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 – Requirements for the materials and processes required for the manufacturing of Portland cement and blended hydraulic cements are given in the following Sections of the Specifications:

   - 806 Mineral Admixtures
   - 815 Cement

2.2. AASHTO Standards – requirements for the materials and processes required for the manufacturing of Portland cement and blended hydraulic cements are given in the following 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
   - M 295 Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
   - M 302 Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

2.3. ASTM Standard – requirements for the materials and processes required for the manufacturing of Portland cement and blended hydraulic cements are given in the following ASTM Standard:

   - C 1005 Reference Masses and Devices for Determining Mass and Volume for Use in the Physical Testing of Hydraulic Cements
3. **Approved Sources Requirements**

3.1. Approved cement producers shall submit a Quality Control Plan to the Materials and Tests Engineer. The Quality Control Plan shall include the procedures for controlling and monitoring the quality of the cement produced.

3.2. The Quality Control Plan will be reviewed by the Concrete Section of the Bureau of Materials and Tests. The Quality Control Plan shall include but not be limited to the following:

   3.2.1. Sampling
   
   3.2.1.1. Cement samples shall be taken for every type of cement produced every two hours. The sample may be secured by either the grab or the continuous method.

   3.2.1.2. 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.

   3.2.2. Analysis of Sample

   3.2.2.1. 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.

   3.2.2.2. All tests shall be performed in conformance with the requirements in AASHTO M 85.

   3.2.2.3. Blended hydraulic cements shall meet the requirements given in AASHTO M 240.

   3.2.2.4. Every two hours determine the fineness of hydraulic cement in accordance to the requirements given in AASHTO T 153.

   3.2.2.5. Every four hours determine the oxides in accordance with the requirements given in AASHTO T 105.

   3.2.2.6. Every 24 hours run a complete physical and chemical analysis on the composite cement sample.

   3.2.3. A complete physical analysis consists of all of the requirements given in Table 3 of AASHTO M 85.

   3.2.4. A complete chemical analysis consists of all of the requirements given in Table 1 and the optional requirement for equivalent alkalies given in Table 2 of AASHTO M 85.

   3.2.5. Composite test samples for the physical and chemical tests shall be prepared as follows:

   3.2.5.1. Group all individual samples collected within a 24-hour period for each type of cement.

   3.2.5.2. Each individual sample shall be split to form a composite sample.
3.2.5.3. 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.

3.2.5.4. The composite sample shall be thoroughly mixed before separation of the mill sample and the ALDOT companion sample.

3.2.5.5. The mill sample and the companion sample shall be identified with the date secured.

4. Certification and Standardization

4.1. Balances shall be calibrated every year. Balances shall be checked and verified at least once every four months between calibrations.

4.2. Balances used in chemical determinations shall conform to the requirements of AASHTO T 105. Balances used in physical determinations shall conform to the requirements of ASTM C 1005.

4.3. Compressive strength testing machines shall be calibrated every year.

4.4. Producer’s testing laboratories shall be inspected by the Cement and Concrete Reference Laboratory (CCRL) every two years.

4.5. Producer’s testing laboratories shall participate in the CCRL Proficiency Samples Program.

5. Producer Testing Requirements

5.1. Portland Cement

5.1.1. 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 alkalies given in Table 2 of AASHTO M 85 and Section 815 of the Specifications. Deletion of specific tests or a reduction in the testing rate for a specific test must be approved in writing by the Materials and Tests Engineer.

5.2. Blended Hydraulic Cement

5.2.1. Blended hydraulic cement shall be tested to meet the chemical and physical requirements described in Tables 1 and 2 of AASHTO M 240. Deletion of specific tests or a reduction in the testing rate for a specific test must be approved in writing by the Materials and Tests Engineer.

5.2.1.1. Type IP cement shall meet the requirement of AASHTO M 240 with the following modifications:
   - The pozzolan shall be limited to fly ash meeting the requirements of Section 806 of the specifications.
   - The fly ash content shall be limited to a maximum of 20% by weight.
   - The total alkali content of the final blend of the IP cement shall not exceed 0.60%.

5.2.1.2. Fly ash for Type IP cement shall meet the chemical and physical requirements given in AASHTO M 295 including the optional chemical
requirements. Fly ash for Type IP cement shall also meet the following requirements:

- A composite test sample of fly ash shall be collected as described in Item 3.2.5, except that the collection period of individual samples shall be one month instead of a 24-hour period.
- If the source of fly ash or type of coal changes then the composite sample collection period of individual samples shall be one week instead of one month.
- The frequency of testing shall be every month if the fly ash is obtained from the same source. If the source or type of coal changes the frequency of testing shall be every week.
- New sources of fly ash shall be approved as per Section 806 of the specifications before they are used in the manufacturing of Type IP cement.

5.2.1.3. Type IS cement shall meet the requirements of AASHTO M 240 with the following modifications:

- Type IS cement is limited for use in soil-cement stabilization only.
- The Ground Granulated Blast Furnace Slag (GGBFS) shall meet the requirements of Section 806 of the specifications.
- The GGBFS content shall be between 25 and 50 percent by weight.
- The total alkali content of the final blend of the IP cement shall not exceed 0.60%.

5.2.1.4. GGBFS for Type IS cement shall meet the chemical and physical requirements given in AASHTO M 302. GGBFS for Type IS cement shall also meet the following requirements:

- A composite test sample of GGBFS shall be collected as described in Item 3.2.5, except that the collection period of individual samples shall be one month instead of a 24-hour period.
- If the source of GGBFS changes then the composite sample collection period of individual samples shall be one week instead of one month.
- The frequency of testing shall be every month if the GGBFS is obtained from the same source. If the source changes the frequency of testing shall be every week.
- New sources of GGBFS shall be approved as per Section 806 of the specifications before they are used in the manufacturing of Type IS cement.

5.3. For each Type of cement produced, producers shall provide a companion 10 lb (5 kg) cement sample every week to the Concrete Section of the Bureau of Materials and Tests.

5.3.1. The companion samples of cement prepared in accordance with Item 3.2.5 shall be delivered to the Concrete Section of the Bureau of Materials and Tests. This companion sample shall be selected from the preceding seven-day period by an approved method of random selection devised by the manufacturer.
5.3.2. The samples should not be selected by a fixed predetermined day of the week.

5.3.3. 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.

5.3.4. A 10 lb (5 kg) portion of the companion sample shall be retained by the producer at the mill laboratory for 90 days.

5.4. Identification cards shall be taped to the outside of each sample container. The following information shall be included in the identification card:

- Cement producer
- Mill location
- Producer’s vendor code
- Type of cement, fly ash, or GGBFS
- Date of production represented by sample
- Sample identification number
- Source of fly ash or GGBFS, if applicable

5.4.1. Samples shall be shipped prepaid.

5.4.2. The producer shall notify the Concrete Section of the Bureau of Materials and Tests any time that there is not production of any type of cement during a seven day period.

6. ALDOT Testing

6.1. Sample types

6.1.1. Independent Assurance Samples and Tests (IAS&T) - These are samples taken by the IAS&T-D personnel from the Divisions from each of the project sites on a monthly basis when concrete operations are in progress.

6.1.2. Companion Mill Samples - These are samples submitted by the mill or facility to the Central Laboratory as outlined in Item 5.3.

6.1.3. Stock samples - These samples will be taken by inspectors from the Concrete Section of the Bureau of Materials and Tests on every visit to the cement mills or terminals.

6.2. The degree of testing for each sample taken by or submitted to the Central Laboratory will be dependent on several factors and will be left to the discretion of the Testing Engineer. In the absence of other instructions a guide for testing shall be as follows:

6.2.1. IAS&T - These monthly samples will be assembled by source (cement mill) on a weekly basis. At least one sample will be randomly selected from each source and a complete analysis will be conducted on that sample.

6.2.2. Companion Mill Samples - A complete analysis will be performed on samples from each approved source biweekly. Fly ash GGBFS samples will be tested monthly except as noted in Item 5.2.1.2 and 5.2.1.4 respectively.

6.2.3. Stock Samples - Instructions for testing stock samples will be shown on the sample card submitted with the sample.
7. **Use of Approved Cement**

7.1. Project Engineers will allow the use of cement only from sources listed in List I-2 of the Materials, Sources, and Devices with Special Acceptance Requirements manual.

7.2. The Concrete Engineer will notify the Project Engineer if the cement being used on an ALDOT project fails to meet the Department specifications. The Project Engineer will discontinue the use of the cement until further notice.

7.3. The Project Engineer will submit to the Concrete Section of the Bureau of Materials and Tests cement samples that are suspected of being non-uniform or out of specification for verification testing. The Project Engineer will discontinue the use of the cement until it has been determined by the Department whether or not the cement meets the specification requirements.

8. **Documentation**

8.1. Records of all test results shall be maintained at the mill laboratory and available for inspection by a representative of the Concrete Section of the Bureau of Materials and Tests.

8.2. Upon request, the approved cement producer shall be required to submit to the Materials and Tests Engineer a current list of ready mix plants and locations which have been furnished bulk cement.

8.3. The following data shall be submitted by all approved cement producers to the Concrete Section of the Bureau of Materials and Tests:

   8.3.1. A monthly list of the production dates for each type of cement produced.

   8.3.2. 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.

   8.3.3. Test results shall be a tabulation of individual results and not average results.

8.4. Approved cement producers shall have records for comparison of all test results.

8.5. Approved cement producers shall have records showing that the production of cement exhibits uniformity within the parameters given in the specifications.

8.6. The cement producer shall complete part 1 of Form BMT-114, "Certified Cement Shipment", for each shipment of cement.

8.7. The ALDOT Certified Concrete Technician shall complete part 2 of Form BMT-114 ensuring the source of the cement is clearly identified.

8.8. A copy of the BMT-114 will be retained by the Division Materials Engineer, who will be responsible for the documentation of all field records.

8.9. A copy of the BMT-114 will be forwarded by the Division Materials Engineer to the Bureau of Materials and Tests for verification by the Testing Engineer.

8.10. All projects served by the concrete plant should be listed on every BMT-114.

8.11. In case of conflict of documentation, central file records will govern.
9. **Distribution Points**

9.1. Storage terminals shall be considered an extension of the mill storage facilities and will therefore be subject to inspection and approval. Cement from approved and non-approved sources, different brands of cement, different types of cement, or same brand of cement from different sources shall not be mixed or placed in the same cement storage compartment.

9.2. Cement producers shall submit to the Concrete Section of the Bureau of Materials and Tests a list of all the sources and types of cement that will be stored and distributed from the approved terminals.

9.3. Cement producers shall submit weekly samples from approved terminals in accordance to Item 5.3, except that the cement sample shall be from a composite sample of daily collected samples. Test results shall be submitted for the companion sample as per Item 8.3.

9.4. Cement producers shipping cement from a terminal shall submit form BMT-114 as described in Item 8.6 indicating the approved cement mill source as well as the terminal location.

10. **Approved Sources List**

10.1. **General**

10.1.1. The Bureau of Materials and Tests will maintain List I-2 of approved sources of cement producers in the Department's Materials, Sources, and Devices with Special Acceptance Requirements manual. Written notification will be given to cement producers as sources are added or deleted from the list.

10.1.2. Approved cement sources shall meet the requirements outlined in this procedure.

10.2. **New Sources**

10.2.1. 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 requirements:

10.2.1.1. A manufacturer's guarantee stating that all cement furnished for use in Alabama Department of Transportation projects is warranted to meet the specifications. This guarantee shall be signed by an officer of the company with authority to bind the company to contract and shall be notarized. An example of such a guarantee is as follows:

   The undersigned certifies that all the cement to be furnished by (cement producer) from (mill location) for use on projects in the Alabama Department of Transportation has been manufactured under strict quality control and meet the specification requirements given in AASHTO M 85 for Low Alkali Cement or in AASHTO M 240, as modified by ALDOT-227, (depending on the type of cement shipped) and that all tests are performed in accordance with the latest AASHTO standards. (Cement producer) agrees to have the mill and mill laboratory inspected at regular intervals by a representative of the Alabama Department of Transportation. (Cement producer) will comply with ALDOT 227, "Quality Control and Quality Assurance of Portland and Blended
Hydraulic Cements", for cement mills listed as "Approved Sources of Portland and Blended Hydraulic cements".

10.2.1.2. An outline of the producer's quality control and quality assurance sampling and testing procedures and a copy of the Quality Control Plan written in English.

10.2.1.3. A description of the cement(s) to be produced and the location of the cement mill, storing facilities, and terminals shall be included.

10.2.2. Upon receipt of the producer’s written request an initial inspection of the cement mill will be scheduled by the Concrete Section of the Bureau of Materials and Tests. The plant facilities, including the testing and quality control areas will be inspected. The testing procedures and technicians ability to perform the tests will be reviewed, and samples of materials (to include raw materials) will be taken.

10.2.3. New cement sources seeking approval shall meet the requirements outlined in this procedure.

10.2.4. If the inspection of the producer’s facilities and the review of the testing procedures indicate the producer’s ability to consistently produce cement exhibiting uniformity within the parameters given in the specifications, and compliance with all the requirements given in this procedure, then the cement source will be presented before the Product Evaluation Board for consideration of approval.

10.2.5. All applicable fees shall be paid in accordance to ALDOT-355, “General Information Concerning Materials, Sources, and Devices with Special Acceptance Requirements”.

10.3. Temporary Approval of Cement Sources

10.3.1. New cement sources may be given temporary approval until an ALDOT representative makes an on site inspection of the manufacturing facility. Cement producers desiring to add new cement sources to List I-2 of the Materials, Sources, and Devices with Special Acceptance Requirements manual on a provisional basis, shall meet, in addition to the requirements given in Item 10.2 of this procedure, the following:

10.3.1.1. A composite sample as described in Item 3.2.5 of this procedure shall be submitted directly from the cement mill source.

10.3.1.2. Test results of the companion sample to the composite sample submitted in item 10.3.1.1 of this procedure covering the requirements listed in Item 3.2.2 of this procedure shall be submitted to the Concrete Section of the Bureau of Materials and Tests.

10.3.1.3. The new cement source shall participate in a proficiency sample program as described in Item 4 of this procedure. If a CCRL proficiency program is not available at the location of the new cement mill source; then, cement mill shall participate in a proficiency program equivalent to CCRL and accepted by ALDOT. A report of the most recent test results shall be submitted to the Concrete Section of the Bureau of Materials and Tests.
10.3.1.4. The cement producer shall obtain a 20 lb (10Kg) sample from every shipment of cement. The 20 lb (10 Kg) sample shall be split in two equal portions. One portion shall be tested by an independent testing laboratory with test results submitted directly to the Concrete Section of the Bureau of Materials and Tests. ALDOT will take possession of the other portion of the sample. Samples shall be obtained directly from the transporting source (vessels, barges, trucks, etc.).

10.4. Removal from the Approved Source List

10.4.1. The Department reserves the right to remove any source from List I-2 at any time confidence is lost in the producer's ability or intention to produce cement of uniform characteristics complying with the requirements stated in this procedure and the specifications.

10.5. Reinstatement to the Approved Sources List

10.5.1. A cement source may gain re-instatement to the approved list by making a written request to the State Materials and Tests Engineer. The request shall include a detailed description of the cause and solution to the problem areas that caused the cement source removal from the approved list. The request shall also include any measures taken to prevent re-occurrence of the problem.

10.5.2. An inspection of the facilities, as described in Item 9, will be conducted and all types of cement in stock will be sampled for testing.

10.5.3. Reinstatement to List I-2 may be granted with or without a probationary period as deemed necessary by the Product Evaluation Board.

11. Inspections

11.1. The Concrete Section of the Bureau of Materials and Tests will conduct initial inspections and annual inspections of all cement sources. Other inspections will be conducted at a frequency set by the Materials and Tests Engineer as deemed necessary.

11.2. The Concrete Section will also conduct inspections of remote storing locations and terminals.

11.3. The producer's testing, Quality Control Plan, and technician’s ability to perform required tests will be reviewed. Materials produced and/or stored will be sampled.

12. Travel Costs and Expenses

12.1. All out of state cement producers whose mills are located more than eight hours travel by automobile or cannot be accessed by automobile from the Department's Central Laboratory will be required to pay for the Department's per diem and transportation. This will apply to all types of inspections. Cost shall include meals, lodging, air fare, and vehicle rental cost if required, and for mileage rates if a Department vehicle is used. If multiple sources are inspected on the same trip, all costs will be proportionally divided.

12.2. Payment for expenses shall be made by check, payable to the Alabama Department of Transportation prior to any visit or inspection.
13. **Mailing Address**

13.1. 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

13.2. Test results may be e-mailed to the following address:

   concretesection@dot.state.al.us