
NTPEP Committee Work Plan for Evaluation of Portland & Blended Cement

NTPEP Designation: PBC-19-1



**National Transportation Product Evaluation Program
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Evaluation of Portland and Blended Cement



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INTRODUCTION

The National Transportation Product Evaluation Program (NTPEP) was established to minimize the amount of duplicative testing of transportation materials performed by AASHTO member states by providing a process where manufacturer/suppliers submit their products to NTPEP for laboratory and field testing. The results of the testing are then shared with member departments for their use in product quality verification.

This work plan provides the NTPEP member departments information on the portland & blended cement testing program. In keeping with the NTPEP philosophy of purely testing materials, no conclusions are provided with the test results. The evaluation of the test results is left up to each member department.

1. SCOPE

- 1.1 This work plan covers the requirements and testing criteria for the National Transportation Product Evaluation Program (NTPEP) evaluation of portland & blended cement. NTPEP serves the member departments of the American Association of State Highway and Transportation Officials (AASHTO).
- 1.2 *This work plan may involve hazardous materials, operations, and equipment. It does not purport to address all safety problems associated with its use. It is the responsibility of the user of this work plan to establish the appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. REFERENCED DOCUMENTS

- 2.1 AASHTO Standards:
- AASHTO M 85, Standard Specification for Portland Cement (Chemical and Physical)
 - AASHTO M 240, Standard Specification for Blended Cement
 - AASHTO T 105, Standard Method of Test for Chemical Analysis of Hydraulic Cement
 - AASHTO T 106, Standard Method of Test for Compressive Strength of Hydraulic Cement Mortar (Using 50-mm or 2-in. Cube Specimens)

- AASHTO T 107, Standard Method of Test for Autoclave Expansion of Hydraulic Cement
- AASHTO T 129, Standard Method of Test for Amount of Water Required for Normal Consistency of Hydraulic Cement Paste
- AASHTO T 131, Standard Method of Test for Time of Setting of Hydraulic Cement by Vicat Needle
- AASHTO T 133, Standard Method of Test for Density of Hydraulic Cement
- AASHTO T 137, Standard Method of Test for Air Content of Hydraulic Cement Mortar
- AASHTO T 153, Standard Method of Test for Fineness of Hydraulic Cement by Air Permeability Apparatus
- AASHTO T 186, Standard Method of Test for Early stiffening of Hydraulic Cement (False Set)
- AASHTO T 192, Standard Method of Test for Fineness by the 45- μm (No. 325) sieve

2.2

ASTM Standards:

- ASTM C150, Standard Specification for Portland Cement
- ASTM C595, Standard Specification for Blended Hydraulic Cements
- ASTM C109/C109M, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
- ASTM C114, Standard Test Methods for Chemical Analysis of Hydraulic Cement
- ASTM C151, Standard Test Method for Autoclave Expansion of Hydraulic Cement
- ASTM C185, Standard Test Method for Air Content of Hydraulic Cement Mortar
- ASTM C188, Standard Test Method for Density of Hydraulic Cement
- ASTM C191, Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
- ASTM C204, Standard Test Methods for Fineness of Hydraulic Cement by Air-Permeability Apparatus
- ASTM C311, Standard Test Method for Loss on ignition
- ASTM C 430, Standard Test Method for Fineness by the 45- μm (No. 325) sieve
- ASTM C451, Standard Test Method for Early stiffening of Hydraulic Cement (False set)
- ASTM C452, Standard Test Method for Potential Expansion of Portland Cement Mortars Exposed to Sulfate
- ASTM C1038, Standard Test Method for Expansion of Mortar Bars stored in water
- ASTM C1702, Standard Test Method for Measurement of Heat of Hydration of Hydraulic Cementitious Materials Using Isothermal Conduction Calorimetry

- ASTM C219, Standard Terminology Relating to Hydraulic Cement
- ASTM E29, Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

3. SUMMARY OF WORK PLAN

- 3.1 This work plan defines the evaluation procedures for portland & blended cement (PBC) which will serve as the standard testing protocol for AASHTO's NTPEP for these materials.
- 3.2 The PBC program operates with capabilities of AASHTO member departments and private testing facilities. Individual manufacturers/suppliers are assessed a testing fee that covers costs for actual laboratory testing by either state highway agencies or an approved testing facility. A portion of the testing fee is used for maintaining the online data repository and reports that are accessible to all member departments and other end users.
- 3.3 This document is furnished for the benefit of manufacturers interested in participating in the program by submitting their materials and AASHTO member departments that are interested in reviewing and utilizing the data generated through this product evaluation. The testing format has been established to provide the end user with test results which can be used to assess the performance of portland & blended cement.
- 3.4 The testing facility will be either a state highway laboratory or a private entity appropriately equipped and capable of performing the required laboratory tests. All laboratories performing these evaluations shall be contracted through NTPEP. NTPEP testing programs do not provide pass/fail acceptance criteria.
- 3.5 Evaluation reports will provide performance data and AASHTO encourages member departments to take advantage of the NTPEP program. However, the state highway agency will make the final determination regarding specification compliance and use of the products based on the data that is reported.

4. PRODUCER'S PARTICIPATION

- 4.1 Producers of portland and blended cement who elect to participate in the NTPEP program must submit a completed NTPEP Product Evaluation Form (PEF) to the attention of the NTPEP Liaison. This process is completed electronically through the NTPEP DataMine website. For the purposes of this testing program, products intended for any non-highway applications will not be evaluated.
- 4.1.1 Producers shall submit a copy of their Quality Management System (QMS) for review & acceptance. At a minimum, the QMS plan shall include or address the following:
- 4.1.1.1 Current organization chart & contact information for person responsible for quality control of the facility.
- 4.1.1.2 Quality mission statement
- 4.1.1.3 Descriptions of key positions
- 4.1.1.4 Quality control personnel training & competency evaluation

- 4.1.1.5 Customer feedback protocol
- 4.1.1.6 Internal quality audits
- 4.1.1.7 Management quality reviews
- 4.1.1.8 Corrective action procedures
- 4.1.1.9 Sampling & testing plan
- 4.1.1.10 Re-testing plan
- 4.1.1.11 Inventory of physical & chemical test equipment
- 4.1.1.12 Lab equipment plan for calibrating & verifying equipment
- 4.1.1.13 Method of recording & maintaining product information & test results
- 4.1.1.14 Procedures for handling raw materials & finished product(s)
- 4.1.1.15 Quality control inspections
- 4.1.1.16 Labeling & storage of finished product(s), including an example of the bill of lading
- 4.1.1.17 Control of nonconforming product(s)
- 4.1.1.18 Proof of current AASHTO Accreditation, or a copy of the most current CCRL Inspection report and proficiency sample program testing results for the laboratory used to perform sample testing.
- 4.1.2 Producers should also submit a minimum of six months of mill test data for all required tests identified in Section 11 of this work plan. The mill test reports shall be in English
- 4.2 This committee has two industry representatives. This ensures that industry concerns, experience, and technical knowledge are considered in the testing and evaluation of products, material, and/or devices that are commonly used by the AASHTO Member Departments.
- 4.3 The evaluation process requires laboratory testing on portland & blended cement samples at regular intervals outline in section 13. Sampling will be conducted at the mill, bulk load out, or processing facility by the manufacturer or approved NTPEP representatives.

5. PRODUCT SUBMISSION GUIDELINES

- 5.1 This testing program will accept products throughout the calendar year.
- 5.2 The NTPEP Liaison will verify receipt of testing fees and all appropriate documentation.
- 5.3 Once the producer is notified the product has been accepted for evaluation, State Department of Transportation (DOT) representatives will select samples for testing.
- 5.4 The testing facility shall notify the Lead State and the NTPEP Liaison of receipt of samples for evaluation.
- 5.5 When the laboratory testing has been started, the producer is bound by the Non-Interference Policy as detailed in the General Terms and Conditions Section of submittal documents. After this

time all written or verbal correspondence between the producer and the Testing Laboratory must be done through the Lead State or NTPEP Liaison. Any implication of interference from the producer during the testing and evaluation process will be cause for the evaluation to cease. Any written or verbal communication between the producer and the Testing Facility that is not shared with the NTPEP Liaison or the Lead State will be considered a violation of the Non-Interference Policy.

- 5.6 Once a producer has submitted material from a particular source and a NTPEP sample ID has been assigned, the producer and product name will remain the same throughout the reporting cycle.

6. POLICIES FOR WITHDRAWING MATERIALS FROM NTPEP EVALUATION OF PORTLAND & BLENDED CEMENT

- 6.1 A written or email request to withdraw the product from the evaluation cycle must be received by the NTPEP Liaison prior to the start of testing. If testing has begun any laboratory test costs that may have been incurred for evaluation will be charged. Results released through the NTPEP Data Mine up until the time of withdrawal will be removed. In this event, the product will be listed in the final report with a note that it was withdrawn from the evaluation program.

7. POLICY FOR REVIEW OF NTPEP REPORTS

- 7.1 The NTPEP Information and Operations Guide contains policies for review of reports. A copy of the guide may be viewed and downloaded from the NTPEP website at: www.ntpep.org.

8. TESTING AND REPORTING REQUIREMENTS

- 8.1 The following information defines the laboratory evaluation procedures consisting primarily of AASHTO and ASTM tests for the evaluation of portland and blended cements. It should be noted that this evaluation program is intended for portland & blended cements; thus, pozzolans, supplementary cementitious or other experimental materials are not included as part of this work plan. The evaluation procedures included herein will serve as the standard for NTPEP in serving the AASHTO states.
- 8.2 The primary testing facility is responsible for entering data generated in its facility and reviewing any data generated at subcontracted facilities in the NTPEP online database. If a module is not available in the online repository, DataMine, the testing facility will provide an unalterable Test Report document.

9. MATERIAL CRITERIA

- 9.1 The program will accept submittals from the following categories:
- 9.1.1 **Portland cement** includes Types I & IA, II & IIA, Type II(MH) & Type II (MH)A, III & IIIA, IV and V cements.
- 9.1.2 **Blended cement** includes Types IS, IP, IL, and IT cements.

10. TESTING FACILITY CRITERIA

Candidate facilities to be considered for classification as an authorized testing facility for NTPEP shall meet the following requirements:

- 10.1 **Facilities Requirements:**

- Provide documentation to demonstrate experience in performing testing of cement and mixtures.
- Provide verification that it has the equipment, facilities, and capability to perform the required testing procedures contained in this work plan. The laboratory shall provide a list of equipment that it uses for testing hydraulic cements.
- Identify its policies regarding qualifications and training of its staff to ensure a high-quality level of performance. This shall include performance reviews of testing proficiencies and standard operating procedures for each testing procedure as detailed in the Quality Control/Quality Assurance portion of this document.
- Identify the administrative procedures that have been implemented to ensure a high-quality level of comparative testing results.
- Provide verification that the facility is in conformance with Federal and State regulations related to health and safety.
- Provide verification that the facility has performed all testing procedures in conformance with requirements of the specified individual test methods, including any x-ray fluorescence (XRF) equipment qualification under ASTM C114. The testing facility shall hold accreditation through the AASHTO Accreditation Program, for the testing performed under this program.
- Complete all laboratory testing of the PBC materials within 2 months from the date samples are received.
- Surrender any backlogged items to NTPEP for redistribution to other labs, and identify the cause of and propose a solution to the problem that caused the backlog to occur.

10.2 **Personnel Requirements:**

- Provide an organizational chart that identifies the names and positions of management personnel and each person that will be involved in, or associated with, testing and the review of the NTPEP reports. A laboratory Quality Control Manager shall be designated for review of all standard operating procedures and proficiency evaluations of technicians as described.
- Provide resumes or credentials for all persons identified in the organizational chart. It is recommended that the responsible person supervising the laboratory and the staff performing the testing have adequate levels of formal education.

10.3 **Quality Control/Quality Assurance:**

10.3.1 The laboratory shall identify the procedures being used to ensure a quality level of testing. The process used for quality control should be based upon statistically evaluated conclusions. The conclusions should verify that the laboratory is capable of producing testing results that are accurate and reproducible. The preferred technique for comparative conclusions is to obtain results based on tests performed on identical samples by other laboratories that are statistically evaluated for their comparative similarity. The comparative testing must be performed using the testing procedures required by NTPEP.

10.3.2 Testing proficiencies of all technicians shall be evaluated and documented by the Laboratory Supervisor. These evaluations shall be performed at one year intervals unless the technician does not routinely perform the test. In this case, proficiency of the technician shall be evaluated and

documented prior to testing of products for this program. If the laboratory is AASHTO accredited this requirement will be waived since it is covered by the CCRL audit.

10.4 **Assignment of Testing Facility**

10.4.1 This program will utilize multiple nationally accredited testing facilities on a regional basis. In general, laboratories will perform testing on sources closest in proximity to them. Import sources will typically be tested at laboratories closest to the import facility.

10.4.2 When more than one facility is used, a single lead facility shall be responsible for the coordination and oversight of all testing and reporting and for the compilation of the final report. The lead facility is responsible for identifying the tests that will be subcontracted and for providing the qualification, experience, and quality control programs of each of the facilities for review and approval of NTPEP. Subcontracted facilities cannot be changed without the approval of NTPEP.

11. LABORATORY EVALUATION OF PORTLAND & BLENDED CEMENTS

11.1 Cements from participating producers will be evaluated for compliance with the applicable standards listed below. The Lead State and the NTPEP Evaluation of Portland & Blended Cement Technical Committee shall address any questions regarding the testing procedures or exceptions to any testing procedure.

11.2 **Portland cements** will be tested for all standard physical & chemical properties listed in AASHTO M 85 or ASTM C150.

TEST		AASHTO STANDARD	ASTM STANDARD
Air Content of mortar, volume		T 137	C185
Fineness, by Air Permeability Apparatus		T 153	C204
Autoclave expansion		T 107/T 107M	C151
Compressive strength		T 106	C109
Time of Setting	Vicat test	T 131	C191
Chemical Analysis (<i>SiO₂, Al₂O₃, Fe₂O₃, CaO, MgO, SO₃, Na₂O_{eq}, ignition loss, insoluble residue, and CO₂</i>)		T 105	C114

11.3 **Blended cements** will be tested for all standard physical & chemical properties listed in AASHTO M 240 or ASTM C 595.

TEST		AASHTO STANDARD	ASTM STANDARD
Fineness, by:	Sieving and	T 192	C430
	Air-Permeability Apparatus	T 153	C204
Air Content of mortar, volume		T 137	C185
Density		T 133	C188
Autoclave expansion/contraction		T 107/T 107M*	C151
Compressive strength		T 106	C109
Time of Setting (Vicat test)		T 131	C191
Chemical Analysis (<i>SiO₂, Al₂O₃, CaO, MgO, SO₃, S²⁻, ignition loss, insoluble residue, and CO₂</i>)		T 105	C114
Heat of Hydration (<i>only for MH or LH blended cements</i>)		N/A	C1702

Water requirement (<i>only for LH blended cements</i>)	T 106	C109
Sulfate resistance (<i>only for MS or HS cements</i>)	N/A	C1012

*=as modified in AASHTO M 240.

- 11.4 The following tests will be performed on pozzolan or slag being blended with the cement at the time of sampling.

TEST	AASHTO STANDARD	ASTM STANDARD
Fineness by the 45- μ m (No. 325) sieve	T 192	C430
Loss on ignition	N/A	C311

- 11.5 The following optional physical tests may be performed on portland cement, at the request of the manufacturer. Note that additional testing fees will apply.

TEST	AASHTO STANDARD	ASTM STANDARD
Early stiffening of Hydraulic Cement (False set)	T 186	C451
Expansion of Mortar Bars stored in water	N/A	C1038
Heat of Hydration (using Isothermal Conduction Calorimetry)	N/A	C1702
Sulfate resistance (only type V portland cements)	N/A	C452

12. TEST REPORT REVIEW AND TEST RESULT APPEALS

- 12.1 Each NTPEP contract laboratory will submit the DataMine data to the lead state Coordinator and the NTPEP Manager within 15 business days after completion of all testing. Each manufacturer will receive a copy of the portion of the report dealing with their specific products. The manufacturer will review the data and may appeal the results of the testing program in accordance with the AASHTO/NTPEP appeals procedures. Re-testing of the materials will be performed by the NTPEP contract laboratory, and only on the relevant sample and parameter being questioned. No additional sample material will be received for re-testing. Prior to re-test, the manufacturer/supplier making the appeal shall submit a fee to NTPEP to cover the costs of re-testing. The NTPEP Manager will determine if the results of the re-test up-hold the appeal. Upon agreement between the organization appealing the test results and the NTPEP Manager, either the original set or re-test set of data shall be published. If the appeal is up-held and the re-test data is published, the re-testing fee shall be reimbursed to the submitting organization.

- 12.2 **Withdrawal of Product after Testing**
If after following the review and appeals process the manufacturer chooses to withdraw a product, the results will be available if requested by a state user. Manufacturers can resubmit their product in the next test cycle.

13. RESUBMITTAL TESTING FREQUENCY

- 13.1 Any significant changes made to the raw material composition of the source require re-submittal to NTPEP for evaluation, regardless of the prior number of product submittals that year.
- 13.2 Products that have not changed are required to be resubmitted and tested every quarter. For the purpose of this standard, quarters are defined as; January through March, April through June, July through September, October through December. Samples shall be taken from production or

shipment in accordance with the producer's quality control plan. When a production facility does not produce cement in a given quarter, and no quarterly shipments will be made to NTPEP, the producer shall notify NTPEP with a Negative Report for each quarter of no production or shipment.

14. TESTING FEES

- 14.1 Product submittal testing fees are to be paid at time of application.
- 14.2 Testing fees are assessed to cover all costs associated with laboratory testing, administrative costs incurred by the NTPEP lead state, report (electronic) generation and distribution by AASHTO, document preparation, and distribution to AASHTO member departments. Specific pricing for submission of products may be found at www.ntpep.org.
- 14.3 Laboratories will be reimbursed for testing performed if a product is withdrawn after testing has begun. If the Manufacturer elects to withdraw initial samples after testing begins and resubmit products, the Manufacturer will be charged additionally for all costs incurred by the laboratory during the initial testing.

15. KEYWORDS

DataMine; NTPEP; portland cement, blended cement, hydraulic cement