

CEEN 3320 - Behavior and Properties of Engineering Materials
Laboratory Experiment 6 - Quickcrete Cylinders

Objective: To evaluate the effects of water quality, curing time, W/CM ratio, cement and fly ash content on the strength of Portland cement concrete.

Equipment: Mixing pan, mixing hoe, scales, 4x8 cylinder molds, vibrating table, rod, trowel.

ASTM Ref: C31, C39, C138, C192, C470

- Procedure:**
1. Prepare a 4x8 cylinder mold (3 molds total) by lightly oiling the sides and bottom.
 2. Obtain a 30 lb portion of Quickcrete mix (1/2 bag). Thoroughly dry mix to ensure a uniform distribution of the aggregates and cement. Record this weight in **Data Table 1**.
 3. Add the appropriate amount of Quickcrete, cement, and fly ash to the mixing pan and hand mix to ensure a uniform blend of materials. Add sufficient mixing water to achieve the target water to cementitious materials (w/cm) ratio listed in **Table 1**. Record all weights in **Data Table 1**.
 4. Mix the concrete by hand until a homogeneous mixture is obtained.
 5. Transfer enough concrete to the prepared molds to fill to approximately 2/3 full. Consolidate the concrete by rodding and vibration. The consolidation should be completed in 10 seconds or less. After the first layer is consolidated, fill the mold with sufficient concrete to completely fill the mold after vibration. Consolidate the concrete by rodding and vibration in 10 seconds or less. After complete consolidation, level the top of the concrete cylinder with the trowel.
 6. Cover the filled mold and move to the appropriate curing environment. Obtain the compressive load to failure of the concrete cylinders after 3, 7 and 28 days of curing. Record the values in **Data Table 2**.
 7. Repeat steps 1 – 6 for each additional target mortar mixture.

- Report:**
1. Prepare a combined plot of compressive strength versus w/c ratio for the plain concrete cylinders (mixes 1 – 8), clearly indicating the 3, 7 and 28 day strength trends. Comment on the trends presented.
 2. Prepare a combined plot of compressive strength versus % Fly Ash for the rich concrete cylinders (mixes 9 - 12), clearly indicating the 3, 7 and 28 day strength trends. Comment on the trends presented.
 3. Prepare separate bar charts (one for each curing period) illustrating the effects of mixing water on the compressive strength of the different concrete cylinders (mixes 13v4, 14v7, 15v8,16v12). Comment on the trends presented.

CEEN 3320- Behavior and Properties of Engineering Materials
Laboratory Experiment 6 - Quickcrete Cylinders

Table 1 - Target Mixture Components

Mix Number	Concrete Type	w/cm	Quickcrete Mix, lb	Cement lb	Fly Ash lb	Water Type	Water lb
1	Plain	0.28	30	0	0	Tap	1.26
2	Plain	0.32	30	0	0	Tap	1.44
3	Plain	0.36	30	0	0	Tap	1.62
4	Plain	0.40	30	0	0	Tap	1.80
5	Plain	0.44	30	0	0	Tap	1.98
6	Plain	0.48	30	0	0	Tap	2.16
7	Plain	0.52	30	0	0	Tap	2.34
8	Plain	0.56	30	0	0	Tap	2.52
9	Rich-0%FA	0.40	30	2.25	0	Tap	2.70
10	Rich-10%FA	0.40	30	1.50	0.75	Tap	2.70
11	Rich-20%FA	0.40	30	0.75	1.50	Tap	2.70
12	Rich-30%FA	0.40	30	0	2.25	Tap	2.70
13	Plain	0.40	30	0	0	Pond	1.80
14	Plain	0.52	30	0	0	Pond	2.34
15	Rich-0%FA	0.40	30	2.25	0	Pond	2.70
16	Rich-30%FA	0.40	30	0	2.25	Pond	2.70

Note: Typical Quickcrete Proportions in 60 lb sack: 17 lb gravel, 34 lb sand, 9 lb cement

CEEN 3320- Behavior and Properties of Engineering Materials
Laboratory Experiment 6 - Quickcrete Cylinders

Data Table 1 - Actual Mixture Components

Mix Number	Mortar Type	w/cm	Quickcrete Mix, lb	Cement lb	Fly Ash lb	Water Type	Water lb
1	Plain	0.28		0	0	Tap	
2	Plain	0.32		0	0	Tap	
3	Plain	0.36		0	0	Tap	
4	Plain	0.40		0	0	Tap	
5	Plain	0.44		0	0	Tap	
6	Plain	0.48		0	0	Tap	
7	Plain	0.52		0	0	Tap	
8	Plain	0.56		0	0	Tap	
9	Rich-0%FA	0.40			0	Tap	
10	Rich-10%FA	0.40				Tap	
11	Rich-20%FA	0.40				Tap	
12	Rich-30%FA	0.40		0		Tap	
13	Plain	0.40		0	0	Pond	
14	Plain	0.52		0	0	Pond	
15	Rich-0%FA	0.40			0	Pond	
16	Rich-30%FA	0.40		0		Pond	

CEEN 3320- Behavior and Properties of Engineering Materials
Laboratory Experiment 6 - Quickcrete Cylinders

Data Table 2 - PCC Cylinder Strength Data

Mix Number	Mortar Type	Water Type	w/cm	Compression Load to Failure, lb		
				3 Day	7 Day	28 Day
1	Plain	Tap	0.28			
2	Plain	Tap	0.32			
3	Plain	Tap	0.36			
4	Plain	Tap	0.40			
5	Plain	Tap	0.44			
6	Plain	Tap	0.48			
7	Plain	Tap	0.52			
8	Plain	Tap	0.56			
9	Rich-0%FA	Tap	0.40			
10	Rich-10%FA	Tap	0.40			
11	Rich-20%FA	Tap	0.40			
12	Rich-30%FA	Tap	0.40			
13	Plain	Pond	0.40			
14	Plain	Pond	0.52			
15	Rich-0%FA	Pond	0.40			
16	Rich-30%FA	Pond	0.40			