

CEEN 3320 - Behavior and Properties of Engineering Materials
Laboratory Experiment 5 - Quickcrete Mortar Cubes

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

Equipment: Mortar mixer, scales, molds, tampers, mixing spoons.

ASTM Ref: C 109, C 1074

- Procedure:**
1. Prepare a cube mold (3 cubes total) by lightly oiling the sides and bottom.
 2. Prepare a Quickcrete mortar mix by sieving off the gravel sized materials (No. 4 sieve). Thoroughly dry mix the mortar to ensure a uniform distribution of the sand and cement. Obtain 2 lb portion of the mortar mix and record this weight in **Data Table 1**.
 3. Add the appropriate amount of mortar, cement, fly ash to the mixing bowl 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 mortar in the Hobart mortar mixer on low speed for approx. 1 minute or until a homogeneous mixture is obtained.
 5. Transfer enough mortar to the prepared molds to fill to approximately 2/3 full. Consolidate the mortar by tamping 32 times (4 circuits around the mold with 8 tamps per circuit). The consolidation should be completed in approx. 10 seconds using a tamping pressure just enough to ensure uniform filling of the molds. After the first layer is consolidated, fill the mold with sufficient mortar to ensure complete filling after a second round of tamping. Repeat the tamping procedure ensuring that excess mortar which spills out over the top of the mold is scraped back in after each round.
 6. Cover the filled mold and move to the appropriate curing environment. Obtain the compressive load to failure of the mortar cubes after 1, 3 and 7 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 mortar cubes (mixes 1 – 8), clearly indicating the 1, 3 and 7 day strength trends. Comment on the trends presented.
 2. Prepare a combined plot of compressive strength versus % Fly Ash for the rich mortar cubes (mixes 9 - 12), clearly indicating the 1, 3 and 7 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 mortar cubes (mixes 13v4, 14v7, 15v8,16v12). Comment on the trends presented.

CEEN 3320- Behavior and Properties of Engineering Materials
Laboratory Experiment 5 - Quickcrete Mortar Cubes

Table 1 - Target Mixture Components

Mix Number	Mortar Type	w/c	Quickcrete Mortar, lb	Cement lb	Fly Ash lb	Water Type	Water lb
1	Plain	0.28	2.5	0	0	Tap	0.15
2	Plain	0.32	2.5	0	0	Tap	0.18
3	Plain	0.36	2.5	0	0	Tap	0.19
4	Plain	0.40	2.5	0	0	Tap	0.21
5	Plain	0.44	2.5	0	0	Tap	0.23
6	Plain	0.48	2.5	0	0	Tap	0.25
7	Plain	0.52	2.5	0	0	Tap	0.27
8	Plain	0.56	2.5	0	0	Tap	0.29
9	Rich-0%FA	0.40	2.5	0.22	0	Tap	0.30
10	Rich-10%FA	0.40	2.5	0.15	0.07	Tap	0.30
11	Rich-20%FA	0.40	2.5	0.07	0.15	Tap	0.30
12	Rich-30%FA	0.40	2.5	0	0.22	Tap	0.30
13	Plain	0.40	2.5	0	0	Pond	0.21
14	Plain	0.52	2.5	0	0	Pond	0.27
15	Rich-0%FA	0.40	2.5	0.22	0	Pond	0.30
16	Rich-30%FA	0.40	2.5	0	0.22	Pond	0.30

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 5 - Quickcrete Mortar Cubes

Data Table 1 - Actual Mixture Components

Mix Number	Mortar Type	w/c	Quickcrete Mortar, 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 5 - Quickcrete Mortar Cubes

Data Table 2 - Mortar Cube Strength Data

Mix Number	Mortar Type	Water Type	w/c	Compression Load to Failure, lb		
				1 Day	3 Day	7 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			