# NEBRASKA DEPARTMENT OF ROADS

# QUALITY ASSURANCE PROGRAM

# FOR

# CONSTRUCTION

DATE: 08-23-00
REVISED: 02-05-04

DATE: 9-13-99
REVISED: 7-11-01

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## 1. INTRODUCTION

**1.1** This manual describes a "Quality Assurance Program for Construction" established by the Nebraska Department of Roads (NDOR). The intent of this program is to provide adequate assurance that the materials and workmanship incorporated in highway construction projects are in reasonable conformity with the requirements of the plans and specifications including any approved changes.

**1.2** The first level of assurance is provided by qualified laboratories and testing personnel. This assures that equipment and personnel are capable of performing the tests properly. An Independent Assurance program provides the second level of assurance. This level assures that testing personnel and equipment remain capable of performing the tests properly. The third level of assurance is provided by verification sampling and testing. This level assures the quality of the product.

**1.3** This program has been developed in conformance with the criteria contained in 23 CFR 637 (B). It consists of an Acceptance Program and Independent Assurance Program. The Acceptance Program provides sampling and test results, obtained by qualified testing personnel and laboratories, used in the acceptance decision. The Independent Assurance Program provides for checking the testing personnel and test equipment.

**1.4** This Quality Assurance Program allows for the use of validated contractor-performed quality control (QC) test results for the acceptance decision. It also allows for the use of test results obtained by commercial laboratories in the Independent Assurance Program, as well as in acceptance decisions. Contractor and commercial laboratories and their personnel performing Quality Control sampling and testing used in the acceptance decision must be evaluated by the Independent Assurance Program.

**1.5** *Applicability* – This "Quality Assurance Program for Construction" is required for all highways on the State Highway System. It does not apply to roadside appurtenances to the State Highway System such as rest areas and weigh stations, except for any driving surfaces or parking areas associated with a roadside appurtenance. The program is desirable, but not required, for construction on local roads and streets. A local jurisdiction may, at their discretion, specify the requirements contained herein for any or all construction projects under their authority.

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## 2. DEFINITIONS

**2.1** ***Acceptance Program*** – All factors that comprise NDOR's determination of the quality of the product as specified in the contract requirements. These factors include verification sampling, testing, and inspection, as well as results of quality control sampling and testing.

**2.2** ***Engineer*** – A representative duly authorized by the Director, such representative acting within the scope of the particular duties assigned to him/her or the authority given to him/her.

**2.3** ***Independent Assurance Program*** – Activities that are an unbiased and independent evaluation of all sampling and testing procedures used in the acceptance program. Test procedures used in the acceptance program which are performed in the Materials and Research Central Laboratory are not covered by the Independent Assurance Program since the central laboratory maintains accreditation through the AASHTO Accreditation Program.

**2.4** ***Proficiency Samples*** – Homogeneous samples that are distributed and tested by two or more laboratories. The test results are compared to assure that the laboratories are obtaining the same results.

**2.5** ***Qualified Laboratories*** – Laboratories that are capable of performing test procedures as established by the NDOR Laboratory/Equipment Qualification Program (Appendix B). This program includes, as a minimum, provisions for checking test equipment and a requirement that the laboratory maintain records of all calibration checks.

**2.6** ***Qualified Sampling and Testing Personnel*** – Personnel who are capable of sampling and testing construction materials as established by the NDOR Sampling and Testing Personnel Qualification Program (Appendix A). This program includes, as a minimum, requirements that personnel demonstrate their ability to perform sampling and testing procedures, as well as, pass a written examination.

**2.7** ***Quality Assurance*** – All those planned and systematic actions necessary to provide confidence that a product or service will satisfy given requirements for quality.

**2.8** ***Quality Control*** – All contractor/vendor operational techniques and activities that are performed or conducted to fulfill the contract requirements.

**2.9** ***Random Sample*** – A sample drawn from a lot in which each increment in the lot has an equal probability of being chosen.

**2.10** ***Vendor*** – A supplier of project-produced material that is not the contractor, such as an aggregate producer or ready-mix concrete supplier.

**2.11** ***Verification Sampling and Testing*** – Sampling and testing performed to validate the quality of a product.

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## 3. ACCEPTANCE PROGRAM

**3.1** ***General*** – Materials incorporated into any highway construction project shall be subject to verification sampling and testing, as well as, QC sampling and testing when required by the specifications.

**3.2** ***Verification Sampling and Testing (Frequency, Location and Attributes)*** – Frequency of the verification sampling and testing will depend on whether or not the contractor's QC testing (See Section 3.3) is a part of the acceptance decision. Verification sampling and testing shall be performed at the location and frequency, and for the attributes (gradation, density, air content, etc.) established in the NDOR Materials Sampling Guide. Verification sampling and testing personnel, laboratories, and equipment shall be qualified in accordance with the NDOR Sampling and Testing Personnel Qualification Program (Appendix A) and the NDOR Laboratory/Equipment Qualification Program (Appendix B) and shall be evaluated under the Independent Assurance Program shown in Section 4 of this document. Qualified NDOR personnel or their designated agents shall perform verification sampling and testing. Copy of the verification test results will be sent to the contractor, NDOR project manager, and the Materials and Research Central Laboratory.

**3.2.1** *Project Produced Materials* – These materials can generally be described as those that are produced to meet the requirements of a specific project. They are characterized by being sampled at the construction project site and tested either at the project site or at a qualified laboratory. Aggregates, asphaltic concrete, and Portland cement concrete are considered project produced materials. The NDOR Materials Sampling Guide identifies the location and frequency for sampling and testing the various attributes (gradation, density, air content, etc.) of project produced materials.

**3.2.2** *Manufactured Materials* – These materials can generally be described as those that are manufactured to meet the requirements of a specific AASHTO, ASTM, or other standard. They can be used on numerous construction projects, provided they meet specification requirements for those projects. These materials may require sampling at the project site with the sample forwarded to the Materials and Research Central Laboratory for testing. These materials may also require manufacturer certifications and/or manufacturer certified test reports. Some manufactured materials may be pre-tested through arrangements with the Materials and Research Central Laboratory. Pre-tested materials are identified by approved lot numbers or identification tags indicating an NDOR approved material. Pre-tested materials that have been primarily tested or approved by the Materials and Research Central Laboratory may be used without further sampling and testing.

**3.2.3** *Approved Products List* – Materials identified in the NDOR Approved Products List may be used on a project by notifying the Engineer of the specific brand name. The NDOR Materials and Research Central Laboratory approves these materials for use on projects. Materials on the NDOR Approved Products List do not require sampling and testing on the project site, unless requested by the Engineer. They do not re-

quire a certificate of compliance or certified test report unless the need for such a document is specifically identified in the NDOR Approved Products List or the project specifications.

**3.3** ***Quality Control Sampling and Testing*** – Contractor performed Quality Control (QC) sampling and testing may be used as a part of the acceptance decision when required or allowed by the project specifications. Quality Control sampling and testing personnel, laboratories, and equipment shall be qualified in accordance with the NDOR Sampling and Testing Personnel Qualification Program (Appendix A) and the NDOR Laboratory/Equipment Qualification Program (Appendix B) and shall be evaluated under the Independent Assurance Program shown in Section 4 of this document. Quality control test results shall be validated by verification test results (See Section 3.2) obtained from independently taken samples. Qualified NDOR personnel or their designated agents shall perform verification sampling and testing.

**3.3.1** *Quality Control Program* – When required by the specifications a Quality Control Program must be developed by the contractor and submitted as required by the contract for approval. The minimum requirements of a Quality Control Program are shown in Appendix C. Specifications may require that additional information be provided in the Quality Control Program.

**3.3.2** *Dispute Resolution System* – When quality control test results are used in the acceptance decision, discrepancies arising between the verification sampling and testing performed by NDOR, or its designated agents, and quality control sampling and testing performed by the contractor, shall be resolved in a reliable, unbiased manner, by referee testing or evaluation performed by the Materials and Research Central Laboratory. The decision by the Materials and Research Central Laboratory will be final. The Materials and Research Central Laboratory may obtain the services of an independent commercial laboratory accredited in the testing to be performed, by the AASHTO Accreditation Program or a comparable laboratory accreditation program approved by FHWA, to aid in resolving any dispute. The decision to utilize the services of an independent commercial laboratory rests solely with the Materials and Research Central Laboratory.

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## 4. INDEPENDENT ASSURANCE PROGRAM

**4.1** ***General*** – All sampling and testing procedures, personnel and equipment used as part of the acceptance decision shall be evaluated by the Independent Assurance (IA) Program. Any non-NDOR laboratory which performs Independent Assurance sampling and testing shall be accredited in the testing to be performed, by the AASHTO Accreditation Program or a comparable laboratory accreditation program approved by FHWA. The Independent Assurance Program includes both system and project-based approaches. The system approach shall be used unless the specifications for a project specifically require a project-based approach for independent assurance sampling and testing.

**4.1.1** *System Approach* – The system approach bases frequency of independent assurance activities on time, regardless of the number of tests, quantities of materials, or number of projects being tested by an individual being evaluated.

**4.1.2** *Project-Based Approach* – The project-based approach bases frequency of independent assurance activities primarily on quantities of materials being tested and requires minimum independent assurance activities on the project.

**4.2** ***Sampling and Testing Frequency and Location*** – Independent assurance sampling and testing shall be performed at the location and frequency, and for the attributes (gradation, density, air content, etc.) established in the NDOR Materials Sampling Guide. Sampling and testing procedures performed by the Materials and Research Central Laboratory are not subject to the independent assurance program since the laboratory maintains accreditation through the AASHTO Accreditation Program.

**4.3** ***Testing Equipment*** – Branch Laboratory equipment used for independent assurance sampling and testing shall be qualified by the Materials and Research Central Laboratory in accordance with the NDOR Laboratory/Equipment Qualification Program (Appendix B). The Central Laboratory shall qualify any AASHTO accredited commercial laboratory equipment used for independent assurance sampling and testing by verifying that the equipment has been calibrated/verified and that supporting calibration/verification data is on file. The frequency for qualifying independent assurance sampling and testing equipment shall not exceed one year. Qualification shall be scheduled on a more frequent basis if the operation of the equipment is suspect. The independent assurance equipment shall be other than that used for quality control sampling and testing. Any equipment used to perform verification and/or quality control sampling and testing for an acceptance decision shall be evaluated by independent assurance sampling and testing personnel. This evaluation shall include calibration checks and split or proficiency sample tests. The requirements for, and frequency of, verification and/or quality control equipment calibration are shown in Appendix B. Acceptable tolerance limits for the comparison of test results for split or proficiency samples are shown in Appendix D.

**4.4 *Testing Personnel*** – Branch Laboratory personnel who perform Independent Assurance sampling and testing shall be qualified by the Materials and Research Central Laboratory in accordance with the NDOR Sampling and Testing Personnel Qualification Program (Appendix A). The Central Laboratory shall qualify any AASHTO accredited commercial laboratory personnel performing independent assurance sampling and testing by verifying that the laboratory is accredited in the applicable test procedures and that the personnel meet the AASHTO Accreditation Program requirements. When contractor's QC testing is part of the acceptance program, Individuals performing independent assurance sampling and testing may also perform the verification sampling and testing. When contractor's QC testing is not part of the acceptance program, Individuals performing independent assurance sampling and testing shall be other than those who perform verification sampling and testing. Any individual who performs verification or quality control sampling and testing shall be evaluated by independent assurance sampling and testing personnel at least once a year. This evaluation shall include observation and spilt or proficiency sampling and testing. Acceptable tolerance limits for the comparison of test results from spilt or proficiency samples are shown in Appendix D.

**4.5 *Comparison of Test Results*** – A prompt comparison of test results obtained by the individual being evaluated and the independent assurance tester shall be performed by a Quality Assurance Manager, a qualified evaluator designated by the Quality Assurance Manager, or AASHTO accredited commercial laboratory personnel. Acceptable tolerance limits for the comparison of test results from split or proficiency samples are shown in Appendix D. If the comparison of test results do not comply with the tolerances, a review of the test procedure and testing equipment shall be performed immediately to determine the source of the discrepancy. Corrective action must be identified and incorporated as appropriate, followed by additional independent assurance testing. Test results from all samples involved in the Independent Assurance Program shall be documented with reports maintained in Branch Laboratory files. Copies of these reports shall be transmitted to the appropriate District. When a project-based approach is used for the Independent Assurance Program, copies of the reports shall also be maintained in the project files. If an AASHTO accredited commercial laboratory performs independent assurance testing, all test results and reports shall be forwarded to the Central Laboratory for distribution to the appropriate Branch Laboratory and District.

**4.6 Annual Report of Independent Assurance Program Results** – The Materials and Research Central Laboratory will compile and submit an annual report to the FHWA Division Administrator summarizing the results of the NDOR system approach Independent Assurance Program. The report shall identify the number and type of tests performed, the number of sampling and testing personnel evaluated and the number and type of equipment evaluations performed. In addition, the report shall identify the independent assurance evaluations found to be acceptable, the number found to be unacceptable, and a summary of any system-wide corrective actions taken. NDOR Quality Assurance Managers will prepare a report containing the above information covering their area of responsibility for forwarding to the Materials and Research Central Laboratory. The Materials and Research Central Laboratory will utilize this information in preparing the final report to be submitted to the FHWA Division Administrator.

## 5. MATERIALS CERTIFICATION

**5.1** A materials certification, conforming in substance to that shown in Appendix E shall be submitted to the FHWA Division Administrator for each construction project which is subject to FHWA oversight activities.

## 6. CONFLICT OF INTEREST

**6.1** To avoid the appearance of a conflict of interest, any qualified non-NDOR laboratory shall perform only one of the following types of testing on the same project: verification testing, quality control testing, independent assurance testing, or dispute resolution testing.

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## 7. QUALIFICATION OF LABORATORIES AND SAMPLING AND TESTING PERSONNEL

**7.1 *Laboratories*:**

**7.1.1** The NDOR Materials and Research Central Laboratory shall be accredited and maintain accreditation through the AASHTO Accreditation Program.

**7.1.2** After June 29, 2000, all contractor, vendor and NDOR testing used in the acceptance decision shall be performed by qualified laboratories and/or equipment in accordance with the NDOR Laboratory/Equipment Qualification Program (Appendix B).

**7.1.3** After June 29, 2000, any non-NDOR laboratory designated to perform independent assurance sampling and testing shall be accredited in the testing to be performed by the AASHTO Accreditation Program.

**7.1.4** After June 29, 2000, any non-NDOR laboratory that is used in dispute resolution sampling and testing shall be accredited in the testing to be performed by the AASHTO Accreditation Program.

**7.2 *Sampling and Testing Personnel*** – After June 29, 2000, all sampling and testing data to be used in the acceptance decision or the independent assurance program shall be performed by qualified sampling and testing personnel in accordance with the NDOR Sampling and Testing Personnel Qualification Program (Appendix A).

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## APPENDIX A

## SAMPLING AND TESTING PERSONNEL QUALIFICATION PROGRAM

**A1.** ***Purpose*** – This program provides uniform statewide procedures for sampling and testing personnel qualifications to ensure that tests required by the specifications are performed in accordance with prescribed sampling and testing methods.

**A2.** ***Qualification of Sampling and Testing Personnel***:

**A2.1** Any individual who samples and/or performs required tests on materials for acceptance or verification must be qualified.

**A2.2** Sampling and testing personnel will be qualified to perform tests for the acceptance or verification of materials in the areas of aggregates, soils, bituminous materials and Portland cement concrete. The test methods for which individuals will be qualified shall include, but are not limited to, those shown in Table A1. There may be other test procedures used in specific geographical locations of the state or used on unique construction projects in which sampling and testing personnel need to be qualified.

**A3.** ***Responsibility for Qualifying Sampling and Testing Personnel***:

**A3.1** The following personnel may qualify an individual to perform required tests on materials by observing each test and administering the required examinations:

**A3.1.1** Materials and Research Central Laboratory personnel.

**A3.1.2** Quality Assurance Managers; responsible for Branch Laboratory personnel and operations and responsible for Independent Assurance Sampling.

**A3.1.3** Qualified Branch Laboratory personnel who have been authorized by a Quality Assurance Manager.

**A3.1.4** Other NDOR personnel who have been qualified to perform specific tests may be authorized by the Materials and Research Central Laboratory to qualify others.

**A 3.1.5** Independent sources, such as the American Concrete Institute (ACI) or qualified consultants, with the approval of the Materials and Research Central Laboratory.

**A3.2** Each Branch Laboratory shall maintain a minimum of one individual qualified by the Materials and Research Central Laboratory for each test procedure performed within the Branch Laboratory's area of responsibility.

**A4.** ***Qualification Procedure***:

A4.1 Except as noted in paragraph A4.2.1, to qualify ,an individual must successfully perform the specific test or series of tests related to a specific level of qualification as identified in Table A1. The test

performance, and any calculations required to determine specification compliance, must be done in the presence of an authorized evaluator as identified in Section A3.1. Successful performance is defined as demonstrating the ability to properly perform key elements for each test method. Anyone failing to demonstrate the ability to perform a test will, at the evaluator's convenience, be allowed a maximum of two re-tests per test method in a calendar year.

A4.2.1 Newly hired and temporary employees may obtain provisional qualification through on-the-job training by a certified technician. The provisional qualification will permit the employee to perform material testing while within sight and sound of a certified field or qualified laboratory technician. An employee will be able to perform testing under the provisional qualification for a maximum of one construction season, however, the person must attend the first available certification training session. Temporary summer employees, who are students enrolled in post secondary education, will be allowed to work a total of three summers before needing to become fully certified.

**A4.2** After successful performance of a test method, the individual must also pass a written examination administered by an authorized evaluator with a minimum score of 70 percent. An individual failing the written examination may request a retest. The individual will be allowed an unlimited number of retests in a calendar year; however, the scheduling of retests for the written examination is at the evaluator's convenience.

**A4.3** If an individual fails to be qualified in a calendar year, or if the qualification is revoked, the individual must obtain additional training and again complete the testing requirements identified in Sections A4.1 and A4.2.

**A4.4** A standard set of examinations will be used statewide. The examination will be developed by a committee of personnel from the Materials and Research Central laboratory, Branch Laboratories, and may include industry representatives for test procedures used in contractor performed quality control testing.

**A4.5** As a part of the qualification process the individual must participate in proficiency or split sample testing through the independent assurance program. The results of the proficiency or split sample testing will be evaluated within the acceptable tolerance limits identified in Appendix D. If the comparison of test results do not comply with the tolerances, a review of the test procedure and equipment shall be performed immediately to determine the source of the discrepancy. Corrective action must be identified and incorporated as appropriate, prior to the individual performing additional testing on that test method.

**A4.6** Qualification of an individual is valid for not more than five years, after which the individual must be re-qualified.

**A4.7** Individuals certified through an independent source approved by the Materials and Research Central Laboratory are exempt from the qualification procedure outlined above.

**A4.8** Individuals performing contractor quality control testing who have been qualified or certified by another state transportation department may be exempt from all or portions of the qualification procedure outlined above. The Materials and Research Central Laboratory will make decisions regarding the granting of a total or partial exemption. To apply for an exemption, the contractor must submit to the Materials and Research Central Laboratory, the names of the individuals seeking exemption, a listing of test procedures for which the individual has been qualified or certified by another state transportation department and the individual's name, address and telephone number from the state transportation department having responsibility for that state's qualification/certification program.

**A5. *Documentation***:

**A 5.1** The Materials and Research Central Laboratory will be responsible for maintaining documentation of all individuals qualified to perform required tests for the acceptance of materials. The Central Laboratory will provide District Offices with records of the qualification certificates for individuals performing testing on projects in their area of responsibility. The requirement for maintaining documentation is applicable to both NDOR personnel performing acceptance and verification testing, and contractor personnel performing quality control testing.

**A5.2** Documentation to be maintained by the Materials and Research Central Laboratory includes:

**A5.2.1** *Sampling and Testing Personnel Qualification Record* – A record for each individual listing all tests the individual has been qualified to perform.

**A5.2.2** *Qualification Worksheet* – A form listing the key elements of the test method as used by the evaluator conducting the observation to record results.

**A5.2.3** Copies of written examinations.

**A5.3** Retention of documents will be for the life of the qualification.

**A5.4** The qualification certificate issued to an individual will show each test procedure for which the individual was qualified or a title, such as "Field Tester I", which can be identified as encompassing a series of test procedures, and the date the qualification will expire.

**A6. *Disqualification***:

**A6.1** Notice of abuse or neglect for any procedures or responsibilities identified in this Quality Assurance Program shall be made to the Qualification Advisory Committee, chaired by the Materials and Research Engineer. The Advisory Committee will notify the person being investigated of the allegation and that the charges are being reviewed. The difference between neglect and abuse is intent and shall be determined by the Qualification Advisory Committee. Penalties shall be imposed upon the recommendation of the Qualification Advisory Committee. Penalties shall range from a minimum of 10-day suspension to a maximum of permanent revocation of the qualification certificate.

**A6.2** *Neglect* – The first instance of neglect shall result in a 10-day suspension of the qualification certificate. The second instance of neglect shall result in a 30-day suspension of the qualification certificate. A third instance of neglect shall be considered as and treated the same as abuse. Example of Neglect – failing to post or properly record a test result.

**A6.3** *Abuse* – The first instance of abuse shall result in a 90-day suspension of the qualification certificate. The second instance of abuse shall result in permanent revocation of the qualification. Permanent revocation of a qualification shall result in that individual being ineligible for qualification at any level. Example of Abuse – falsification of test results.

**A6.4** *Qualification Advisory Committee* – In addition to the Materials and Research Engineer as chair of the committee, Two other NDOR members and two industry members shall be appointed to the committee by the Materials and Research Engineer. The Nebraska Chapter of the Associated General Contractors shall be consulted concerning the selection of the two industry members. The appointed members shall have no direct involvement with the case. The Qualification Advisory Committee may, at their discretion, conduct a hearing involving the individual accused of neglect or abuse and other interested parties.

**A6.5** The policies and procedures described above are applicable to NDOR personnel, or designated agent, involved in the acceptance and verification of materials as well as contractor personnel or vendor in-

volved in quality control testing.

**A6.6** The reference made above to "suspension" applies only to suspension of the qualification certificate and is not intended to imply that an individual will be suspended from work. While suspension from work or termination of employment may be a consideration depending on the level of neglect or abuse exhibited, such action would be taken through normal NDOR or contractor procedures for disciplinary action.

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REVISED: 02-05-04

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**TABLE A1 – TEST METHODS FOR QUALIFICATION OF SAMPLING AND TESTING PERSONNEL**

| **PORTLAND CEMENT CONCRETE** | |
|---|---|
| **CONCRETE FIELD TEST TECHNICIAN – LEVEL 1** | |
| ASTM C 31 | Making and Curing Concrete Test Specimens in the Field |
| ASTM C 138 | Unit Weight, Yield and Air Content (Gravimetric) of Concrete |
| ASTM C 143 | Slump of Hydraulic Cement Concrete |
| ASTM C 172 | Sampling of Freshly Mixed Concrete |
| ASTM C 173 | Air Content of Freshly Mixed Concrete by the Volumetric Method |
| ASTM C 231 | Air Content of Freshly Mixed Concrete by the Pressure Method |
| ASTM C 1064 | Temperature of Freshly Mixed Concrete |
| **CONCRETE PLANT TECHNICIAN – LEVEL 2** | |
| **NOTE:** A Concrete Plant Technician, Level 2 must be qualified in the test methods identified for Concrete Field Technician, Level 1, in addition to the following test methods. | |
| AASHTO T 2 | Sampling Aggregates |
| AASHTO T 27 | Sieve Analysis of Fine and Coarse Aggregates |
| AASHTO T 248 | Reducing Field Samples of Aggregate to Testing Size |
| AASHTO T 255 | Total Moisture Content of Aggregate by Drying |
| NDR T 506 | Determination of the Free Moisture Content of Aggregates |

**TABLE A1 – TEST METHODS FOR QUALIFICATION OF SAMPLING AND TESTING PERSONNEL (CONTINUED)**

| ASPHALT CONCRETE | |
|---|---|
| **ASPHALT CONCRETE TEST TECHNICIAN** | |
| **NOTE:** An Asphalt Concrete Field Inspector must be qualified in the test methods identified for Aggregate Inspector in addition to the following test methods. | |
| AASHTO T 166 | Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens |
| AASHTO T 168 | Sampling Bituminous Paving Mixtures |
| AASHTO T 209 | Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures |
| AASHTO T 11 | Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing |
| AASHTO T 30 | Mechanical Analysis of Extracted Aggregates |
| AASHTO T 84 | Specific Gravity and Absorption of Fine Aggregate |
| AASHTO T 85 | Specific Gravity and Absorption of Coarse Aggregate |
| AASHTO T 269 | Volumetric Analysis of Compacted Hot Mix Asphalt (HMA) |
| AASHTO T 304 | Uncompacted Void Content of Fine Aggregate |
| AASHTO T 248 | Reducing Samples of Aggregate to Testing Size |
| ASTM D 5821 | Determining the Percentage of Fractured Particles in Coarse Aggregate |
| AASHTO T 312 | Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the SHRP Gyratory Compactor |
| AASHTO T 308 | Asphalt Content of Hot Mix Asphalt (HMA) by the Ignition Method |
| AASHTO T 269 | Percent Air Voids in Compacted Dense and Open Bituminous Mixtures |

**TABLE A1 – TEST METHODS FOR QUALIFICATION OF SAMPLING AND TESTING PERSONNEL (CONTINUED)**

| SOILS | |
|---|---|
| **SOIL TEST TECHNICIAN** | |
| AASHTO T 87 | Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test * |
| AASHTO T 89 | Determining the Liquid Limit of Soils * |
| AASHTO T 90 | Determining the Plastic Limit and Plasticity Index of Soils * |
| AASHTO T 99 | Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12 in.) Drop * |
| AASHTO T 205 | Density of Soil In-Place by the Rubber Balloon Method ** |
| AASHTO T 238 | Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth) ** |
| AASHTO T 248 | Reducing Samples of Aggregate to Testing Size * |
| AASHTO T 265 | Laboratory Determination of Moisture Content of Soils * |
| AASHTO T 272 | Family of Curves – One Point Method * |
| ASTM D 2488 | Description and Identification of Soils (Visual-Manual Procedure) ** |

** Project personnel Performing sampling and testing

* Branch Lab Personnel Performing sampling and testing

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## APPENDIX B

## LABORATORY/EQUIPMENT QUALIFICATION PROGRAM

**B1.** ***Purpose*** – This program provides uniform statewide procedures to ensure that laboratory facilities and equipment are adequate for performance of the required sampling and testing of materials.

**B2.** ***Scope*** – The scope of this program covers the qualification of all laboratories and equipment used for acceptance, verification, quality control, independent assurance and dispute resolution sampling and testing. The qualification of non-NDOR equipment is intended only to ensure that the equipment has been calibrated and/or verified on a regularly scheduled basis. The actual calibration and/or verification of equipment is the responsibility of the owner, unless otherwise required by NDOR. The Materials and Research Central Laboratory will calibrate branch laboratory equipment. All other NDOR-owned test equipment used for verification and independent assurance testing at the construction site will be calibrated by the Quality Assurance Manager. Equipment may be subjected to calibration, verification or other inspection prior to qualification or through the Independent Assurance program.

**B3.** ***Laboratory/Equipment Qualification and Responsibility for Qualification*** – All laboratories that perform testing for NDOR require qualification. Laboratory and equipment qualification shall be as follows:

**B3.1** *NDOR Materials and Research Central Laboratory* – The Materials and Research Central Laboratory shall be accredited through the AASHTO Accreditation Program.

**B3.2** *NDOR Branch Laboratories* – Branch Laboratories shall be qualified by the Materials and Research Central Laboratory.

**B3.3** *Field Laboratories* – Field laboratories at construction sites generally consist of a laboratory building provided by a contractor and testing equipment owned and provided by NDOR.

**B3.3.1** *Laboratory Building Qualification* – The laboratory building and any contractor furnished testing equipment shall be qualified by the NDOR Branch Laboratory Quality Assurance manager. The Quality Assurance Manager may authorize other Branch Laboratory personnel to perform the laboratory building qualification.

**B3.3.2** *Equipment Qualification* – NDOR owned testing equipment used in a field laboratory shall be qualified by the NDOR Branch Laboratory Quality Assurance Manager. The Quality Assurance Manager may authorize other Branch Laboratory personnel to perform equipment qualification activities.

**B3.4** *Commercial Laboratories* –

**B3.4.1** Commercial laboratories performing independent assurance testing or dispute resolution testing shall be accred-

ited by the AASHTO Accreditation Program or a comparable laboratory program approved by the Federal Highway Administration. In addition, commercial laboratories performing independent assurance testing or dispute resolution testing must be qualified by the Materials and Research Division Central Laboratory to ensure that accreditation has occurred in the sampling and testing procedure being performed

**B3.4.2** Commercial laboratories performing contract quality control testing shall be qualified by the Materials and Research Central Laboratory or the Branch Laboratory Quality Assurance Manager. The Materials and Research Central Laboratory shall determine the responsibility for qualifying commercial laboratories.

**B3.5** *Contractor Laboratories* – Contractor laboratories, when performing quality control testing, shall be qualified by the Materials and Research Central Laboratory or a Branch Laboratory Quality Assurance Manager. The Materials and Research Central Laboratory shall determine the responsibility for qualifying contractor laboratories. If the responsibility is assigned to the Branch Laboratory, the Quality Assurance Manager may authorize other Branch Laboratory personnel to perform contractor laboratory qualification activities.

**B3.6** *Vendor Laboratories (Material Suppliers)* – Vendor laboratories, when performing quality control testing, shall be qualified by the Materials and Research Central Laboratory or a Branch Laboratory Quality Assurance Manager. The Materials and Research Central Laboratory shall determine the responsibility for qualifying vendor laboratories. If the responsibility is assigned to the Branch Laboratory, the Quality Assurance Manager may authorize other Branch Laboratory personnel to perform vendor laboratory qualification activities.

**B4** ***Equipment Qualification and Responsibility for Qualification*:**

**B4.1** Non-specialized sampling and testing equipment is considered as a part of the laboratories identified in Section B3 even though the equipment may not be physically housed in the laboratory. Responsibility for qualification of the equipment is the same as in Section B3.

**B4.2** Specialized sampling and testing equipment used for pay factor determination, material acceptance and/or material verification; that is, equipment not directly associated with one of the laboratories identified in Section B3, shall be qualified by the Materials and Research Central Laboratory. Specialized equipment, such as profilographs and nuclear density gauges, will be identified by the Materials and Research Division.

**B5*. Laboratory Qualification Process*** – The laboratory authority identified in Section B3 shall perform the following functions:

**B5.1** *Accredited Laboratories (Laboratories accredited through the AASHTO Accreditation Program.)*:

**B5.1.1** Verify that the accreditation is current and has occurred in the sampling and testing procedures performed.

**B5.2** *Non-Accredited Laboratories (All laboratories except accredited laboratories and field laboratory buildings.)*:

**B5.2.1** Identify the scope of testing to be performed by the laboratory.

**B5.2.2** Verify that manuals and/or test methods used to perform the tests are available and current.

**B5.2.3** Document that the laboratory has the required equipment to perform the tests.

**B5.2.4** Check the calibration/verification records for each piece of equipment to include:

**B5.2.4.1** Description of the equipment.

**B5.2.4.2** Identification or serial number of the equipment.

**B5.2.4.3** Identification of any traceable standard used for calibration.

**B5.2.4.4** Frequency of calibration.

**B5.2.4.5** Date of last calibration.

**B5.2.4.6** Date of next scheduled calibration.

**B5.2.4.7** Procedure used to calibrate equipment.

**B5.2.4.8** Procedure used to identify equipment not in compliance.

**B5.2.5** In addition, all equipment may be subjected to calibration/verification by the qualifying authority.

**B5.3** *Field Laboratories (Laboratory Building)*:

**B5.3.1** Verify that the laboratory building meets the requirements of the specification.

**B5.3.2** Verify that the building, furnishings and utilities have been maintained to the extent that testing equipment and testing personnel will be adequately accommodated.

**B6. *Frequency for Laboratory Qualification:***

**B6.1** *Accredited Laboratories.*

**B6.1.1** Accredited laboratories shall be qualified annually.

**B6.1.2** If the laboratory has not previously been used by NDOR or has not been used within the past year, the laboratory must be qualified prior to performing any testing.

**B6.2** *Non-Accredited Laboratories* – Laboratories that have not been accredited through the AASHTO Accreditation Program shall be qualified at an interval not to exceed two years.

**B6.3** *Field Laboratories (Laboratory Building)* – Contractor provided laboratory buildings shall be qualified as described in Section B5 at intervals not to exceed two years.

**B6.4** The owner of the laboratory shall have the responsibility for requesting laboratory qualification to meet the frequency schedule identified in Section B6.

**B7. *Laboratory Equipment – Calibration Procedures and Frequencies:***

**B7.1** The frequency and procedures for calibrating/verifying testing equipment is shown in Table B1.

**B7.2** The calibration procedure and frequency of calibration are applicable to equipment used for quality control testing, verification testing and independent assurance testing.

**B7.3** Calibration procedures and frequencies shown herein may vary from those established by the AASHTO Accreditation Program. Laboratories requesting AASHTO accreditation or accreditation by a comparable laboratory program approved by the Federal Highway Administration shall comply with accreditation program requirements for calibration frequencies and procedures.

**B7.4** The qualifying authority identified in Section B3 has the right to require calibration/ verification of equipment at intervals more frequent than discussed herein if the performance of the equipment is suspect or if the equipment has been moved.

**B8. *Documentation*.**

**B8.1** *Laboratory Qualification Records* – Copies of laboratory qualification records shall be kept on file as follows:

**B8.1.1** One copy within the qualified laboratory.

**B8.1.2** One copy by the qualifying authority as identified in Section B3.

**B8.1.3** One copy by the Materials and Research Central Laboratory for any laboratory that is mobile or any commercial laboratory that may be performing testing in more than one District. It is the responsibility of the qualifying authority to submit documentation to the Materials and Research Central Laboratory.

**B8.2** *Equipment Calibration/Verification Records:*

**B8.2.1** Calibration/verification records for laboratory equipment shall be kept on file in the laboratory.

**B8.2.2** Copies of calibration/verification records for NDOR owned equipment that is not normally a permanent part of a laboratory shall be kept on file as follows:

**B8.2.2.1** One copy by the qualifying authority identified in Section B3.

**B8.2.2.2** One copy by the District having ownership of the equipment.

**B8.3** All laboratory qualification records and equipment calibration/verification records shall be kept on file for a period of three years.

**B9. *Non-Compliance***:

**B9.1** Laboratories must meet the above requirements to become qualified. Laboratories failing to maintain the requirements contained herein are subject to disqualification.

**B9.2** Any equipment failing to meet specified calibration/verification requirements for a specific test method shall not be used for that test method.

**B10*. Dispute Resolution*** – Disputes concerning laboratory qualification or calibration/verification of equipment that cannot be resolved at the District level will be submitted to the Materials and Research Central Laboratory for resolution. The decision of the Materials and Research Central Laboratory will be final. The Materials and Research Central Laboratory may obtain the services of an AASHTO accredited independent commercial laboratory to aid in resolving a dispute. This independent commercial laboratory must be independent of the original process. The decision to utilize the services of an independent commercial laboratory rests solely with the Materials and Research Central Laboratory.

DATE: 10-4-99
REVISED: 07-31-00

**NEBRASKA DEPARTMENT OF ROADS**
**QUALITY ASSURANCE PROGRAM FOR CONSTRUCTION**

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## TABLE B1 – EQUIPMENT CALIBRATION AND VERIFICATION FREQUENCY

| EQUIPMENT | REQUIREMENT | INTERVAL (Months) | METHOD |
|---|---|---|---|
| Balances, Scales and Weights | Verify | 12 | AASHTO M231 |
| Compression Test Machines | Calibrate | 12 | ASTM E4 |
| Gyratory Compactors | Verify | 24 | AASHTO TP4-99 |
| Mechanical Compactors (Marshall) | Calibrate | 24 | AASHTO T245 |
| Nuclear Moisture/Density Gauges | Calibrate* | 12 | Manufacturer's Recommendation |
| Ovens | Verify Temperature Settings | 12 | See Sheet B-6 |
| PCC Air Meters | Calibrate | 3 | ASTM C231 |
| PCC Metallic Reusable Molds | Check Critical Dimensions | 12 | ASTM C470 |
| PCC Single Use Molds | Check Dimensions Each Shipment | — | ASTM C470 |
| PCC Slump Cones | Check Critical Dimensions | 12 | ASTM C143 |
| PCC Unit Weight Measures | Calibrate | 12 | ASTM C29 |
| Sieves | Coarse (≥ No. 4) Check Openings and Physical Condition<br>Fine (< No. 4) Check Physical Condition | 12 | AASHTO M92 |

*Calibration to be performed by Materials and Research Central Laboratory.

DATE: 5-11-00
REVISED:

# Procedure for Verifying Ovens

Equipment Checked: DRYING OVENS

## Purpose:

This method provides instructions for checking drying ovens used in the laboratory.

## Inspection Equipment Required:

1. A calibrated thermometer graduated in 1.0$^{o}$ C increments having a range which includes the temperature range to be checked.
2. A thermometer well to retain heat while the oven door is open.
3. A clothespin to hold thermometer in such a manner as to enable the operator to read the scale easily.

## Tolerance:

Drying ovens shall be capable of maintaining a constant temperature range listed in the appropriate test methods.

## Procedure:

1. Place the thermometer inside the well with the clothespin attached to the thermometer. Position the thermometer on the shelf where the samples are normally dried.
2. Take the first reading at least 1 hour after closing the oven (oven should remain undisturbed).
3. Take as many readings as necessary to determine if the temperature range is within the specified tolerance (three consecutive readings, taken no less than ½ hr. apart, within the tolerance allowed are adequate).
4. Adjust the temperature of the oven if an observed temperature reading is outside the tolerance specified (allow at least ½ hr. for the temperature to stabilize between each adjustment). Return to step 3.

## Verification Interval:

12 months

## Report:

Send a copy of the results of each oven checked to the In-House Inspection Team for verification and issuance of a Certificate of Verification.

DATE: 09-29-99
REVISED: 02-05-04

**NEBRASKA DEPARTMENT OF ROADS**
**QUALITY ASSURANCE PROGRAM FOR CONSTRUCTION**

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## APPENDIX C

## QUALITY CONTROL PROGRAM MINIMUM REQUIREMENTS

**C1.** ***General*** – When required by the specifications a "Quality Control Program" must be developed by the contractor and submitted as required by the contract for approval. Minimum requirements for a Quality Control Program are identified herein. The specifications may require additional documentation or a more detailed Quality Control Program than these minimum requirements. The specification requirement takes precedent over the minimum requirements described herein.

**C2.** ***Minimum Quality Control Program Requirements*****:**

**C2.1** The contractor will provide, maintain and follow a quality control system that reasonably ensures the materials and work incorporated into the project conforms to the contract requirements.

**C2.2** The contractor shall provide qualified sampling and testing personnel to perform quality control inspection, sampling and testing required by the contract

**C2.3** The contractor will develop a Quality Control Plan and submit it to the Engineer for review and approval as identified in the specifications. The contractor's Quality Control Plan may include Quality Control Plans developed by subcontractors and/or vendors. As a minimum the Quality Control Plan will:

**C2.3.1** Include the project number, signature and date of signing by the contractor's authorized representative.

**C2.3.2** Identify the laboratory(s) to be used.

**C2.3.3** Provide an organization structure identifying:

**C2.3.3.1** The program administrator and names of sampling and testing personnel.

**C2.3.3.2** The qualifications, experience and level of authority of the program administrator.

**C2.3.3.3** The certificate numbers and duties of all sampling and testing personnel.

**C2.3.3.4** Include a sampling, testing and analysis plan with frequencies, location of sampling and methods of testing and analysis.

**C2.3.3.5** Include procedures for documenting quality control activities.

**C2.3.3.6** Address corrective actions to be taken when quality control and/or acceptance criteria are not met.

**C2.3.3.7** Address methods used to control product quality that cannot be adequately addressed by product testing.

**C2.4** The provisions of the Quality Control Program apply to the material and construction furnished under the contract. The Quality Control Program must, to the satisfaction of the Engineer, deal with issues affecting the achievement of a quality product, including workmanship, construction methods, plant operations, and sampling and testing methods.

DATE: 10-06-99
REVISED: 02-05-04

**NEBRASKA DEPARTMENT OF ROADS**
**QUALITY ASSURANCE PROGRAM FOR CONSTRUCTION**

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## APPENDIX D

## ACCEPTABLE TOLERANCE LIMITS FOR INDEPENDENT ASSURANCE SPLIT OR PROFICIENCY SAMPLES

| MATERIAL | TEST PROCEDURE | TEST METHOD | TOLERANCE |
|---|---|---|---|
| **Portland Cement Concrete** | Gradation | NDR T 27 | |
| Coarse Aggregate | > No. 4 | | ± 5% |
| | ≤ No. 4 | | ± 3% |
| **Portland Cement Concrete** | Gradation | NDR T 27 | |
| Fine Aggregate | 3/8" thru No. 200 | | ± 3% |
| **Portland Cement Concrete** | Yield | ASTM C 138 | ± 3% |
| | Slump | ASTM C 143 | ± 1.0 in. |
| | Air Content | ASTM C 138 | ± 1% |
| Complete Mixture | Compressive Strength | ASTM C 31 | 20% of the mean* |
| **Embankment** | In-Place Density | AASHTO T 238 | ± 2.5% |
| | In-Place Moisture | AASHTO T 239 | ± 1.5% |
| **Subgrade** | In-Place Density | AASHTO T 238 | ± 2.5% |
| | In-Place Moisture | AASHTO T 239 | ± 1.5% |
| **Granular Foundation Course (Regular)** | Gradation | NDR T 27 | ± 3% |
| | In-Place Density | AASHTO T 238 | ± 2.5% |
| | In-Place Moisture | AASHTO T 239 | ± 1.5% |

**APPENDIX D (CONTINUED)**

| MATERIAL | TEST PROCEDURE | TEST METHOD | TOLERANCE |
|---|---|---|---|
| **Asphalt Concrete (Superpave)**<br>Coarse Aggregate | Coarse Aggregate Angularity | ASTM D 5821 | ± 10.0% |
| **Asphalt Concrete (Superpave)**<br>Fine Aggregate | Fine Aggregate Angularity | AASHTO T 304 (Method A) | ± 0.5% |
| **Asphalt Concrete (Superpave)**<br>Combined Aggregate | Gradation | AASHTO T 30 | **0 – 3.0 ± 2.0%<br>3.1 – 10.0 ± 3.0%<br>10.1 – 20.0 ± 5.0%<br>20.1 – 30.0 ± 6.0%<br>30.1 – 40.0 ± 7.0%<br>40.1 – 50.0 ± 9.0% |
| | **Percent in size fraction between two consecutive aggregate sieves. | | |
| **Asphalt Concrete (Superpave)**<br>Complete Mixture | Asphalt Content | Ignition Oven AASHTO T 308 | ± 0.5% |
| | Gyratory Compaction | AASHTO T 312 | Visual Observation |
| | Air Voids | AASHTO T 269 | ± 0.5% |
| | Voids in Mineral Aggregate | Calculated | ± 0.5% |
| | Bulk Specific Gravity | AASHTO T 166 | ± 0.028 |
| | Theoretical Maximum Specific Gravity | AASHTO T 209 | ± 0.015 |

**APPENDIX D (CONTINUED)**

| MATERIAL | TEST PROCEDURE | TEST METHOD | TOLERANCE |
|---|---|---|---|
| **Asphalt Concrete (Convetional)** | Gradation | AASHTO T 30 | |
| | >5/8" | | ± 5% |
| | 5/8" thru No. 200 | | ± 3% |
| Combined Aggregate | Passing No. 200 | | ± 1.5% |
| **Asphalt Concrete (Conventional)** | Asphalt Content | Ignition Oven AASHTO T 308 | ± 0.5% |
| | Marshall Compaction | AASHTO T 245 | Visual Observation |
| | Air Voids | AASHTO T 269 | ± 0.5% |
| | Voids in Mineral Aggregate | Calculated | ± 0.5% |
| Complete Mixture | Bulk Specific Gravity | AASHTO T 166 | ± 0.028 |
| | Theoretical Maximum Specific Gravity | AASHTO T 209 | ± 0.015 |

*The difference between compared test results shall not exceed the indicated percentage of the mean of the compared test results – the mean being the average of the two test results.

EXAMPLE: Portland Cement Concrete Compressive Strength

| | |
|---|---|
| Job control test value | 3000 psi |
| Independent Assurance test value | 4000 psi |
| Mean | 3500 psi |
| 20% difference | 700 psi |

Both values are within 20% of the mean

DATE: 10-6-99
REVISED: 5-10-00

**NEBRASKA DEPARTMENT OF ROADS**
**QUALITY ASSURANCE PROGRAM FOR CONSTRUCTION**

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## APPENDIX E

## LETTER OF CERTIFICATION BY STATE ENGINEER

Division Administrator
U. S. Department of Transportation
Federal Highway Administration
Lincoln, Nebraska

Date: _____
Nebraska Project No.: _____
Location: _____
Contractor: _____
Type of Work: _____

This is to certify that:

The results of the tests used in the acceptance program indicate that the materials incorporated in the construction work, and the construction operations controlled by sampling and testing, were in conformity with the approved plans and specifications. All independent assurance samples and tests are within tolerance limits of the samples and tests that are used in the acceptance program.

Exceptions to the plans and specifications are explained on the attached sheet.

Sincerely

Materials and Research Engineer

_____ Additional Materials Certifications will be required for this project.

_____ This is the only Materials Certification required for this project.

_____ This is the final Materials Certification required for this project. Previous certifications were sent on the dates indicated below.

| Contractor | Type of Construction | Date Sent |
|---|---|---|
| _____ | _____ | _____ |
| _____ | _____ | _____ |