



9/9/19

ALDOT-227 QUALITY CONTROL AND QUALITY ASSURANCE OF PORTLAND AND BLENDED HYDRAULIC CEMENTS

1. Scope

- 1.1. The Quality Control of all Portland and blended hydraulic cements used on Department founded projects is the responsibility of the approved Cement Producer.
- 1.2. The Quality Assurance of all Portland and blended hydraulic cements used on Department founded projects is the responsibility of the Testing Division of the Bureau of Materials and Tests.
- 1.3. All cement used on Department projects shall be from approved sources as listed in List I-2 of the Department's Materials, Sources, and Devices with Special Acceptance Requirements manual.

2. Reference Documents

- 2.1. ALDOT Standard Specifications for Highway Construction
 - 806 Mineral Admixtures
 - 815 Cement
- 2.2. ALDOT Procedures
 - ALDOT-355 General Information Concerning Materials, Sources, and Devices with Special Acceptance Requirements
- 2.3. AASHTO Standards
 - T 105 Chemical Analysis of Hydraulic Cement
 - T 127 Sampling and Amount of testing of Hydraulic Cement
 - T 153 Fineness of Hydraulic Cement by Air Permeability Apparatus
 - M 85 Portland Cement
 - M 240 Blended Hydraulic Cement
- 2.4. ASTM Standard
 - C 1005 Reference Masses and Devices for Determining Mass and Volume for Use in the Physical Testing of Hydraulic Cements

3. Initial Source Approval Requirements

- 3.1. Cement producers shall request in writing to the State Materials and Tests Engineer the addition of new sources of cement to List I-2. The request shall include the following:
 - 3.1.1. A 10 lb (5 kg) sample of each type of cement being requested for approval.
 - 3.1.2. A minimum of 6 months of test data, indicating compliance with either AASHTO M 85 or AASHTO M 240, whichever is appropriate.
 - 3.1.3. A copy of the Quality Control Plan for the plant. The Quality Control Plan shall, at minimum, include the items addressed in Section 4 of this procedure.
 - 3.1.4. All forms and fees required per ALDOT-355.
- 3.2. Upon completion of the Department's testing of the sample(s), the source will be recommended for approval to the Product Evaluation Board.

- 3.3. Distribution terminals are also subject to approval by the Department. Cement producers shall request in writing to the State Materials and Tests Engineer the addition of new distribution terminals to List I-2. The request shall include the following:
 - 3.3.1. A copy of the Quality Control Plan for the terminal.
 - 3.3.2. A list of all sources and types of cement stored at and shipped through the terminal. Non-approved sources and types of cement may be stored at a terminal, but only approved sources and types of cement may be supplied to Department projects.
 - 3.3.3. All forms and fees required per ALDOT-355.

4. Producer Quality Control Requirements

- 4.1. The producer's Quality Control Plan shall include but not be limited to the following:
 - 4.1.1. Cement samples shall be taken for every type of cement produced at a frequency not to exceed every 4 hours. The sample may be secured by either the grab or the continuous method.
 - 4.1.2. All samples, for each type of cement produced, taken within a 24 hour period shall be combined into a composite sample for a complete chemical and physical analysis.
 - 4.1.3. Samples shall be prepared in accordance with the requirements given in AASHTO T 127 before any testing is performed. The sample shall be stored in airtight moisture-proof containers to prevent aeration or absorption of moisture prior to testing.
 - 4.1.4. Determine the fineness of hydraulic cement at a frequency not to exceed every 4 hours in accordance to the requirements given in AASHTO T 153.
 - 4.1.5. Determine the oxides at a frequency not to exceed every 4 hours in accordance with the requirements given in AASHTO T 105.
 - 4.1.6. For each type of cement produced, all samples taken within a 24-hour period shall be combined into a composite sample for a complete physical and chemical analysis.
 - 4.1.6.1. The composite sample shall be large enough to allow the producer to perform the required mill physical and chemical analysis and to obtain a companion sample of at least 20 lb (10 kg) for ALDOT.
 - 4.1.6.2. The composite sample shall be thoroughly mixed before separation of the mill sample and the ALDOT companion sample.
 - 4.1.6.3. The mill sample and the companion sample shall be identified with the date secured.
 - 4.1.6.4. Portland cement shall be tested to meet the chemical and physical requirements given in Tables 1 and 3 of AASHTO M 85. In addition, Portland cement shall meet the optional requirements for equivalent alkalis given in Table 2 of AASHTO M 85 and Section 815 of the Specifications.
 - 4.1.6.5. Blended hydraulic cement shall be tested to meet the chemical and physical requirements described in Tables 1, 2 and (when applicable) 3 of AASHTO M 240.
 - 4.1.6.5.1. A composite sample of pozzolans (fly ash for Type IP cement and GGBFS for Type IS cement) shall be collected in

accordance with Item 4.1.6 and tested to meet the requirements in Table 4 of AASHTO M 240. The sample frequency shall be once per production day and combined into a monthly composite.

- 4.1.6.5.2. A composite sample of limestone for Type II cement shall be collected and tested to meet the requirement in Section 8.2 of AASHTO M 240. The sample frequency shall be once per production day and combined into a monthly composite.
- 4.2. Records of all test results shall be maintained at the mill laboratory and available for review at the request of the Department.
- 4.3. The producer shall provide a bill of lading which clearly states the source of the material with each shipment of cement.
- 4.4. The producer's testing laboratories shall be inspected by the Cement and Concrete Reference Laboratory (CCRL) every two years and maintain laboratory accreditation from the AASHTO Materials Reference Laboratory (AMRL).
- 4.5. Producer's testing laboratories shall also participate in the CCRL Proficiency Samples Program.
- 4.6. Cement producers shall provide a **monthly** companion 10 lb (5 kg) cement sample to the Concrete Section of the Bureau of Materials and Tests. Producers shall provide a **quarterly** companion sample of the pozzolan or limestone used in the production of blended cements.
- 4.6.1. The companion samples prepared in accordance with Item 4.1.6 shall be delivered to the Concrete Section of the Bureau of Materials and Tests. This companion sample shall be selected from the preceding month by an approved method of random selection devised by the manufacturer.
- 4.6.2. The samples should not be selected by a fixed predetermined day of the week.
- 4.6.3. All samples shall be submitted in either 1-gallon metal cans or 1 gallon plastic buckets. The sample container shall have a lid that can be resealed.
- 4.6.4. A 10 lb (5 kg) portion of the companion sample shall be retained by the producer at the mill laboratory for 90 days.
- 4.6.5. The following information shall be clearly listed on the outside of the container
- Cement producer
 - Mill location
 - Producer's CAMMS facility ID
 - Type of cement, fly ash, or GGBFS
 - Date of production represented by sample
 - Source of fly ash or GGBFS, if applicable
- 4.6.6. Samples shall be shipped prepaid.
- 4.7. The following data shall be submitted by all approved cement producers to the Concrete Section of the Bureau of Materials and Tests:
- 4.7.1. A monthly list of the production dates for each type of cement produced.

- 4.7.2. Monthly test results for each of the composite test samples. The composite sample where the ALDOT companion sample was extracted shall be clearly marked in the monthly tabulation of results.
- 4.7.3. Test results shall be a tabulation of individual results and not average results.
- 4.8. Samples, test results, and correspondence shall be mailed to the following address:
 - Materials and Tests Engineer
 - Attn.: Concrete Section
 - 3704 Fairground Road
 - Montgomery, AL 36110

5. ALDOT Quality Assurance Testing

- 5.1. On ALDOT projects with more than 200 yd³ (150 m³) of structural concrete or more than 10,000 yd² (8,000 m²) of concrete pavement, the Area Materials Office will collect a 10 lb (5 kg) quality assurance sample of cement **monthly** from the ready-mix concrete plant supplying the project.
 - 5.1.1. Samples shall be taken in accordance with Section 4.6. In lieu of a companion sample, the ready-mix concrete producer shall provide the ALDOT representative with a copy of the mill cert from the most current shipment of cement received.
- 5.2. QA samples will be shipped to the Central Lab for a complete physical and chemical analysis.
 - 5.2.1. A failing test will require a new sample be submitted immediately, regardless of any prior testing performed that month.
 - 5.2.2. Repeated failures may result in an sampling & increased testing frequency, or revocation of source qualification.