NDOR SiteManager
Materials Management

Standard Operating Procedures and Instructions

Cement – Field Sampling

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Illustrations

Modification Tracking Summary

Summary of Changes	Date	Author
Standard Operating Procedures and Instructions document created	1/25/2013	Andi Clark
Updated to reflect MSG (version 1/1/2014) and J15 Spec change	2/6/2014	Andi Clark

1. Introduction and Purpose

This document is intended to be used in conjunction with the existing training materials provided by the NDOR (Nebraska Department of Roads), M&R (Materials & Research) Division.

The NDOR Standard Specifications for Highway Construction, Section 1004 – Portland Cement, and the NDOR Materials Sampling Guide, Section 14, Portland Cement/Interground-Blended Cement/Pozzolans/Slag Cement/Silica Fume, detail the NDOR Portland cement requirements

1.1 Purpose:

The purpose of this document is to define the responsibilities of the M&R personnel and construction field inspectors during:

- Pre-construction
- Construction
- Post Construction

1.2 Roles and Responsibilities:

As of the publication date of this document, roles and responsibilities are defined as follows:

SiteManager Staff: 402.479.4760, DOR.SiteManagerMaterials@nebraska.gov

Portland Cement Concrete Engineer: Wally Heyen, 402.479.4677, Wally.Heyen@nebraska.gov

NDOR Portland Cement Concrete Material & Tests Manager: Tim Krason, 402.479.4709, Tim.Krason@nebraska.gov

NDOR Highway Chemical Tests Manager: Jasmine Dondlinger, 402.479.4874, Jasmine.Dondlinger@nebraska.gov

1.3 Authentication:

ASTM C 109, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars

ASTM C 114, Standard Test Methods for Chemical Analysis of Hydraulic Cement

ASTM C 150, Standard Specification for Portland Cement

ASTM C151, Standard Test Method for Autoclave Expansion of Hydraulic Cement

ASTM C 185, Standard Test Method for Air Content of Hydraulic Cement Mortar

ASTM C 191, Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle

ASTM C 204, Standard Test Methods for Fineness of Hydraulic Cement by Air-Permeability Apparatus

ASTM C 451, Standard Test Method for Early Stiffening of Hydraulic Cement (Paste Method)

ASTM C 595, Standard Specification for Blended Hydraulic Cements

ASTM C 1038, Standard Test Method for Expansion of Hydraulic Cement Mortar Bars Stored in Water

Attach a File to a Sample Record: http://www.transportation.nebraska.gov/mat-n-tests/MMG/General/AttachFiletoSampleRecord.pdf

Creating and Authorizing a SiteManager Sample Record: http://www.dor.state.ne.us/mat-n-tests/MMG/General/CreatingSMGRSampleRecord.pdf

NDOR Approved Products List, http://www.dor.state.ne.us/mat-n-tests/aplist.htm

NDOR Final Review Process Manual, S:\Final Review Manual.

NDOR Material Management Guidance, http://www.dor.state.ne.us/mat-n-tests/matmanguidance.htm

NDOR Materials Sampling Guide, http://www.dor.state.ne.us/mat-n-tests/sampguide.htm

NDOR Standard Specifications for Highway Construction: http://www.nebraskatransportation.org/ref-man/specbook-2007.pdf

NDOR Standard Test Methods Manual, http://www.roads.nebraska.gov/mat-n-tests/NDR%20Standard%20Test%20Methods/index.pdf

SMGR Active Materials List, http://www.dor.state.ne.us/mat-n-tests/pdfs-docs/matlist.pdf

SiteManager Instructions for PCC Plant and Field Performed Tests, S:\SMG\Materials\Instructions\Concrete\Site Manager Plant & Field Inspection-Steps.pptx

1.4 Abbreviations:

AASHTO: American Association of State Highway and Transportation Officials
ASTM: American Society for Testing and Materials
GGBFS: Ground Granulated Blast Furnace Slag
ID: Identification Number
M&R: NDOR Materials & Research
NDOR: Nebraska Department of Roads
PCC: Portland Cement Concrete
SCM: Supplemental Cementitious Material
SMGR: SiteManager

2. Pre-Construction:

2.1 Inspection Team Responsibilities:

The inspection team is responsible for these activities:

2.1.1 Review Specification Requirements:

Review the NDOR Standard Specifications for Highway Construction, Informational Proposals/Special Provisions, project plans, Materials Sampling Guide (MSG), and Required Document List (RDL) for Portland Cement Concrete (PCC) requirements. For more information, refer to Section 14, Portland Cement/Interground-Blended Cement/Pozzolans/Slag Cement/Silica Fume, of the NDOR Materials Sampling Guide.

2.1.2 Verify Portland Cement Concrete Inspector Certification Credentials:

Verify the technician certification requirements for the type of work performed. Notify the NDOR Quality Assurance (QA) Manager if an Independent Assurance (IA) is required. Certified personnel changes throughout the life of the project will require documentation.

2.1.2.1 PCC Field Technician Requirements:

Technicians are required to be qualified in these levels of certification:

- Portland Cement Sampler

2.1.3 Material Requirements:

Review all materials requirements for a given contract to determine the documentation procedures.

- The complete list of SiteManager (SMGR) active materials is maintained online. For more information, refer to SMGR Active Material List.
- If a product is not on the NDOR Approved Products List (APL) and is anticipated for use on the project, contact the M&R PCC Engineer, prior to usage. For more information, refer to NDOR Approved Products List.

2.1.3.1 Cement/Blended Cement:

The base type of cement is found in contract specifications, including special provisions. NDOR Standard Specifications for Highway Construction, Table 1002.02, Concrete Proportions, details material, ratio, and strength requirements.

Review MSG Section, 29, Policy 4, Acceptance Policy for Portland Cement and Interground/Blended Cements. This policy provides guidance on acceptance procedures for Portland and interground/blended cements supplied for use in Nebraska state highway construction and maintenance

Further, this policy provides guidance regarding materials from the Approved Products List. For additional information on APL process and procedures, refer to MSG Section, 29, Policy 4, Acceptance Policy for Portland Cement and Interground/Blended Cements.

Review Sections 4, 14-16 of the NDOR MSG for more information, NDOR Materials Sampling Guide.

3. Construction:

3.1 Materials:

Review the contract specifications and special provisions to determine the class of cement designated for the project.

Contract line items will match the concrete class.

3.2 Acceptance:

3.2.1 Interground/Blended Cements:

Cement materials designated as Interground/Blended Portland Cement Portland Cement Blended- IS, IT, IP, IL, Material Code 1004PC0001, are accepted based on verification sampling and testing performed by NDOR.

3.2.1.1 Sampling Requirements – Field:

As defined in Section 14 of the NDOR Materials Sampling Guide, a minimum of one one-gallon sample for every 750 ton of material shall be taken by a certified Portland Cement sampler under the supervision of designated NDOR personnel.

MSG Policy 4, Acceptance Policy for Portland Cement and Interground/Blended Cements provides guidance on material acceptance. For more information, refer to NDOR Materials Sampling Guide.

Following the procedures outlined in Creating and Authorizing a SiteManager Sample Record, create the SMGR sample record, using material code 1004PC0001, Portland Cement Blended- IS, IT, IP, IL.

Submit the sample using a Sample Identification tag.


SiteManager
Sample Identification
Sample ID No.: (Fill all spaces)
Year SiteManager User # Dist. Sample #
Project No.: _____
Contract No.: _____
Project Mgr.: _____
Number of Items _____ of _____
Comments: _____
Contact Materials & Research Division's SiteManager staff for replacement cards.

Figure 1, SiteManager Sample Identification Tag

All pertinent certification and documentation must be submitted to NDOR M&R.

3.2.1.2 Testing Requirements – Chemical Laboratory:

Pursuant to Policy 4, Acceptance Policy for Portland Cement and Interground/Blended Cements, of the NDOR Materials Sampling Guide, the M&R Chemical Laboratory will perform chemical analysis to validate field sampling requirements. The findings of the Chemical Tests Manager will be

documented on CHL003002, Portland Cement Blended- IS, IT, IP, IL (Chemical Analysis)

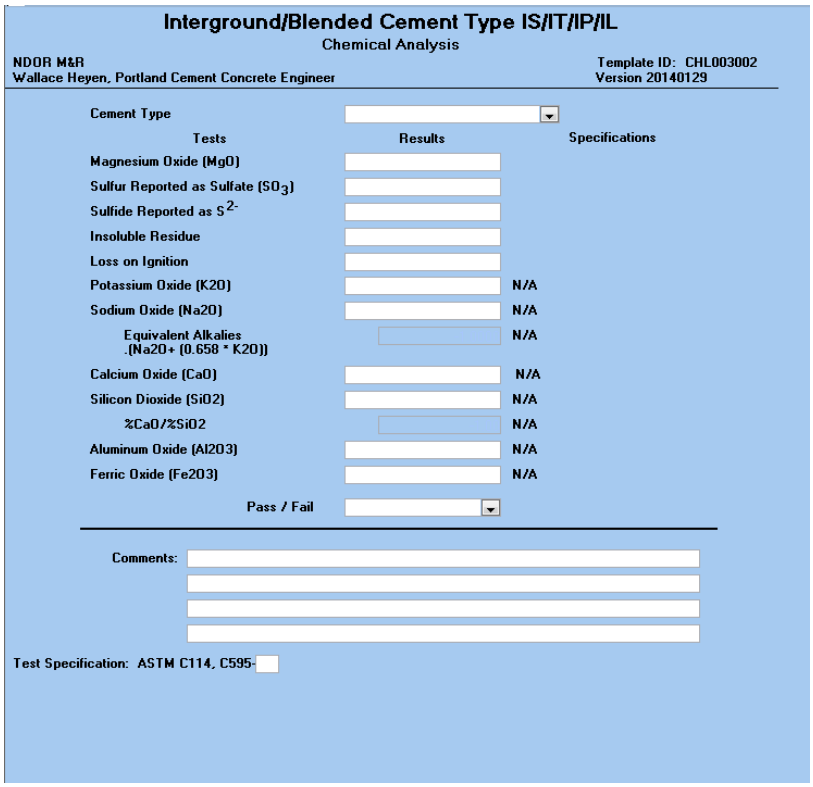
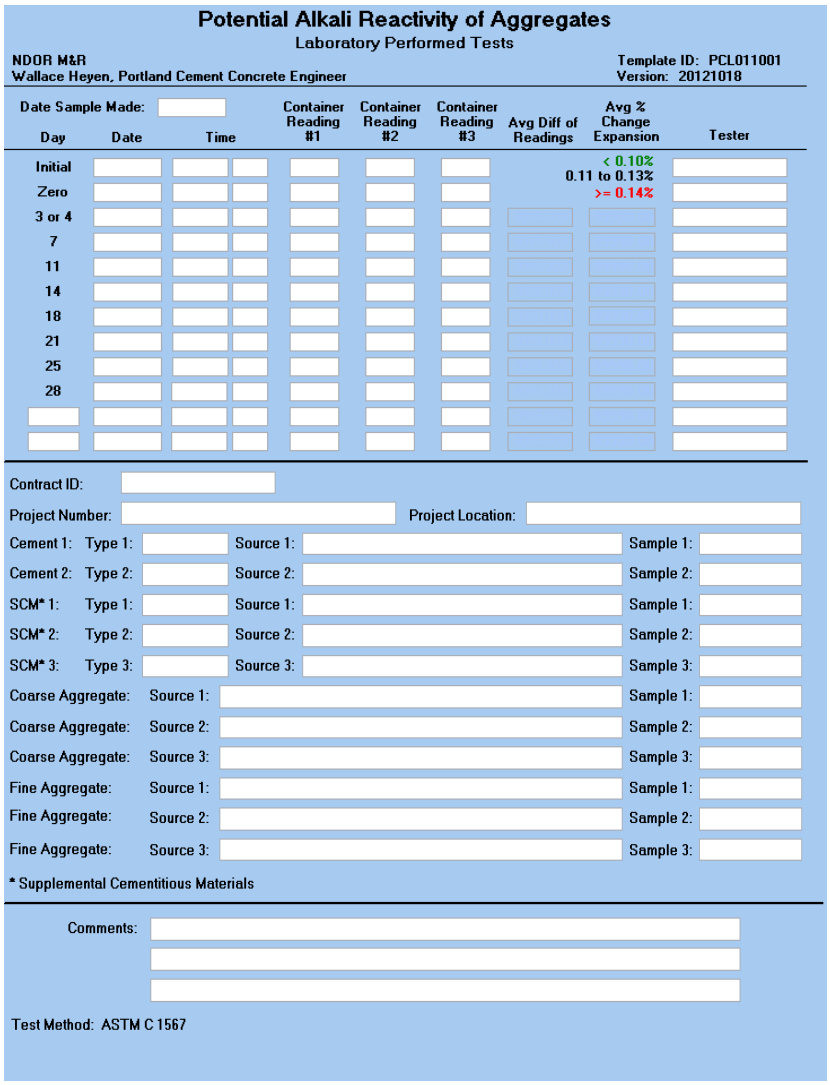


Figure 2, SiteManager Test Template, Portland Cement Concrete, Type IP (Chemical Analysis)

3.2.1.3 Testing Requirements – Concrete Laboratory:

Pursuant to Policy 4, Acceptance Policy for Portland Cement and Interground/Blended Cements, of the NDOR Materials Sampling Guide, the M&R Concrete Laboratory may perform additional testing to determine conformance with specification. The findings of the NDOR Portland Cement Concrete Material & Tests Manager will be documented on PCL011001, Potential Alkali Reactivity of Aggregates.



Potential Alkali Reactivity of Aggregates

Laboratory Performed Tests

NDOR M&R
Wallace Heyen, Portland Cement Concrete Engineer

Template ID: PCL011001
Version: 20121018

Date Sample Made:

Day	Date	Time		Container Reading #1	Container Reading #2	Container Reading #3	Avg Diff of Readings	Avg % Change Expansion	Tester
Initial								< 0.10%	
Zero								0.11 to 0.13%	
3 or 4								>= 0.14%	
7									
11									
14									
18									
21									
25									
28									

Contract ID:

Project Number: Project Location:

Cement 1:	Type 1:		Source 1:	Sample 1:	
Cement 2:	Type 2:		Source 2:	Sample 2:	
SCM* 1:	Type 1:		Source 1:	Sample 1:	
SCM* 2:	Type 2:		Source 2:	Sample 2:	
SCM* 3:	Type 3:		Source 3:	Sample 3:	
Coarse Aggregate:		Source 1:		Sample 1:	
Coarse Aggregate:		Source 2:		Sample 2:	
Coarse Aggregate:		Source 3:		Sample 3:	
Fine Aggregate:		Source 1:		Sample 1:	
Fine Aggregate:		Source 2:		Sample 2:	
Fine Aggregate:		Source 3:		Sample 3:	

* Supplemental Cementitious Materials

Comments:

Test Method: ASTM C 1567

Figure 3, SiteManager Test Template, Potential Alkali Reactivity of Aggregates

3.2.2 Non-Blended Cements:

Cement materials designated as Portland Cement Non-Blended- I,I/II,III, Material Code 1004PC0002, are accepted based on documented receipt of a Certificate of Compliance.

3.2.2.1 Sampling Requirements:

Following the procedures outlined in Creating and Authorizing a SiteManager Sample Record, create the SMGR sample record.

Document the material on MSL004001, Certificate of Compliance

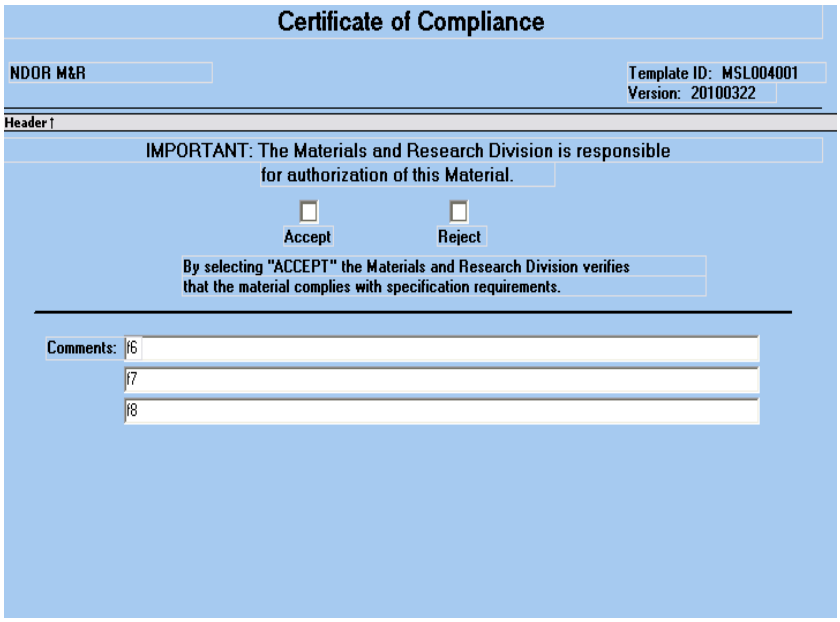


Figure 4, SiteManager Test Template, Certificate of Compliance

Following the procedures outlined in Attach a File to a Sample Record, attach the Certificate of Compliance to the sample record. Alternatively, the certificate of compliance may be submitted to NDOR M&R.

As defined in Section 14 of the NDOR Materials Sampling Guide, non-blended cement is an approved product and is prequalified for use on projects. For more information, refer to NDOR Approved Products List. If a product is not on the NDOR APL and is anticipated for use on the project, contact the SiteManager staff prior to usage.

3.2.2.2 Testing Requirements – Chemical Laboratory:

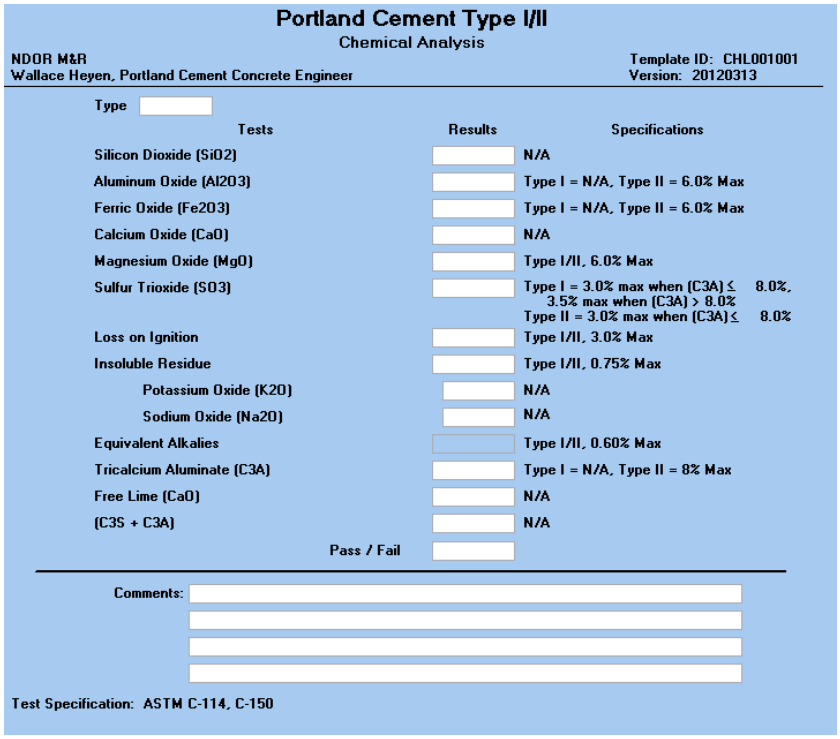
Pursuant to Policy 4, Acceptance Policy for Portland Cement and Interground/Blended Cements, of the NDOR Materials Sampling Guide, the M&R Chemical Laboratory will perform chemical analysis to validate field sampling requirements. The findings of the Chemical Tests Manager will be documented on CHL001001, Portland Cement Concrete Type I/II (Chemical analysis) or CHL002001, Portland Cement Concrete Type III (Chemical Analysis).

Additional testing may be performed to address lithium nitrate used in lieu of Class F fly ash or Class N pozzolan. When lithium nitrate is used, the contractor shall submit one five-pound sample of the cement used on the project to the project engineer.

M&R Chemical Laboratory will perform chemical analysis to validate field sampling requirements. The findings of the Chemical Tests Manager will be documented on CHL001001, Portland Cement Concrete Type I/II (Chemical analysis) or CHL002001, Portland Cement Concrete Type III (Chemical Analysis).

The equivalent alkali content findings, as determined by the NDOR Portland Cement Concrete Material & Tests Manager, will be reported to the project engineer. The project engineer will report the equivalent alkali content to the

contractor. The contractor shall use the reported equivalent alkali content to determine the required dose rate based on the manufacturer's recommendation.



Portland Cement Type I/II
Chemical Analysis

NDOR M&R
Wallace Heyen, Portland Cement Concrete Engineer

Template ID: CHL001001
Version: 20120313

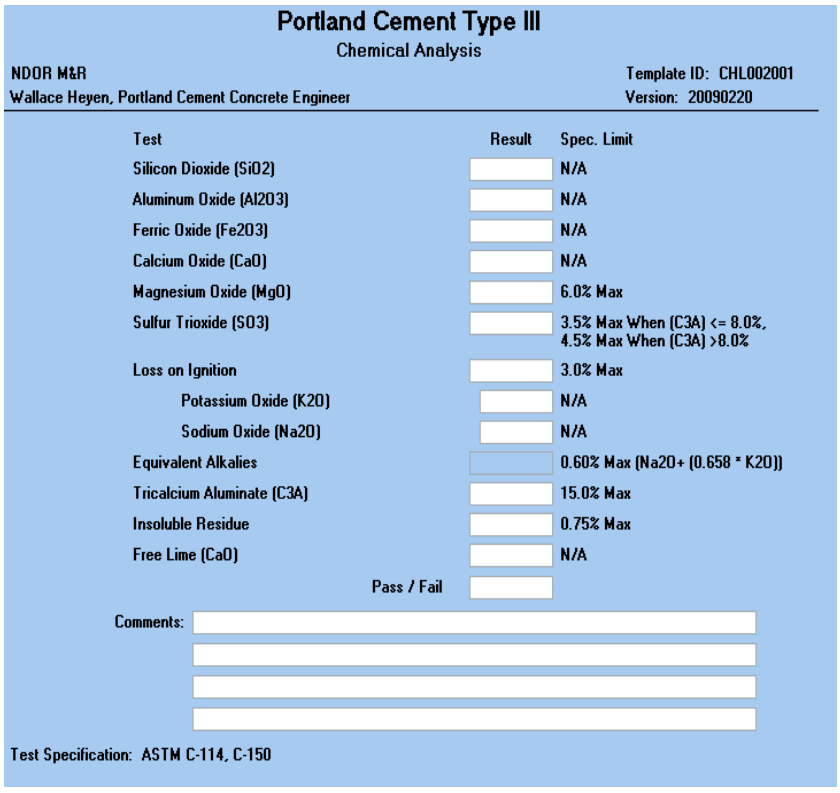
Type

Tests	Results	Specifications
Silicon Dioxide (SiO2)		N/A
Aluminum Oxide (Al2O3)		Type I = N/A, Type II = 6.0% Max
Ferric Oxide (Fe2O3)		Type I = N/A, Type II = 6.0% Max
Calcium Oxide (CaO)		N/A
Magnesium Oxide (MgO)		Type I/II, 6.0% Max
Sulfur Trioxide (SO3)		Type I = 3.0% max when (C3A) ≤ 8.0%, 3.5% max when (C3A) > 8.0% Type II = 3.0% max when (C3A) ≤ 8.0%
Loss on Ignition		Type I/II, 3.0% Max
Insoluble Residue		Type I/II, 0.75% Max
Potassium Oxide (K2O)		N/A
Sodium Oxide (Na2O)		N/A
Equivalent Alkalies		Type I/II, 0.60% Max
Tricalcium Aluminate (C3A)		Type I = N/A, Type II = 8% Max
Free Lime (CaO)		N/A
(C3S + C3A)		N/A
Pass / Fail		

Comments:

Test Specification: ASTM C-114, C-150

Figure 5, SiteManager Test Template, Portland Cement Concrete, Type I/II (Chemical Analysis)



Portland Cement Type III
Chemical Analysis

NDOR M&R
Wallace Heyen, Portland Cement Concrete Engineer

Template ID: CHL002001
Version: 20090220

Test	Result	Spec. Limit
Silicon Dioxide (SiO2)		N/A
Aluminum Oxide (Al2O3)		N/A
Ferric Oxide (Fe2O3)		N/A
Calcium Oxide (CaO)		N/A
Magnesium Oxide (MgO)		6.0% Max
Sulfur Trioxide (SO3)		3.5% Max When (C3A) <= 8.0%, 4.5% Max When (C3A) >8.0%
Loss on Ignition		3.0% Max
Potassium Oxide (K2O)		N/A
Sodium Oxide (Na2O)		N/A
Equivalent Alkalies		0.60% Max (Na2O+ (0.658 * K2O))
Tricalcium Aluminate (C3A)		15.0% Max
Insoluble Residue		0.75% Max
Free Lime (CaO)		N/A
Pass / Fail		

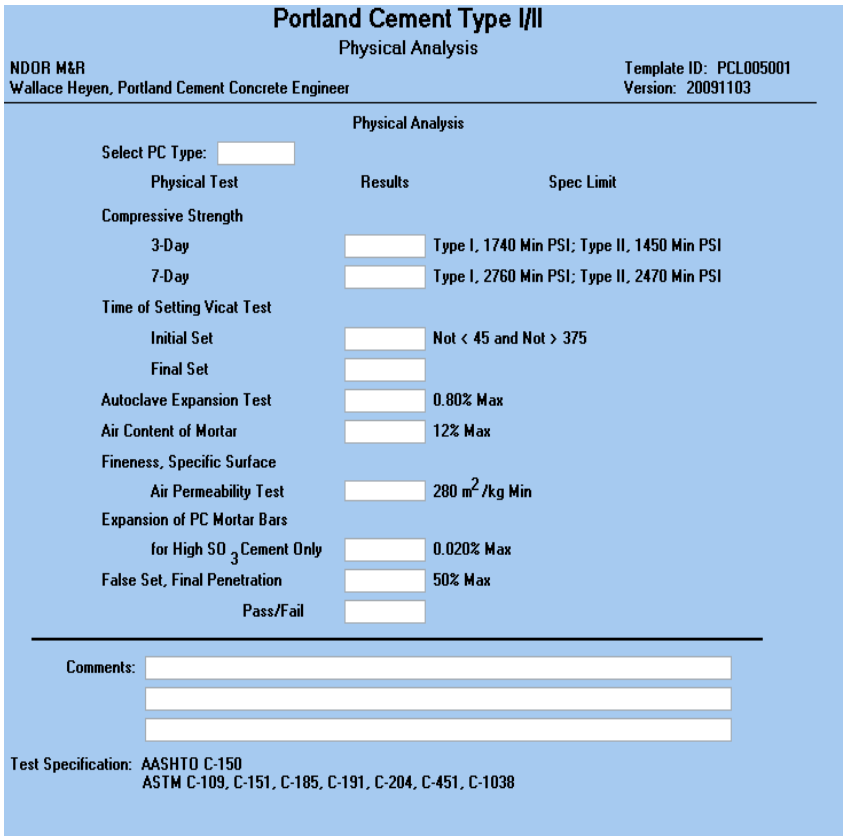
Comments:

Test Specification: ASTM C-114, C-150

Figure 6, SiteManager Test Template, Portland Cement Concrete, Type III (Chemical Analysis)

3.2.2.3 Testing Requirements – Concrete Laboratory:

Pursuant to Policy 4, Acceptance Policy for Portland Cement and Interground/Blended Cements, of the NDOR Materials Sampling Guide, the M&R Concrete Laboratory will perform physical analysis to validate field sampling requirements. The findings of the NDOR Portland Cement Concrete Material & Tests Manager will be documented on PCL005001, Portland Cement Type I/II (Physical Analysis) or PCL006001, Portland Cement Type III (Physical Analysis).



Portland Cement Type I/II

Physical Analysis

NDOR M&R
Wallace Heyen, Portland Cement Concrete Engineer

Template ID: PCL005001
Version: 20091103

Physical Analysis

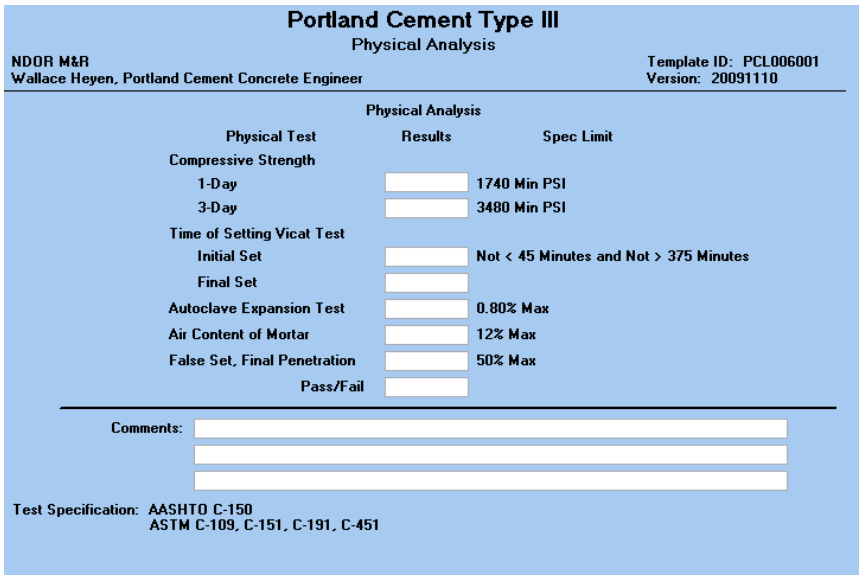
Select PC Type:

Physical Test	Results	Spec Limit
Compressive Strength		
3-Day		Type I, 1740 Min PSI; Type II, 1450 Min PSI
7-Day		Type I, 2760 Min PSI; Type II, 2470 Min PSI
Time of Setting Vicat Test		
Initial Set		Not < 45 and Not > 375
Final Set		
Autoclave Expansion Test		0.80% Max
Air Content of Mortar		12% Max
Fineness, Specific Surface		
Air Permeability Test		280 m^2/kg Min
Expansion of PC Mortar Bars		
for High SO_3 Cement Only		0.020% Max
False Set, Final Penetration		50% Max
Pass/Fail		

Comments:

Test Specification: AASHTO C-150
ASTM C-109, C-151, C-185, C-191, C-204, C-451, C-1038

Figure 7, SiteManager Test Template, Portland Cement Concrete, Type I/II (Physical Analysis)



Portland Cement Type III

Physical Analysis

NDOR M&R
Wallace Heyen, Portland Cement Concrete Engineer

Template ID: PCL006001
Version: 20091110

Physical Analysis

Physical Test	Results	Spec Limit
Compressive Strength		
1-Day		1740 Min PSI
3-Day		3480 Min PSI
Time of Setting Vicat Test		
Initial Set		Not < 45 Minutes and Not > 375 Minutes
Final Set		
Autoclave Expansion Test		0.80% Max
Air Content of Mortar		12% Max
False Set, Final Penetration		50% Max
Pass/Fail		

Comments:

Test Specification: AASHTO C-150
ASTM C-109, C-151, C-191, C-451

Figure 8, SiteManager Test Template, Portland Cement Concrete, Type III (Physical Analysis)