

**FIELD SAMPLING AND TESTING MANUAL**

**SECTION 100**

**GENERAL INSTRUCTIONS**

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**Section 100****OUTLINE****100.01 INTRODUCTION.**

This manual defines the procedures for field sampling, testing, inspecting, and controlling materials used on construction projects. Follow the methods outlined in this manual to assure uniformity in the use and control of materials on all construction projects. All materials covered in the contract, whether a bid item or incidental to other items, must be approved before being incorporated in the work. The Department either tests these materials or accepts them by "Certificate of Compliance". Change procedures only when authorized by the Materials and Research Engineer.

The contents of this manual follow the numbering sequence outlined in the Standard Specifications. As an example, test requirements for Section 408 of the Standard Specifications can be found in Section 408 of this manual. This section gives the required specific instructions for methods used in sampling, testing, and acceptance of Section 408 materials. Use this manual with the Standard Specifications.

The NDDOT and FHWA created this manual. The Associated General Contractors reviewed this manual before printing. Notify the Materials and Research Division of any errors or changes in this manual.

**100.02 DUTIES AND RESPONSIBILITIES.**

**A. Materials and Research Division.** The Materials and Research Division operates under the supervision of the Materials and Research Engineer and participates in the AASHTO Materials Reference Laboratory (AMRL), and the Cement and Concrete Reference Laboratory (CCRL) inspection programs.

Each State Highway Agency (SHA) is required by 23 (CFR) Code of Federal Regulations Part 637 to maintain an accredited Central Laboratory and to assure that all materials used for highway and bridge construction conform to contract requirements. Procedures to accomplish this are detailed in this manual.

The Materials and Research Division is a materials and testing resource. If a materials conflict occurs during project construction, notify Construction and Materials and Research Divisions. Materials and Research will make a recommendation to the Construction Division.

## 100.02 B.

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**B. District Materials Coordinator.** The District Materials Coordinator is the construction materials specialist within the district and is responsible for proper materials sampling, testing, and specification compliance. The District Materials Coordinator is accountable to the District Engineer but must coordinate activities with the Materials and Research Division. Responsibilities include but are not limited to the following:

1. Instruct district personnel in proper sampling and testing procedures.
2. Assure that the required field tests are performed in accordance with proper test procedures (independent assurance testing).
3. Inspect and approve all field laboratories.
4. Issue and maintain field laboratory and survey equipment.
5. Conduct progress and final sampling, testing, and measurements.
6. For all federal-aid projects, prepare the FHWA's required certification of quality and quantity of each type of material and submit it to the District Engineer for his signature.
7. Assure that the "Materials Safety Data Sheet" for hazardous materials is posted in the field laboratory where they are used.

**C. Field Laboratory Personnel.** Obtain samples, either independently or from the Contractor, of all material requiring testing for quality control or acceptance. Perform tests, document test results, complete paper work, and inform the Project Engineer/Manager of test results. Test as much of the sampled materials in the field laboratory as possible. Perform all work in accordance with procedures set forth in this manual.

**D. Consultants.** Follow the procedures outlined in this manual and directives of the District Engineer. Advice and/or direction is available from the same sources that are open to Department personnel.

**E. Independent Laboratories.** Perform material testing for the Department using the Department's specifications and testing procedures. Provide certifications of all test results and, on request, allow inspection of the laboratory by representatives of the Department.

## 100.03 PROCUREMENT OF EQUIPMENT AND SUPPLIES.

Each district office maintains a complete stock of testing equipment, sample containers, forms, and other supplies relating to material quality control. Request supplies from the District Materials Coordinator. To keep district inventory levels at a minimum and yet have ample supply when needed, each Project Engineer/Manager needs to anticipate well in advance and keep the District Materials Coordinator fully informed.

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**100.04 SAMPLES AND SAMPLING.**

- A. General.** The Project Engineer/Manager approves all sampling and testing methods used at the project level. Contract Documents indicate the test method used.

Appendix F contains the required number of field, district, and Materials and Research Division tests.

Use field numbers to identify samples submitted to the District and Materials and Research Division. Accompany all samples submitted to the District or Materials and Research Division with the field sample test results. The District Materials Coordinator will compare the field test results with the results from the district laboratory and the Materials and Research Division and issue a report showing the comparison.

- B. Information to Be Submitted with Samples.** Sample cards and tag envelopes may be obtained from the district office. Appendix D has information on, and examples of, these cards.

When submitting samples, make out a sample card, place it in a tag envelope, seal the envelope, and tie it securely to the sample. For questions about the information required on the sample card, contact the District Laboratory. Report all pit location information by section, township, range, and by the owner's name. Record the results of field testing on the back of the sample card. Add additional information to the back of the card.

- C. Packing of Samples.** Obtain containers for all materials at any district office through the District Materials Coordinator. Ship all samples in these approved containers. Ship asphalt cements and cutback oils in metal cans. Ship emulsified asphalt in plastic bottles or plastic pails. Securely fasten the lids on all containers used to ship liquid materials to prevent leakage. Mark packages containing these samples "Liquid Handle with Care." Ship samples of other materials in pails or sacks (i.e., aggregate samples) or boxes (i.e., cores) and securely seal. To prevent injury, keep all shipping containers as light as practicable.

Carefully handle concrete cylinders and place them in the transport vehicle so that they do not touch each other or any other hard object. Separate concrete cylinders by a soft material and load them carefully to avoid damage. Protect concrete cylinders from freezing and hot temperatures.

## Section 101

## ABBREVIATIONS &amp; DEFINITIONS

Authorized Laboratories	Central lab, District Lab, State Field Lab, and any lab the engineer approves.
Composite Samples	A number of samples taken from different parts of the batch and are mixed to form a single, homogeneous, composite sample of sufficient quantity for testing.
Concrete Yield	The "yield" is defined in this manual as "volume in cubic feet per batch of concrete."
Cement Content	The "cement content" is defined as the sacks of cement per cubic yard of concrete as calculated from the data obtained.
Unit Weight of Water	62.4 lb/cu ft
Fractured Face	A broken surface constituting an area equal to at least 25% of the largest cross-sectional area of the particle. A fractured face is caused either by mechanical means or by nature. Natural fractures to be accepted must be similar to fractures produced by a crusher.
Soft Particles	Exclusive of shale, hard iron oxide particles, lignite and other coal. Includes clay, soft iron oxide, and other friable material.
Thin or Elongated pieces	Maximum thickness less than 1/4 the maximum width, or maximum length more than three times the maximum width.
Fractured Material	An aggregate crushed to a smaller size from a larger size. (i.e. aggregate retained on a 3/4" sieve crushed to produce aggregate of 1/2" or less in size.)
Set of Cylinders	Two Concrete Cylinders cast from the same sample.
28-day Compression Test	Concrete Compression tests are conducted on a set of cylinders cast on the project site and cured for 28 days under laboratory conditions. Average of two cylinders.
7-day Compression Test	Concrete Compression tests are conducted on a set of cylinders cast on the project site and cured for 7 days under laboratory conditions. Average of two cylinders.

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**Section 105****CONTROL OF WORK**

The Standard Specification Sections; 105.07, 105.09 and 105.12 give direction on control of work as it pertains to materials. Additional information follows:

**105.01 INSPECTION OF WORK.**

Carefully inspect all materials in the field to be accepted by certification prior to incorporation into the work. Inspect as soon as possible after the material arrives on the project. Reject any material found to be defective, regardless of previous certification, inspection, or testing.

If not used immediately, give approved materials another careful visual examination. Before use, decide acceptability of previously approved materials (on the basis of a certification) that have deteriorated in condition or quality.

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## Section 106 Control of Material

### 106.01 Description

The following NDDOT *Standard Specifications for Road and Bridge Construction* sections give direction on control of work as it pertains to materials: 106.01, "General Methods of Materials Acceptance;" 106.03, "Samples, Tests, Cited Specifications;" 106.04, "Storage of Materials;" 106.07, "Rights In and Use of Material Found in the Work;" 106.08, "Department-Furnished Material;" and 106.09, "Buy American Products."

The following contains additional information pertaining to materials.

### 106.02 General Methods

- For each project keep a materials file containing copies of all laboratory tests, field tests, inspection reports, and certifications.
- All sampling and testing is conducted at the frequencies outlined throughout this manual. The specified frequencies are the minimum required for the project. The Engineer may increase sampling and testing at any time to verify the quality of the material.
- To ensure bias is eliminated from the sample selection process, sampling must be from random sample locations. The Engineer may utilize the random number table found in this manual or any other common method they find acceptable.
- At sufficient intervals, check the number of samples submitted to the laboratory, certifications, inspection reports, and number of field tests to be certain all materials used have the required supporting documents.
- SFN 10072, "Aggregate Quality Test Summary" should be posted on the project and used to record the results of all tests performed at an authorized laboratory. At the completion of the project, submit the original copy of this form to the District Materials Coordinator for review, approval, and distribution.
- If the Engineer waives the requirements for sampling and testing, or certification of compliance under the guidelines established in Section 106.01, "General Methods of Materials Acceptance," of the NDDOT *Standard Specifications for Road and Bridge Construction*, the materials accepted under these conditions must be listed on SFN 10110, "Project Engineer's Report on Materials Acceptance."
- When the Engineer waives the requirements for sampling and testing materials or chooses to use non-conforming materials, justification must be attached to SFN

10110. The justification must include, but may not be limited to, the consultation of the Materials and Research, Design, and Bridge Divisions.

- Specifications require the submittal of shop drawings for specified construction components. Shop drawings are required for some items such as pre-stressed beams, structural steel, lighting, traffic signal components, etc.
- The Contractor submits a minimum of two sets of shop drawings to the Engineer. It is the Engineer's responsibility to send the drawings with a transmittal letter to the construction office for review and approval. If the project is a non-NDDOT engineered project, send the drawings and transmittal letter to the County or

Consultant in charge of the project. Indicate in the transmittal letter if the shop drawings are for a project where a Critical Path Method (CPM) is specified. Components covered by shop drawings do not need certification unless required by specifications or plan notes.

### **106.03 Independent Assurance Sampling and Testing Program**

The Independent Assurance (IA) Sampling and Testing Program is a major element of NDDOT's Materials Quality Control Program. It is intended to ensure that test data derived from project acceptance testing is reliable by providing an independent check of test results and equipment. The program includes observations of project sampling and testing, split sample testing, equipment checking, and documentation.

The IA program is mandated by the Federal Highway Administration (FHWA). The purpose is to confirm the reliability of the test results obtained in the acceptance sampling and testing program. This is accomplished by observing sampling and testing procedures, as well as obtaining split portions of acceptance samples. Split samples are tested using equipment and testing personnel different from those used for acceptance testing. The test results are then compared to the acceptance test results. If these test results do not correlate, follow-up actions are taken to discover and correct the deficiencies.

The IA will evaluate the sampling and testing personnel and equipment of the NDDOT. The program covers sampling procedures, testing procedures, and testing equipment. The testing equipment will be evaluated by calibration checks, split samples, or proficiency samples. Testing personnel will be evaluated by observation, review of the control charts and documentation, and split samples.

An IA program is required of all states by the FHWA for all federal aid projects. The states develop their own program content using FHWA prescribed guidelines. FHWA concurrence with the IA is necessary before implementation by the state. It is NDDOT policy to apply the program to all federal aid projects, including Local Public Agencies on the NHS system.

Management of this program is at the District Materials Coordinator level and is the responsibility of the Materials and Research Engineer. All IA is independent of project management activities, however close cooperation between the two is essential. It is also particularly important that project personnel appreciate the importance of the IA and cooperate fully to accomplish its intended purpose.

The specific guidelines relative to the sampling and testing undertaken in this program are not described here. All areas requiring IA are designated throughout this manual.