July 13, 2017

Mr. Scott Seiter
Division Engineer
Oklahoma Department of Transportation
200 Northeast 21st Street
Oklahoma City, Oklahoma 73105

Subject: Inspection of Cement, Pozzolan, and Concrete Testing Laboratories

Dear Mr. Seiter:

Enclosed is a confirmatory report on Inspection Number W-1166, which was completed in your testing laboratories at Oklahoma City, Oklahoma, on May 18, 2017, by a representative of the Cement and Concrete Reference Laboratory.

This letter, and the accompanying report, provide written evidence that your laboratories have been inspected during the 37th Inspection Tour.

Very truly yours,

Jan A. Prowell

Jan A. Prowell
Director
Cement and Concrete Reference Laboratory

Enclosure

cc: D. McCullough
J. Thomas
Division Administrator, FHWA

Inspection Report Introduction

This report covers the cement, pozzolan, and concrete inspection conducted in the laboratories of Oklahoma Department of Transportation, at Oklahoma City, Oklahoma. This inspection, designated as Inspection Number W-1166, was completed in the laboratories on May 18, 2017.

Inspections generally cover three areas: quality systems; testing equipment; and procedures. Under all material types inspected there will be a Summary of Findings and a Footnote Section. The Summary of Findings will denote items examined, which may include: documents, equipment and procedures performed by the laboratory. Entries in the Summary of Finding Section cover availability, physical condition, and/or conformance to specification requirements. These items, when checked, will indicate whether the items conformed to the ASTM standard or will state briefly any deviation from the standard and will be listed in the Footnote Section. The Footnote Section is also used to convey observations, recommendations or explanations of conditions found. When a footnote of this nature appears in a report it is labeled as an "Informational Footnote" in bold font. These informational footnotes do not require deficiency corrections.

Corrections of minor deficiencies are encouraged during the course of each inspection. In the interest of brevity, any adjustments of this nature which may have been made have not been mentioned in the report.

Several pieces of apparatus in the laboratory have been assigned CCRL identification numbers. Some of these numbers are listed in the Summary and Footnote Sections.

For a more in-depth description of the scope of each inspection, please see www.ccrl.us/Lip/lip.htm. The inspection was conducted using the most recent version of the applicable Book of ASTM Standards available at the time of the inspection, unless otherwise indicated in the Footnote Section of this report.

This report confirms the condition of the laboratory on the inspection date noted above. It does not approve, certify or accredit this laboratory; therefore, publicizing the inspection without offering a review of this report is prohibited.

CEMENT SUMMARY OF FINDINGS

Quality System

Inspection Item	Status
Quality System C1222-13	
• Organization	Satisfactory
• Human Resources	
· Director of Testing	Satisfactory
· Training	Satisfactory
· Performance Evaluation	Satisfactory
· Personnel Records	Satisfactory
• Operations	
· Standard Operating Procedures	Satisfactory
· Final Report	Satisfactory
• Quality	
· Technical Complaints	Satisfactory
· External Technical Services	Satisfactory
· Proficiency Sample Testing	Satisfactory
· Standard Test Methods	Satisfactory
· Internal Quality System Review	Satisfactory
• Equipment	
· Inventory	Satisfactory
· Equipment Calibration	Satisfactory
· Records	Satisfactory
· Calibration Procedures	Satisfactory
Qualification of Chemical Analysis C114-15	
• Frequency	Satisfactory
• Records:	

Analyte	Method	*Qualified
Silicon Dioxide	X-Ray	See footnote (a)
Aluminum Oxide	X-Ray	Yes
Ferric Oxide	X-Ray	Yes
Calcium Oxide	X-Ray	See footnote (a)
Magnesium Oxide	X-Ray	Yes
Sulfur Trioxide	X-Ray and Reference	Yes
Loss on Ignition	Reference	Yes
Sodium Oxide	X-Ray	See footnote (a)
Potassium Oxide	X-Ray	Yes
Titanium Dioxide	X-Ray	Yes
Phosphorus Pentoxide	X-Ray	Yes
Zinc Oxide	X-Ray	Yes
Manganic Oxide	X-Ray	Yes
Insoluble Residue	Reference	Yes

*Entry covers conformance to permissible variations in data results as listed in Table 1 of C114.

Apparatus

Inspection Item	Status
Storage Facilities for Test Specimens C511-13	
• Moist Air Storage Facilities	See footnote (b)
• Water Storage Facilities	See footnote (b)
Density C188-15	
• Density Equipment	Satisfactory
• Accessory Apparatus	Satisfactory
Loss on Ignition C114-15	
• Crucible	Satisfactory
• Muffle Furnace	Satisfactory
• Miscellaneous	Satisfactory
Wet Sieving Apparatus C430-08	
• 45-µm (No. 325) Sieve(s)	Satisfactory
• Accessory Apparatus	Satisfactory
Autoclave Soundness Apparatus C151-15 and C490-11	
• Autoclave(s):	
• Maker: Boekel Serial Number: 1011-24	Satisfactory
• Length Comparator(s) Number Checked: 1	Satisfactory
• Bar Mold(s) Number Checked: 3	Satisfactory
Graduates C1005-10	
• Capacity: 250 mL CCRL Number: R-1761	Satisfactory
Flow Table C230-14	
• Flow Table(s):	
• Maker: Humboldt	Satisfactory
• Accessory Apparatus	Satisfactory
Compression Test Apparatus C109-16a and E4-16	
• Compression Testing Machine:	
• Maker: Tinius Olsen	
• Serial Number: 222424 Capacity: 60,000 lbf	
• Accuracy of Indication:	
· Range: 60,000 lbf From: 5,000 to 36,000 lbf	Satisfactory
• Mechanical Condition	Satisfactory
• Design	Satisfactory
• Verification Records	Satisfactory
• Bearing Blocks	Satisfactory
• Cube Molds: Number Checked: 12	Satisfactory
• Tampers	Satisfactory
Mix Balance(s) C1005-10	
• Maker: Mettler Toledo	
Capacity: 3,100 g CCRL Number: M-1142	Satisfactory
Vicat Apparatus C187-11, C191-13, and C451-13	
• Vicat Apparatus(es):	
• CCRL Number: P-280	Satisfactory
• CCRL Number: U-2450	Satisfactory
• Vicat Rings: Number Checked: 5	Satisfactory

Inspection Item	Status
Gillmore Needles C266-15	
• Initial Needles: • Final Needles:	
• CCRL Number: T-3001 • CCRL Number: W-3334	Satisfactory
• Mountings:	Satisfactory
Mechanical Mixing Apparatus C305-14	
• Mixer(s):	
• Maker: Hobart Serial Number: 31-1391-318	Satisfactory
• Accessory Apparatus:	Satisfactory
Air Content Apparatus C185-15a	
• 400 mL Measure(s)	Satisfactory
• Accessory Apparatus	Satisfactory
Air Permeability Apparatus C204-16	
• Blaine Meter(s):	
• CCRL Number: K-1620	Satisfactory
• Accessory Apparatus	Satisfactory
Standard Sands C778-13 and E11-16	
• Sand Verification	Satisfactory
• Sample Splitter	Satisfactory
• Sieves	Satisfactory
Miscellaneous	
• Temperature of Air in Laboratory	Satisfactory
• Relative Humidity of Air in Laboratory	Satisfactory
• Temperature of Mixing Water	Satisfactory
• Miscellaneous Accessory Testing Apparatus	Satisfactory

Procedures

Test	Method Reference	Technique in Exact Agreement With Standard Practice
Normal Consistency Test	C187-11 and C305-14	Yes
Vicat Time of Set Test (Method A)	C191-13 and C305-14	Yes
Preparation of:		
Gillmore Pat	C266-15 and C305-14	Yes
Autoclave Bars	C151-15 and C305-14	Yes
Mortar Cubes	C109-16a, C305-14, and C1437-15	Yes
Testing of Autoclave Bars	C151-15	Yes
Testing of Mortar Cubes	C109-16a	Yes
Air Content Determination	C185-15a and C305-14	Yes
No. 325 Sieve Fineness Test	C430-08	Yes
Loss on Ignition	C114-15	Yes
Density	C188-15	Yes
Air Permeability Fineness Test	C204-16	Yes
Handling of Samples	C183-15	Yes

CEMENT FOOTNOTE SECTION

Qualification of Chemical Analysis (C114-15):

(a) Records: Seven Certified Reference Materials (CRMs) were used when performing qualification testing for silicon dioxide, calcium oxide, and sodium oxide. Duplicate tests for sodium oxide did not meet the criteria that at least six of the seven differences between duplicates shall not exceed the limits in Column 2 of Table 1 of C114 and all data shall differ by no more than twice that value as required by Section 5.4.2.2 of C114. Also, when data from the average of duplicate tests for silicon dioxide, calcium oxide, and sodium oxide were compared to the certified concentrations, these analytes did not meet the criteria that at least six of the seven averages for each analyte shall not differ from the limits in Column 3 of Table 1 of C114 and all data shall differ by no more than twice that value as required by Section 5.4.2.3 of C114.

Curing Facilities (C511-13):

(b) The temperature of the moist storage air and the temperature of the storage water tanks were observed at intervals on May 11, 2017 and found to be as follows:

Time:	Moist Storage Air:	Water Storage #1:	Water Storage #2:	Water Storage #3:
8:30 a.m.	20.8°C	20.6°C	20.6°C	20.3°C
12:00 p.m.	21.0°C	20.1°C	20.1°C	20.0°C
4:00 p.m.	20.6°C	20.3°C	20.3°C	20.1°C

The range specified in C511 is 21.0 to 25.0°C.

POZZOLAN SUMMARY OF FINDINGS

Apparatus

Inspection Item	Status
Qualification of Chemical Analysis C114-15 and C311-13	
• Frequency	Satisfactory
• Records:	

Analyte	Method	*Qualified
Silicon Dioxide	X-Ray	See footnote (a)
Aluminum Oxide	X-Ray	Yes
Ferric Oxide	X-Ray	Yes
Calcium Oxide	X-Ray	See footnote (a)
Magnesium Oxide	X-Ray	Yes
Sulfur Trioxide	X-Ray and Reference	Yes
Loss on Ignition	Reference	Yes
Sodium Oxide	X-Ray	See footnote (a)
Potassium Oxide	X-Ray	Yes

*Entry covers conformance to permissible variations in data results as listed in Table 1 of C114.

Storage Facilities for Test Specimens C511-13	
• Moist Air Storage Facilities	See footnote (b)
• Water Storage Facilities	See footnote (b)
Sieves C441-11 and E11-16	Satisfactory
Wet Sieving Apparatus C311-13 and C430-08	
• 45-µm (No. 325) Sieve(s)	Satisfactory
• Accessory Apparatus	Satisfactory
Autoclave Soundness Apparatus C151-15 and C490-11	
• Autoclave(s):	
• Maker: Boekel Serial Number: 1011-24	Satisfactory
• Length Comparator(s) Number Checked: 1	Satisfactory
• Bar Mold(s) Number Checked: 3	Satisfactory
Graduates C1005-10	
• Capacity: 250 mL CCRL Number: R-1761	Satisfactory
Flow Table C230-14	
• Flow Table(s):	
• Maker: Humboldt	Satisfactory
• Accessory Apparatus	Satisfactory

Inspection Item	Status
Compression Test Apparatus C109-16a and E4-16	
• Compression Testing Machine:	
• Maker: Tinius Olsen	
• Serial Number: 222424 Capacity: 60,000 lbf	
• Accuracy of Indication:	
· Range: 60,000 lbf From: 5,000 to 36,000 lbf	Satisfactory
• Mechanical Condition	Satisfactory
• Design	Satisfactory
• Verification Records	Satisfactory
• Bearing Blocks	Satisfactory
• Cube Molds: Number Checked: 12	Satisfactory
• Tampers	Satisfactory
Mix Balance(s) C1005-10	
• Maker: Mettler Toledo Capacity: 3,100 g CCRL Number: M-1142	Satisfactory
Mechanical Mixing Apparatus C305-14	
• Mixer(s):	
• Maker: Hobart Serial Number: 31-1391-318	Satisfactory
• Accessory Apparatus:	Satisfactory
Air Content Apparatus C185-15a	
• 400 mL Measure(s)	Satisfactory
• Accessory Apparatus	Satisfactory
Vicat Apparatus C187-11	
• Vicat Apparatus(es):	
• CCRL Number: P-280	Satisfactory
• CCRL Number: U-2450	Satisfactory
• Vicat Rings: Number Checked: 5	Satisfactory
Density C188-15	
• Density Equipment	Satisfactory
• Accessory Apparatus	Satisfactory
Loss on Ignition C114-15 and C311-13	
• Crucible	Satisfactory
• Muffle Furnace	Satisfactory
• Miscellaneous	Satisfactory
Standard Sands C778-13 and E11-16	
• Sand Verification	Satisfactory
• Sample Splitter	Satisfactory
• Sieves	Satisfactory
Miscellaneous	
• Temperature of Air in Laboratory	Satisfactory
• Relative Humidity of Air in Laboratory	Satisfactory
• Temperature of Mixing Water	Satisfactory
• Miscellaneous Accessory Testing Apparatus	Satisfactory
• ASTM Standards	Satisfactory

Procedures

Test	Method Reference	Technique in Exact Agreement With Standard Practice
Normal Consistency Test	C187-11 and C305-14	Yes
Preparation of:		
Autoclave Bars	C151-15, C305-14, and C311-13	Yes
Mortar Cubes	C109-16a, C305-14, C311-13, and C1437-15	Yes
Testing of Autoclave Bars	C151-15	Yes
Testing of Mortar Cubes	C109-16a	Yes
No. 325 Sieve Fineness Test	C311-13 and C430-08	Yes
Moisture Content	C311-13	Yes
Loss on Ignition	C114-15 and C311-13	Yes
Density	C188-15 and C311-13	Yes

POZZOLAN FOOTNOTE SECTION

Qualification of Chemical Analysis (C114-15):

(a) Records: Seven Certified Reference Materials (CRMs) were used when performing qualification testing for silicon dioxide, calcium oxide, and sodium oxide. Duplicate tests for sodium oxide did not meet the criteria that at least six of the seven differences between duplicates shall not exceed the limits in Column 2 of Table 1 of C114 and all data shall differ by no more than twice that value as required by Section 5.4.2.2 of C114. Also, when data from the average of duplicate tests for silicon dioxide, calcium oxide, and sodium oxide were compared to the certified concentrations, these analytes did not meet the criteria that at least six of the seven averages for each analyte shall not differ from the limits in Column 3 of Table 1 of C114 and all data shall differ by no more than twice that value as required by Section 5.4.2.3 of C114.

Curing Facilities (C511-13):

(b) The temperature of the moist storage air and the temperature of the storage water tanks were observed at intervals on May 11, 2017 and found to be as follows:

Time:	Moist Storage Air:	Water Storage #1:	Water Storage #2:	Water Storage #3:
8:30 a.m.	20.8°C	20.6°C	20.6°C	20.3°C
12:00 p.m.	21.0°C	20.1°C	20.1°C	20.0°C
4:00 p.m.	20.6°C	20.3°C	20.3°C	20.1°C

The range specified in C511 is 21.0 to 25.0°C.

CONCRETE SUMMARY OF FINDINGS

Quality System

Inspection Item	Status
Quality System C1077-16	
• Organization	Satisfactory
• Human Resources	See footnote (a)
• Operations	See footnote (b)
• Quality Assurance	Satisfactory
• Equipment	Satisfactory

Apparatus

Curing Facilities C511-13	
• Moist Air Storage Facilities	Satisfactory
• Water Storage Facilities	Satisfactory
Compression Test Apparatus C39-16 and E4-16	
• Compression Testing Machine:	
• Maker: Forney	
• Serial Number: 06129 Capacity: 400,000 lbf	
• Accuracy of Indication:	
· Range: 400,000 lbf From: 50,000 to 115,000 lbf	Satisfactory
• Mechanical Condition	Satisfactory
• Design	Satisfactory
• Verification Records	Satisfactory
• Bearing Blocks for Cylinders	Satisfactory
Molds for Concrete Testing C31-15a and C470-15	
• Cylinder Molds for Four Inch Diameter Specimens	Satisfactory
• Beam Molds	Satisfactory
Specimen Shipping Containers C31-15a	
• Four Inch Diameter Specimens	Satisfactory
Capping Equipment and Materials C617-15	
• Capping Equipment for Four Inch Diameter Specimens	Satisfactory
• Capping Material	Satisfactory
• Conditions of Caps	Satisfactory
Unbonded Caps C1231-15	
• Retaining Rings and Pads for Four Inch Diameter Specimens	Satisfactory
• Accessory Apparatus	Satisfactory
Slump Cone(s) C143-15a	See footnote (c)
Tamping Rod(s) C31-15a	Satisfactory
Concrete Vibrators C31-15a, C138-16, and C231-14	Satisfactory
Temperature of Concrete C1064-12	Satisfactory
Reference Temperature Measuring Devices C511-13 and C1064-12	
• Reference Thermometer(s) - C511	Satisfactory
• Reference Thermometer(s) - C1064	Satisfactory

Inspection Item	Status
Unit Weight Apparatus C138-16	
• Unit Weight Measure(s)	Satisfactory
• Accessory Apparatus	Satisfactory
• Scale or Balance	Satisfactory
Air Content Apparatus (Volumetric) C173-16	
• Air Meter(s)	See footnote (d)
• Accessory Apparatus	Satisfactory
Air Content Apparatus (Pressure) C231-14	
• Air Meter(s)	Satisfactory
• Accessory Apparatus	Satisfactory
• Aggregate Correction Factors	Satisfactory

Procedures

Test	Method Reference	Technique in Exact Agreement With Standard Practice
Slump of Concrete	C143-15a	Yes
Unit Weight of Concrete	C138-16	Yes
Air Content (Volumetric Method)	C173-16	Yes
Air Content (Pressure Method)	C231-14	Yes
Sampling Freshly Mixed Concrete	C172-14a	Yes
Measuring Temperature of Concrete	C1064-12	Yes
Fabrication of Four Inch Diameter Cylinders	C31-15a	Yes
Fabrication of Beams	C31-15a	Yes
Curing of Cylinders	C39-16	Yes
Cylinder Measurements	C39-16	Yes
Capping of Cylinders	C617-15	Yes
Cylinder Checks for Unbonded Caps	C1231-15	Yes
Compressive Strength of Cylinders	C39-16	Yes

Additional Test Methods

	Status
Obtaining and Testing Drilled Cores and Sawed Beams of Concrete C42-13	
• Equipment	See footnote (e)
• Procedure	Satisfactory
Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading) C78-15a	
• Equipment	Satisfactory
• Procedure	Satisfactory
Making and Curing Concrete Test Specimens in the Laboratory C192-16a	
• Equipment	Satisfactory
• Procedure	Satisfactory
Fundamental Transverse, Longitudinal and Torsional Resonant Frequencies of Concrete Specimens C215-14	
• Equipment	See footnote (f)
• Procedure	Satisfactory

	Status
Resistance of Concrete to Rapid Freezing and Thawing C666-15	
• Equipment	Satisfactory
• Procedure	Satisfactory
Measuring Length of Concrete Cores C1542-16a	
• Equipment	See footnote (g)
• Procedure	Satisfactory

CONCRETE FOOTNOTE SECTION

Quality System (C1077-16):

(a) Human Resources: It was understood that technician performance evaluations of the ASTM test method C78 were not conducted at the frequency listed in the performance evaluation description.

(b) Operations: The final report included the nominal cylinder diameter rather than the average measured diameter of the cylinders as specified in Section 9.4.7 of C1077 and Section 9.1.2 of C39.

Slump Cone(s) (C143-15a):

(c) The verification of the slump cones did not include all of the dimensional checks required by Section 5.1.1 of C143.

Air Content Apparatus (Volumetric) (C173-16):

(d) The volumetric air meter had been verified within the last year; however, records indicated that the verification was not routinely performed at the frequency prescribed in Section 5.1 of C173. Also, records for the volumetric air meter did not include the readings for verifying the graduations throughout the graduated range of the neck as required by Section 5.3.1 of C173.

Additional Test Methods:

(e) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete (C42-13): With reference to measuring the length of cores, which is required for this test, attention is invited to footnote (g).

(f) Fundamental Transverse, Longitudinal and Torsional Resonant Frequencies of Concrete Specimens (C215-14): The waveform analyzer had a recording capacity of 1024 points of the waveform rather having the ability to record at least 2048 points of the waveform as specified in Section 6.2.3 of C215.

(g) Measuring Length of Concrete Cores (C1542-16a): The caliper used to measure the core was not equipped with offset points as required by Section 5.1.1 of C1542.

R18 QUALITY SYSTEM SUMMARY OF FINDINGS

Inspection Item	Status
General Criteria	Satisfactory
Human Resources	
• Position Descriptions	Satisfactory
• Biographical Sketches	Satisfactory
• Training	Satisfactory
• Performance Evaluations	See footnote (a)
Test Methods	Satisfactory
Internal Audits	Satisfactory
Corrective Action	Satisfactory
Sample Management	Satisfactory
Records Retention	Satisfactory
Test Records and Reports	Satisfactory
Assuring the Quality of Results	Satisfactory
Equipment Verifications	
• List	Satisfactory
• Procedures	Satisfactory
• Records	Satisfactory
Equipment Maintenance	
• List	Satisfactory
• Procedures	Satisfactory
• Records	Satisfactory

Note: This R18 quality system review was performed in conjunction with other quality system reviews previously listed in this report, attention is invited to those sections.

R18 QUALITY SYSTEM FOOTNOTE SECTION

Quality System (R18-16):

(a) Human Resources: It was understood that technician performance evaluations of the AASHTO test method T97 were not conducted at the frequency listed in the performance evaluation description.

CLOSURE

This inspection was performed by the writer. While the work was in progress, many of the details covered by this report were discussed with laboratory personnel. At the conclusion of the inspection the special work sheets, on which all observations were recorded, were made available for review by members of the laboratory staff, and all of the entries thereon were discussed in detail.

Identification of the testing equipment used by the CCRL inspector during the inspection can be found on the CCRL website at www.ccrl.us under the heading of traceability.

It is recommended that this report be compared with the report of the preceding inspection which was made in October 2014. For further reference the CCRL laboratory number is 35.

This report does not approve, certify or accredit this laboratory. Publicizing the inspection without full disclosure of this report is not permitted.

Cement and Concrete Reference Laboratory

Angela N. Windland
Inspector