this handbook, NIST Handbook 150, and the laboratory's management system documents, including the quality manual.

3.3.4 The laboratory shall make available, at the beginning of the on-site assessment, all supporting technical information in a format that is conducive to a detailed review.

3.3.5 NVLAP assessors will use the NIST Handbook 150 Checklist and the Test Method Review Summary. The checklist and the technical specifics contained in this handbook ensure that the assessment is complete and that all assessors cover the same items at each laboratory.

3.3.6 The activities covered during a typical on-site assessment are discussed below. The NVLAP assessor, prior to the visit, will provide a preliminary agenda, which may change due to findings observed during the on-site assessment.

- a) *Opening meeting:* The NVLAP assessor(s) will meet with laboratory management, supervisory personnel, and other staff members at the discretion of laboratory's management to explain the purpose of the on-site assessment and to discuss the schedule for the assessment activities. Information provided by the laboratory on its application form may be discussed during this meeting.
- b) *Staff interviews:* The NVLAP assessor will ask the laboratory manager to assist in arranging times for individual interviews with laboratory staff members. The NVLAP assessor will interview staff members filling key positions (e.g., Laboratory Manager, Technical Director, Quality Manager, Authorized Representative) and staff members who have an effect on the outcome of the testing. The NVLAP assessor does not need to talk to all staff members; however, the NVLAP assessor will select staff members representing all aspects of the laboratory. These interviews are conducted to determine if the staff members are properly trained, assigned, and supervised, and are technically competent for the tasks assigned to them.
- c) *Records review:* The NVLAP assessor will review laboratory documentation, including the management system, quality manual, equipment and maintenance records, record-keeping procedures, testing procedures, laboratory test records and reports, personnel competency records, personnel training plans and records, and safeguards for the protection of sensitive and proprietary information. The NVLAP assessor may request additional information to clarify issues regarding nonconformities to delve more deeply into technical issues.

Laboratory staff shall be available to answer questions; however, the NVLAP assessor may wish to review the documents and records alone. The NVLAP assessor usually does not ask to remove any laboratory documents or records from the laboratory premises.

NVLAP assessors do not need access to employee information that may be considered sensitive or private such as salary, medical information, or performance reviews for work done outside the scope of the laboratory's accreditation. However, this information is often stored together with

technical information that a NVLAP assessor will need to check (e.g., job descriptions, resumes, and technical performance reviews). In these cases, the NVLAP assessor will work with the laboratory to ensure the review is performed without violating individual privacy. At the discretion of the laboratory, a member of its human resources department may be present during the review of personnel information.

- d) *Internal audit and management review:* The NVLAP assessor will review and discuss with the laboratory staff the laboratory's internal audit and management review activities, which are separate and distinct activities. The discussion will include all aspects of those activities including the management system procedures, the audit findings, the results of the management review, and the actions taken to resolve problems identified.
- e) *Equipment and software:* The NVLAP assessor will examine and determine the suitability of all equipment and facilities required to perform the standard test methods for which the laboratory is accredited (or is seeking accreditation). The appropriate environmental conditions required for testing will be assessed. The NVLAP assessor will examine hardware and software for function and appropriateness and review software validation and verification procedures.
- f) *Demonstrations:* The demonstrations requested may be selective or all-inclusive. The NVLAP assessor will observe the demonstration of testing procedures by technical personnel assigned to conduct the tests, and will discuss the tests with the technical personnel to assure their understanding of the procedures. The demonstrations shall include sample test material(s), preparation of devices, establishment of test conditions and the setup/use of major equipment. The NVLAP assessor may select and trace the history of one or more samples from receipt to final issuance of the test reports.
- g) *Proficiency testing:* The NVLAP assessor will discuss all aspects of proficiency testing results with appropriate staff. Test methodology and records documenting the laboratory's execution of the testing will be reviewed and discussed. Unusual trends and outlying results will be discussed.
- h) *On-site assessment report:* The NVLAP assessor will complete an on-site assessment report, which summarizes the findings and clearly lists nonconformities and comments (positive or negative). This report normally consists of the On-Site Assessment Report, the NIST Handbook 150 Checklist, the NIST 150-5 Checklist, and the Test Method Review Summary. The first page of the report will be signed by the NVLAP assessor and the NVLAP Authorized Representative to acknowledge the discussion, but this does not necessarily indicate agreement by the laboratory. The assessor will give a copy of the report to the laboratory representative for retention, and send the original to NVLAP.
- i) *Closing meeting:* The NVLAP assessor will conduct a closing meeting with the laboratory manager, supervisory personnel, and other staff members at the discretion of the laboratory's management to discuss the findings. During the visit, a NVLAP assessor will have categorized all problems identified as nonconformities and comments. They will be discussed at the closing meeting and resolutions may be mutually agreed upon. The NVLAP assessor will specifically note items that have been corrected during the on-site assessment along with any recommendations for other action(s). The process for resolving nonconformities identified during the on-site is documented in Handbook 150. Any disagreements between the laboratory and a NVLAP assessor may be referred to NVLAP headquarters for resolution. All information obtained by the assessor is held in strictest confidence.

3.3.7 The laboratory shall address all nonconformities and provide, within 30 days from the date of the on-site assessment, a response to NVLAP headquarters.

3.3.8 The laboratory shall review all comments for potential improvements in construction materials testing.

3.4 Proficiency testing

3.4.1 Laboratories shall participate in interlaboratory proficiency testing conducted by a proficiency testing (PT) provider that has been qualified by NVLAP.

3.4.2 Laboratories shall participate in proficiency testing categories as required by the Standard Practices for which the laboratory is accredited.

3.4.3 Each laboratory shall complete and return to NVLAP the proficiency data release form, which is provided by NVLAP. Proficiency testing results are sent directly to NVLAP from the PT provider.

3.4.4 The laboratory shall evaluate the proficiency testing results, identify all outliers and follow the requirements of NIST Handbook 150 for the control of nonconforming work.

3.4.5 The laboratory shall correct the problems that led to the poor performance in proficiency testing. The laboratory's accreditation may be suspended if the proficiency testing results indicate continued poor or unsatisfactory performance on consecutive proficiency testing rounds.

3.4.6 The proficiency testing results will be monitored by NVLAP. The laboratory's accreditation may be suspended if the proficiency testing results indicate poor performance for two consecutive rounds of proficiency samples.

3.4.7 Procedures for receiving, analyzing, and monitoring the laboratory's proficiency test results shall be in the laboratory's quality manual.

4 Management requirements for accreditation

4.1 Organization

There are no requirements additional to those set forth in NIST Handbook 150.

4.2 Management system

4.2.1 The requirements for a management system are contained in NIST Handbook 150, *NVLAP Procedures and General Requirements*.

4.2.2 The controlled version of the laboratory management system documentation may be paper-based or computer-based. Version control shall be maintained in either case.

4.2.3 If the laboratory uses a computer-based documentation system, the laboratory should consider the ease of usability by the staff. The laboratory shall ensure that the requirements of NIST Handbook 150

are met so that staff is knowledgeable of the online documentation system and can readily retrieve appropriate information.

4.2.4 The laboratory shall create a cross-reference document allowing the laboratory and a NVLAP assessor to verify that all requirements of clauses 4 and 5 and annexes A and B of NIST Handbook 150 and the corresponding NIST Handbook 150-5 are addressed in the management system documentation.

4.2.5 The laboratory shall develop, document, and implement procedures covering all the technical requirements of this handbook.

4.2.6 The most recent editions of the documents listed in 1.4 shall be available as references in maintaining the management system.

4.2.7 The laboratory shall have readily available the latest published version of all of the test methods for which accreditation has been requested.

4.2.8 If a customer, for whatever reason (e.g., regulatory requirement), requires performance against previous versions of a standard test method, then the laboratory shall document that requirement and shall have available the required version of the standard test method.

4.2.9 The laboratory shall have copies of applicable referenced standards, practices and procedures.

4.2.10 In addition to the information specified in NIST Handbook 150, the quality manual and/or supporting management system procedures shall include the following:

- a) testing facilities and scope of services offered;
- b) testing equipment inventory;
- c) test plan for each test method performed;
- d) acceptance criteria for test materials/specimens;
- e) actions concerning damaged test materials/specimens;
- f) policy for utilizing subcontractors.

4.3 Document control

There are no requirements additional to those set forth in NIST Handbook 150.

4.4 Review of requests, tenders and contracts

There are no requirements additional to those set forth in NIST Handbook 150.

4.5 Subcontracting of tests and calibrations

There are no requirements additional to those set forth in NIST Handbook 150.

4.6 Purchasing services and supplies

There are no requirements additional to those set forth in NIST Handbook 150.

4.7 Service to the customer

There are no requirements additional to those set forth in NIST Handbook 150.

4.8 Complaints

There are no requirements additional to those set forth in NIST Handbook 150.

4.9 Control of nonconforming testing and/or calibration work

There are no requirements additional to those set forth in NIST Handbook 150.

4.10 Improvement

There are no requirements additional to those set forth in NIST Handbook 150.

4.11 Corrective action

There are no requirements additional to those set forth in NIST Handbook 150.

4.12 Preventive action

There are no requirements additional to those set forth in NIST Handbook 150.

4.13 Control of records

4.13.1 Records shall be maintained for at least three years.

4.13.2 Records shall be reviewed during the on-site visit either in total or by selected sampling.

4.14 Internal audits

4.14.1 The most recent internal audit report shall be available for review during NVLAP on-site assessments.

4.14.2 Previous internal audit reports, as much as three years back, shall be available for review if requested by the NVLAP assessor.

4.14.3 The internal audit shall cover compliance with NVLAP, laboratory management system, regulatory, and contractual requirements.

4.14.4 The laboratory shall perform at least one complete internal audit of its management system prior to the first on-site assessment. The records will be reviewed before or during the on-site assessment visit.

4.15 Management reviews

4.15.1 Periodic reviews of the management system shall reflect adherence to NVLAP requirements and the laboratory's quality objectives.

4.15.2 The periodic management reviews shall reflect positive aspects of the management system as well as nonconformities.

4.15.3 The most recent management review report shall be available for review during NVLAP on-site assessments.

4.15.4 Previous management review reports, as much as three years back, shall be available for review if requested by the NVLAP assessor.

4.15.5 The laboratory shall perform at least one complete management review prior to the first on-site assessment. The records will be reviewed before or during the on-site assessment visit.

5 Technical requirements for accreditation

5.1 General

The quality manual shall contain, or refer to, documentation that describes and details the laboratory's implementation of procedures covering all of the technical requirements in NIST Handbook 150 and this handbook.

5.2 Personnel

5.2.1 The laboratory shall maintain a list of personnel designated to fulfill NVLAP requirements including: Laboratory Director, Technical Director, Team Leaders, NVLAP Authorized Representative, and NVLAP Approved Signatories.

5.2.2 The laboratory's Technical Director shall be a person with appropriate education and experience in a related field and shall have the technical competence and the supervisory capability to direct the work of professionals and technicians in construction materials testing.

5.2.3 If the standard practice(s), for which the laboratory desires accreditation, specifies that the laboratory operate under the technical direction of a professional engineer (P.E.), the laboratory shall have a P.E. in order to be accredited by NVLAP for that practice.

5.2.4 When key personnel are added to the staff, the notification to NVLAP of the personnel changes shall include a current resume for each new staff member.

5.2.5 Laboratories shall document the required qualifications for each staff position. The staff information may be kept in the official personnel folders or in separate, official folders that contain only the information that the NVLAP assessors need to review.

5.2.6 The training program shall be updated when procedures change.

5.2.7 Staff members shall be retrained when procedures change, or when the individuals are assigned new responsibilities. Each staff member may receive training for assigned duties either through on-the-job training, formal classroom study, attendance at conferences, or another appropriate mechanism.

5.2.8 Training materials that are maintained within the laboratory shall be kept up-to-date and readily available to laboratory staff.

5.2.9 For each staff member, the staff member's immediate supervisor, or a designee appointed by the laboratory director, shall conduct annually an assessment and an observation of performance.

5.2.10 Individuals hired to perform testing activities are sometimes referred to as *subcontractors*. NVLAP does not make a distinction between full-time laboratory employees and individuals hired on a contract. NVLAP requires that the construction materials testing laboratory maintain responsibility for and control of any work performed within its scope of accreditation. The laboratory shall ensure all individuals performing testing activities satisfy all NVLAP requirements, irrespective of the means by which individuals are compensated (e.g., the laboratory must ensure all test personnel receive proper training and are subject to annual performance reviews, etc.).

5.3 Accommodation and environmental conditions

There are no requirements additional to those set forth in NIST Handbook 150.

5.4 Test and calibration methods and method validation

5.4.1 A laboratory may be accredited to perform standard test methods in their entirety or to perform only certain sections in the test method.

5.4.2 The laboratory shall have written procedures for laboratory personnel to follow when conducting tests. If determined suitable by NVLAP, the laboratory may use the specific standard test method as the only written procedure.

5.4.3 The procedures shall address any information not specifically contained in the standard method and any deviations used by the laboratory.

5.4.4 The procedures shall include equipment operation, calibration checks, and quality control checks.

5.5 Equipment

There are no requirements additional to those set forth in NIST Handbook 150.

5.6 Measurement traceability

5.6.1 The laboratory shall determine equipment calibration intervals based on the equipment's frequency of use and the environment in which it is used, in accordance with standard test methods.

5.6.2 The laboratory shall provide proof that the calibration intervals used by the laboratory are sufficient.

5.6.3 Proper performance of the testing equipment shall be periodically verified.

5.6.4 The reference standards used and the environmental conditions at the time of calibration shall be documented for all calibrations.

5.6.5 Calibration records and evidence of the traceability of the reference standards used shall be made available for inspection during the on-site visit.

5.6.6 In addition to the equipment records specified in NIST Handbook 150, testing equipment calibration records shall include the following:

- a) notation of all equipment variables requiring calibration or verification;
- b) range of calibration/verification;
- c) resolution (precision or the number of digits read) of the instrument and its tolerance (allowable error);
- d) calibration/verification date and schedule;
- e) identity of the laboratory individual or external service responsible for calibration;
- f) source of reference standard and traceability.

5.7 Sampling

There are no requirements additional to those set forth in NIST Handbook 150.

5.8 Handling of test and calibration items

There are no requirements additional to those set forth in NIST Handbook 150.

5.9 Assuring the quality of test and calibration results

There are no requirements additional to those set forth in NIST Handbook 150.

5.10 Reporting the results

5.10.1 Test reports shall provide all necessary information to permit the same or another laboratory to reproduce the test plan and obtain comparable results.

5.10.2 Test reports shall clearly indicate that the test results apply to the product or system as tested and, if required, conform to customer/regulator requirements.

6 Additional requirements

There are no additional requirements beyond NIST Handbook 150 and its associated normative annexes, and any other normative references previously cited in this handbook.