

CEEN 3320 - Behavior & Properties of Engineering Materials

Laboratory Experiment No. 5

Mixing and Casting of PCC Cylinders

OBJECTIVE: To examine the effects of curing time and cementitious materials content on the strength of PCC.

EQUIPMENT: A balance, large pans, molds, concrete mixing equipment, slump cone.

ASTM REF: C 143, C 138, C 192

PROCEDURES:

Part A – Mixing and Casting of PCC Cylinders

1. Place ½ bag of concrete mix into the mixing pan. Add additional cementitious materials as directed by the lab instructor. Thoroughly dry mix until the coarse aggregates are uniformly distributed throughout the batch.
2. Weigh out proscribed amount of mix water. Add approximately 80% of the required water and mix the mass until the concrete is homogeneous in appearance. Add additional water as **needed** to bring the concrete to a workable state (slump of approx 4”). Record the total amount of water added to the batch. Weigh and record any mix water not used.
3. Place the fresh concrete in each mold using a scoop, blunted trowel, or shovel. Select each measure of concrete from the mixing pan to ensure that it is representative of the batch. It may be necessary to remix the concrete in the mixing pan to prevent segregation during the molding of the specimens. Move the scoop, shovel, or trowel around the top edge of the mold as the concrete is discharged in order to ensure a symmetrical distribution of the concrete and to minimize segregation of the coarse aggregate.
4. Fill the molds in three equal layers. Further distribute the concrete with a tamping rod prior to the start of consolidation. Rod each layer with the rounded end of the rod using 25 strokes per layer. Distribute the strokes uniformly over the cross section of the mold. Rod the bottom layer throughout its depth. For the two upper layers, allow the rod to penetrate about 1/2 inch into the layer below. In placing the final layer, attempt to add an amount of concrete that will exactly fill the mold after consolidation. After each layer is rodded, tap the outsides of the mold lightly 10 to 15 times with an open hand or rubber mallet to close any holes left by the rodding and to release any large air bubbles that may have been trapped.
5. After consolidation of the final layer, strike off the top surface of the concrete and float or trowel the surface with the minimum manipulation necessary to produce a flat even surface that is level with the rim of the mold.
6. Weigh the filled molds, cover, and place in the environmental chamber to cure for 24 hours. After 24 hours, the concrete cylinders will be removed from the molds and placed in a saturated lime-water bath until testing. Measure the compressive strength of the concrete after 7 and 28 days of curing.

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PARTA – Mixing and Casting of PCC Cylinders

Team	1	2	3	4
Mix Type	OPC 0.4 w/cm	OPC 0.5 w/cm	FA 0.4 w/cm	Rich 0.4 w/cm
Wt of Mixing Pan, lb				
Wt of Dry Mix, lb				
Wt of Cement, lb (15%)				
Wt of Additional Cement, lb	0	0	0	2.0
Wt of Fly Ash, lb	0	0	2.0	
Tare Weight of Water Container, lb				
Target Mixing Water Weight, lb	2.0	2.5	2.8	2.8
Tare + Initial Water, lb				
Tare + Final Water , lb				
Wt of Filled 4x8 Mold, lb				
Wt of Pan + Excess PCC, lb				
7-Day Compressive Load, lb				
28-Day Compressive Load, lb				

Dry Sieve Analysis of Quickcrete

Sieve Size	% passing
#4	72.1
#200	14.8

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This is a formal lab report that is to be completed with the group you worked with in the lab. This report will include the data from lab's 4 and 5. Follow the "Guidelines for Writing a Lab Report" on the laboratory website.

Report: Part A

1. Provide a summary table of mortar cube and cylinder strengths (compressive stress).
2. Plot each mortar type's average compressive strength vs. curing time. (Tuesday labs use Tuesday's data; Thursday's labs use Thursday's data.)
3. Using the average 7 day cylinder compressive strengths, estimate the 28 day compressive strength of each mix type.
4. Discuss the results of the mortar cube and cylinder strength data.

Part B: Concrete Design

Design a cubic yard of concrete using the absolute volumetric method based on the following requirements and material characteristics. Follow the design procedures in *Design and Control of Concrete Mixtures* 14th edition (Chapter 9).

Reinforced concrete with design strength of 3,500 psi is being considered for a footing of the new DLC. The footing requires a minimum cover of 3 inches with a minimum clear space between reinforcing bars of 1.5 inches. Assume that a standard deviation for this mix is not known and that data from trial mixes is not available.

Aggregates:

Coarse Aggregate: Angular crushed stone

3/4" max size

Bulk Specific Gravity = 2.68

Absorbance = 1.0%

Dry Rodded Unit Weight = 110 lb/ft³

Moisture Content of Stockpile = 2.0%

Fine Aggregate:

Bulk Specific Gravity = 2.64

Absorbance = 0.75%

Moisture Content of Stockpile = 6.0%

Fineness Modulus = 2.80

Be sure to report all tables and figures used. Provide a summary table of the batch weights which should include, water, cement, coarse and fine aggregates (adjusted for moisture content), air content (%), slump (in.), and estimated density (lb/ft³). Be neat and show your work!

Also answer the following:

1. If the stockpile moisture contents (not absorption) were incorrectly measured (either too high or too low)
 - a. What effect would it have on the batch weights? Slump?
 - b. How do you think it would affect the properties of hardened concrete?