



HYDRAULIC CEMENTS

GENERAL

Portland cement shall meet the requirements of ASTM C150 for the type specified. When blended cement is to be furnished, it shall meet the requirements of ASTM C595. Cement Type I, II, III, IP, IS and **IL** shall also meet the additional requirements outlined in [Section 4101](#) of the Standard Specifications. Approval of any type of Portland and blended cements will be based on certification by an approved source or upon source sampling and testing before being incorporated into the work. Approved cement sources and distribution terminals are listed in the Appendixes of this IM.

The available cement types are:

ASTM C150

- Type I For general use.
- Type II For moderate sulfate resistance. C₃A less than 8%.
- Type III High early strength. Generally, a finer ground Type I cement.

White Cement White cement sources shall meet the requirements of ASTM C150, except the maximum Fe₂O₃ shall not exceed 0.5%. Approved sources of white cement are listed in the [Appendix B](#).

ASTM C595

- Type IS Type I Slag is a Portland cement blended, or clinker interground, up to 35% GGBSF.
- Type IP Type I Pozzolan is a Portland cement blended or clinker interground, up to 25% pozzolan.
- Type IL Type I Limestone is a Portland cement blended or clinker interground, between 5% and 15% limestone.

SOURCE APPROVAL

For consideration for approval, the manufacturer shall provide the following to the Materials Office:

1. A quality control program that meets the requirements of Section A.
2. A copy of the latest CCRL inspection report on quality control laboratory, including documentation of resolution of any discrepancies noted.

-
3. A 3-month strength uniformity report prepared in accordance with the requirements of ASTM C917, "Standard Test Method for Evaluation of Cement Strength Uniformity from a Single Source".
 4. A letter indicating the type of each processing addition, and the percent range that will be used in Type I cement.

The manufacturer shall also prepare a 24-hour composite sample of cement from current production according to ASTM C183. This sample will be tested by the Central Materials Laboratory for acceptance.

Iowa may approve a source based on another state source approval, provided that state will agree to the terms in [Appendix C](#) and the source meets [Section 4101](#) of the Iowa DOT Standard Specifications.

Mixing of cement from different sources, different plants, or of different types in one storage bin or silo will not be allowed.

When **less than 5% of** limestone is used, the manufacturer shall inform the Office of Materials in writing on the amount of the addition. The manufacturer shall also supply comparative test data on chemical and physical properties of the cement with and without limestone. The amount of limestone used shall be included in the manufacturer's Mill Test Reports. **Approval of Type IL cement which contains limestone in a range of 5% to 15%, is described in Section C of this IM.**

A. Quality Control Program

The control of the production from each grinding mill type shall be considered separately. The following minimum testing frequencies are presented as a general guideline:

1. One sample representing 24 hours of production to be tested for air content, false set, and soundness. Determinations of free lime may be used to alter the frequency of testing soundness.
2. One sample representing 4 hours production to be tested for time of set and fineness.
3. One sample representing 48 hours production to be tested for chemical analysis.
4. One sample representing 4 day's production to be tested for 3- and 7-day compressive strength.

The sampling, tests and testing frequencies required may vary from the above guidelines depending of the particular production problems of the plant. In all cases, the quality control procedure used shall be submitted in writing to the District Materials Engineer for approval.

The plant sample test records shall be available for study by Highway Division personnel for at least seven years after the cement represented has been produced.

B. Quality Control Laboratory

The Portland cement plant is required to have a control laboratory compliant with ASTM C1222, Standard Practice for Evaluation of laboratories Testing Hydraulic Cement. The control laboratory shall be AASHTO accredited. This laboratory will perform testing on the applicable types of cement meeting ASTM C150 and C595. Any major difference on test results between the control laboratory and the Highway Division Ames Laboratory shall be resolved quickly. Continued unresolved differences in test results will be considered a basis for discontinuing control laboratory approval.

C. Approval of Type IL Cement

To apply for approval of a Type IL cement, manufacturer shall submit test results of two concrete mixtures, one with the Type IL cement and other with the control Type I/II cement of the same source, to the Office of Materials. These two concrete mixtures shall be cast per the Iowa DOT Concrete Mix Designation C-3WR-C20. The coarse aggregate used shall be an Iowa DOT approved limestone or dolomite. Fly ash, sand, air entraining agent and chemical admixtures used shall also be from Iowa DOT approval lists. The air content shall be in the range of 5.5% and 7.0%.

The tests and approval requirements are listed below:

- ASTM C39, Compressive Strength at 7, 28, and 56 Days: 90% or better of control.
- ASTM C78, Flexural Strength or ASTM C496, Splitting Tensile Strength at 28 and 56 Days: 95% or better of control or a 28-day 3rd point MR greater than 640 psi.
- ASTM C157, Concrete Shrinkage up to 56 Days: 95% or better of control or 56-day shrinkage less than 0.040%.
- ASTM C666, Freeze-Thaw Resistance up to 300 Cycles: 95% or better of control or a durability factor greater than 90%.
- ASTM C457, Air Void Analysis.
- ASTM C1202, Rapid Chloride Permeability.
- ASTM C1012, Sulfate Resistance up to 6 Months.

CONTINUED SOURCE APPROVAL

A. DOT Sampling and Testing

After initial approval, random samples will be taken and tested at a minimum rate of one sample semiannually. The samples may be taken at the source or at the distribution terminal if the source is outside the district's normal area of travel.

A split-sample will be obtained from the plant of a Regular Supplier twice a year, preferably in January and July. The sample will be split and tested for complete chemical and physical properties by supplier's control laboratory and the Highway Division Ames Laboratory, respectively. The date of the split sampling and load out silo number will be identified on the sample identification report for later comparison.

Verification samples will be secured at the project site just before incorporation into the work. Test results, which do not comply with the specifications, may be considered sufficient cause to rescind approval to furnish cement. Construction that contains cement represented by verification samples showing deficient test results will be subject to the requirements of [Article 1105.04](#) of the Standard Specifications.

B. Mill Test Reports

Mill Test Reports covering cement to be certified shall be submitted to the Cement and Concrete Engineer at the Central Laboratory at Ames, and if requested, to the District Materials Engineer who monitors the plant. An electronic form (Excel spreadsheet) is acceptable.

The plant of a regular supplier is required to submit reports for ASTM C917, Standard Test method for Evaluation of Cement Strength Uniformity at least annually.

PROJECT DOCUMENTATION

All approved cements shipped for intended use in Iowa shall be clearly identified. The producer of approved cement shall furnish for the project records, two invoices or bill of lading copies, which bear the following certification statement and the signature of an authorized representative of the producer:

CERTIFICATION STATEMENT

The material herein described has been sampled and tested as prescribed by the Highway Division of the Iowa Department of Transportation and complies with the applicable specification requirements for type _____ cement.

Bin No. _____ Signed _____
Date _____

The bills of lading or invoices shall include project number, if available, source name, source location, source code, type, and quantity in the shipments. For blended cements (Types IP and IS), the above type designation shall include the suffix (X), where (X) equals the targeted percentage of slag or pozzolan in the product.

In the case of truck shipments, these copies of the bill of lading or invoice shall accompany each load, and shall be retained at the project or ready mixed concrete plant for the project engineer records. In the case of rail shipments, these copies shall be mailed to the project or ready mix plant.