

**DEPARTMENT OF TRANSPORTATION  
OFFICE OF MATERIALS AND TESTING**

**Standard Operating Procedure (SOP) 5**

**Quality Control of Portland Cement and Blended Hydraulic Cements and  
Quality Control of Fly Ash and Granulated Blast-Furnace Slag**

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**I. General**

The monitoring of quality of all Hydraulic Cements and Pozzolans used on Department of Transportation projects is the responsibility of the Office of Materials and Testing. The basic principles of the testing program shall be as follows:

- A. Materials from approved sources may be accepted on the basis of producer's certification of an approved Quality Control Program.
- B. Materials from unapproved sources will be tested prior to use.
- C. In order to be carried on the approved list, a producer must meet certain minimum criteria specified by the Department.
- D. Quality Assurance samples will be taken from materials delivered to projects or concrete plants.

**II. DOCUMENTATION AND USE OF MATERIALS**

A. Approved Sources

The Construction Project Manager/Engineer shall complete DOT form 319, or whichever form is used, in accordance with the Sampling, Testing and Inspection Manual. If the Construction Project Manager/Engineer, for any reason, suspects non-uniform or non-specification material, they may submit samples to the Central Laboratory for tests and not use the material until it has been determined whether or not the material meets the Specification requirements for the type specified.

B. Non-Approved Sources

Materials from non-approved sources will generally be sampled at the project and test results reported prior to use. Construction Project Manager/Engineers should not allow use of material from non-approved sources until test reports have been received from the Central Laboratory or the material has been otherwise approved by the State Materials Engineer.

**III. REQUIREMENTS FOR APPROVED SOURCES**

- A. Approved producers must have an effective quality control and quality assurance program. The quality control program shall be sufficient to ensure that the finished product possesses uniform characteristics fully within the Specifications. The quality assurance program shall be reviewed and approved by the Department. Minimum requirements of the quality assurance program shall be as follows:
  - 1. Sampling. Individual samples shall be representative of the material and may be secured by either the grab or the continuous method.
  - 2. Preparation of Sample. Composite test samples for the physical and chemical tests shall be prepared by arranging all individual samples in a group. From each of the individual samples in a group, equal portions shall be taken to form a composite test sample. The composite test sample shall weigh a minimum of 20 pounds (9 kilograms), mixed thoroughly and then separated to

permit making the producer's physical and chemical determinations and the Department's companion sample.

- a. Portland Cement, Portland Cement with Limestone, and Blended Hydraulic Cements: Composite test samples for the physical and chemical tests shall represent no more than the quantity of that type cement produced in a 24 hour period.
  - b. Imported Portland Cement: Imported cements will be sampled on a shipment basis at the port of entry. Notification must be given to the Cement Engineer 24 hours prior to the arrival of the ship. At least one sample shall be taken for each 2000 tons (1800 Mg) of material. These samples shall be used to make a composite sample representing each cargo hold. A ship composite sample shall then be made to represent the entire shipment. A complete analysis must be performed on each of these composite samples by the distributor's laboratory and a report of this analysis submitted to the Central Laboratory. Imported Cement may not be used in Department work until the Central Laboratory receives a companion of the ship composite sample and the results of acceptance tests which have been performed in this Country.
  - c. Fly Ash: Individual samples shall represent not more than 400 tons (360 Mg). Composite test samples for the physical and chemical tests shall represent no more than the quantity of fly ash produced in a one month period.
  - d. Imported Fly Ash: Imported fly ash shall be sampled on a shipment basis at the port of entry. Notification must be given to the Cement Engineer 24 hours prior to the arrival of the ship. At least one sample shall be taken for each 2000 tons of material. These samples shall be used to make a composite sample representing each cargo hold. A ship composite sample shall be made to represent the entire shipment. A complete analysis must be performed on each of these composite samples by the distributors laboratory and a report of this analysis submitted to the Central Laboratory. Imported Fly Ash may not be used in Department work until the Central Laboratory receives a companion of the ship composite sample and the results of acceptance tests which have been performed in this Country.
  - e. Granulated Blast-Furnace Slag: Individual samples shall represent not more than 125 tons (115 Mg). Composite test samples for the physical and chemical tests shall represent no more than the quantity of slag produced in a three day period or 2500 tons (2300Mg), whichever results in the greater number of samples.
3. Amount of Testing: Deletion of specific tests or a reduction in the testing rate for specific tests must be approved by the State Materials Engineer.
- a. Portland Cements: All chemical and physical tests required by the "Specification for Portland Cement," AASHTO Designation M 85 shall be conducted on every test sample and shall include the alkali content and false set test.
  - b. Portland Cement with Limestone: All chemical and physical tests required by the "Specification for Portland Cement," AASHTO Designation M 85 shall be conducted on every test sample and shall include the alkali content, false set test, % CO<sub>2</sub> in the cement, % CO<sub>2</sub> in the limestone, % limestone in the cement, and CaCO<sub>3</sub> in the limestone.
  - c. Blended Hydraulic Cements:  
Type IP: All chemical and physical tests required by the "Specification for Blended Hydraulic Cements", AASHTO Designation M 240, Type IP, as well as the insoluble residue test shall be conducted on every test sample. Pozzolan used in the manufacture of Type IP Cement is limited to fly ash. All chemical and physical tests required by Subsection 831.03 of the Standard Specifications shall be conducted on a monthly composite or monthly grab sample of fly ash.  
Type IS: All chemical and physical tests required by the "Specification for Blended Hydraulic Cements," AASHTO Designation M 240, Type IS, shall be conducted on every test sample. All chemical and physical tests required by AASHTO M 302 "Ground Iron Blast-Furnace slag for use in Concrete and Mortars" shall be conducted on no more than the

quantity of slag produced in a three day period or 2500 tons (2300 Mg), whichever results in the greater number of samples.

- d. Fly Ash: Fineness and loss on ignition tests shall be conducted on each individual sample representing not more than 400 tons (360 Mg) of fly ash. All chemical and physical tests required by Subsection 831.03 of the Standard Specifications shall be conducted on the monthly composite test sample.
  - e. Granulated Blast-furnace Slag: All chemical and physical tests required by AASHTO M 302 "Ground Iron Blast-Furnace Slag for Use in Concrete and Mortars," shall be conducted on no more than the quantity of slag produced in a three day period or 2500 tons (2300 Mg), whichever results in the greater number of samples.
- B. Producers must provide samples representative of their production to the Central Laboratory. Companion samples prepared in accordance with the above shall be selected by the manufacturer and transmitted to the Department of Transportation. At least a ten-pound portion (five kilogram) of the companion samples must be retained at the producer's laboratory for 90 days.
1. Portland Cement, Portland Cement with Limestone, and blended Hydraulic Cements: Each week, one of the companion samples of cement shall be transmitted to the Department of Transportation. This mill sample shall be selected from the preceding seven day period by an approved method of random selection devised by the manufacturer.
  2. Fly Ash: Each month, the companion sample of fly ash shall be transmitted to the Department of Transportation.
  3. Granulated Blast-Furnace Slag: Each two weeks, one of the companion samples of slag shall be transmitted to the Department of Transportation. This mill sample shall be selected from the preceding fourteen day period by an approved method of random selection devised by the producer.

Identification cards or tags must be attached to each sample container and list the following information:

1. Producer/DOT Qualified Product Lists Code
2. Location
3. Types of Material
4. Date of production represented by sample
5. Sample identification number Samples will be shipped prepaid to:

Office of Materials and Testing  
Georgia Department of Transportation  
15 Kennedy Drive, Dock "C"  
Forest Park, Georgia 30297-2534

- C. Approved producers shall furnish all test data required by Section III.A.3 to the Department. Each month, a list of the dates of production of the material to be furnished with the corresponding test results for each of the composite test samples shall be transmitted to the State Materials Engineer by the specified method.
- D. The producer shall furnish the State Materials Engineer a manufacturer's guarantee stating that all material furnished for use on Department of Transportation projects is warranted to meet the Specifications. An example of such guarantee is attached. This certification must be submitted no later than December 1 of each year in order to remain an approved source for the following year.
- E. When limestone is used as an ingredient in Portland Cement, the manufacturer shall state in writing the source of limestone, the amount thereof and shall supply comparative test data on chemical and physical properties of the cement with and without the limestone. (Comparative test data may be from qualification tests performed by the manufacturer during formulation of the cement with limestone.)

The comparative tests do not supersede the normal testing to confirm that the cement meets chemical and physical requirements of this standard. The amount of limestone in cement shall be determined in accordance with Annex A2 of AASHTO M85.

#### **IV. LIST OF APPROVED SOURCES**

##### **A. General**

The Office of Materials and Testing will publish an approved list of sources periodically. The list will designate the name of the company, location of the approved source and terminals, and any other data considered pertinent.

##### **B. New Sources**

Those sources desiring to be added to the list of approved sources should make application in writing to the State Materials Engineer. The request should include the following items:

1. A manufacturer's guarantee stating that all material furnished for use in Department of Transportation projects is warranted to meet the Specifications.
2. An outline of the producer's quality assurance sampling and testing and of his quality control sampling and testing procedures.
3. A brief discussion of materials to be marketed and their sources. This need not be detailed but should state where the material is manufactured and storage terminal points.

Upon receipt of such a request, an inspection will be scheduled by the Structural Materials Branch - Concrete Section. The inspection will include testing and quality control facilities, sampling of materials and a review of past records of materials produced. If the results of these procedures indicate characteristics conforming to the Specifications, the source will be added to the approved list.

##### **C. Removal From the Approved List**

The Department reserves the right to remove any source from the approved list at any time confidence is lost in a producer's ability or intention to produce material of uniform characteristics complying with the Specifications.

The Department reserves the right to remove any source from the Qualified Products List when materials are not received for a Departmental project for a period of twelve (12) months.

##### **D. Reinstatement to Approved List**

Once removed from the approved list, a source may gain reinstatement in the following manner:

1. Suppliers should make a written request to the State Materials Engineer asking to be reinstated to the approved list. The request should detail the causes and solutions to the problem areas which caused removal from the approved list. In addition, the supplier should state measures taken to prevent reoccurrence of problems.
2. If, after review of the request for reinstatement, it appears the producer's problems have been solved, an inspection of facilities will be made and all material in stock will be sampled.
3. After examination of data gained from subparagraph 1 and 2 above, the State Materials Engineer will decide if the supplier may be reinstated to the approved list. In some cases, extenuating circumstances may warrant conditional reinstatement.

## V. INSPECTION

Scheduled and unscheduled visits will be made to all producers periodically by a representative from the Central Laboratory. Materials being produced or stored will be sampled and the producer's testing program will be reviewed.

## VI. SAMPLING AND TESTING

- A. Sample Types
  - 1. Stock Samples. These will be samples taken by a representative from the Central Laboratory on periodic visits to the terminal or mill.
  - 2. Companion Mill Samples. These are samples submitted by the mill or facility to the Central Laboratory as outlined previously in Section III.B.
  - 3. Quality Assurance Samples: These are samples taken from the project site or concrete plant by a representative from the Laboratory.
- B. The degree of testing for each sample taken by or submitted to the Central Laboratory will be left to the discretion of the Cement Engineer with the approval of the State Materials Engineer.

## VII. DISTRIBUTION POINTS

- A. Producers shall show on the bill of lading the source of each shipment of material. If the material was not produced by the seller, the source and location shall be identified. The bill of lading for all types of Portland Cement shall indicate if the material contains limestone.
- B. Producers who allow shipments in excess of Georgia legal load limits will be removed from the List of Approved Producers.
- C. Producers must have vehicle scales at bulk loading facilities inspected at least annually by the State Agriculture Department and a copy of their scale test report submitted to the State Materials Engineer.
- D. Each shipment shall be supported by a validated delivery ticket or bill of lading which must be signed by a certified public weigher. The certified public weigher shall meet all conditions in the Laboratory SOP-15, entitled "Standard Operating Procedure, Certified Public Weighers." Shipment invoices may be reviewed by the cement inspector.
- E. For base construction, a Department of Transportation seal shall be placed on the discharge cap of each unit by the producer after the unit is weighed. The seal shall be removed and retained by the Engineer until completion of the final project audit. The project number and county shall be shown on the delivery ticket or bill of lading.

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State Materials Engineer

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Director of Construction

## EXAMPLE

### MANUFACTURER'S GUARANTEE

The certification to be submitted by the producer shall contain the following or similar wording:

“The undersigned guarantees that all the (Material) to be furnished by (Producer) from (Location) for use on transportation projects in the State of Georgia has been manufactured under strict quality control and will meet (Specification title) AASHTO Designation: (Number) for the (Type of Material) shipped and that all tests are performed in accordance with the latest AASHTO standard methods. (Producer) agrees to have the facilities and laboratory checked at regular intervals by a representative of the Georgia Department of Transportation, Office of Materials and Testing. (Producer) will comply with the Georgia Department of Transportation Standard Operating Procedures for “Approved sources of Material.”

For Portland cement Types I/II or III: The certification shall contain wording as above specifying that the cement will meet “Specifications for Portland Cement”, AASHTO Designation M 85. Portland cement must meet the low alkali and the false set requirements of AASHTO M 85.

For Portland-Pozzolan cement Type IP producers: The certification shall contain wording as above, specifying that the cement will meet “Specifications for Blended Hydraulic Cement,” AASHTO Designation M 240, Type IP, with a Pozzolan content of (Not more than 25) percent by weight and the amount of Pozzolan will not vary more than plus or minus 5.0 weight percent from lot to lot or within a lot and shall not exceed 25 percent. In the event the producer changes the certified Pozzolan content by more than plus or minus 5 percent, the producer must re-certify the Portland Pozzolan cement.

For Portland Blast-Furnace Slag Cement: The certification shall contain the wording as above, specifying that the cement will meet “Specifications for Blended Hydraulic Cements” AASHTO Designation: M 240, Type IS, with a slag content of (no more than 50) percent by weight and the amount of slag shall not vary more than plus or minus 5.0 percent by weight from lot to lot or within a lot and shall not exceed 55 percent by weight.

For Granulated Iron Blast Furnace Slag: The certification shall contain wording as above, specifying that the material will meet AASHTO M 302, Grade 100 or Grade 120.

For Fly Ash: The certification shall contain wording as above, specifying that the material will meet AASHTO M 295, Class F, Class C, or Class N.

The guarantee must be signed by a responsible officer of the company with authority to bind the company to a contract and shall be notarized.