

Highway Engineering Materials - CE 400  
Spring 2009  
**Concrete Labs**  
**Draft Due March 11, 2009**  
**Final Report Due March 25, 2009**

February 11<sup>th</sup> to March 11<sup>th</sup>, 2009

**T1) ASTM C 192-90a: Making and Curing Concrete Test Specimens in the Laboratory.**

***Equipment needed:***

- |                  |                              |
|------------------|------------------------------|
| - Cylinder Molds | - Trowel                     |
| - Tamping Rod    | - Small batch concrete mixer |
| - Scale          |                              |

***Material:***

- |                    |              |
|--------------------|--------------|
| - Coarse Aggregate | - Cement     |
| - Fine Aggregate   | - Admixtures |
| - Water            |              |

***Procedure:***

1. Record a brief description of aggregates used in the mix
2. Add the coarse aggregate and half of the water to the concrete mixer before starting
3. Add the fine aggregate, cement, and remaining water after the mixer has been started
4. Mix for ~3 minutes then stop for ~2 minutes and add the admixtures
5. Mix for an additional 2 minutes
6. Remove from mixer
7. Measure the air content (T2)
8. Measure the slump (T3)
9. Fill the cylinders with three equal lifts rod each lift 25 times
10. Trowel the top of the cylinder so that the top surface is smooth and flat
11. After 24 hrs of curing remove the concrete from mold and place in water for the rest of curing time (TA and group leaders will perform this)
12. Remove from water 12-24 hours before compression or tension tests are performed
13. Weigh cement specimens for approximate unit weight of concrete

***Report Requirements:***

1. Visual Description of aggregate, wet concrete, and cured concrete
2. Mix proportions – Include both 1.4ft<sup>3</sup> lab batch and standard 1yd<sup>3</sup> mix proportions (client is interested in 1yd<sup>3</sup> proportions)
3. Results of compression cylinder tests, including:
  - Compressive strength vs. age (from tests at 7, 14, and 28days)
  - Comparison of measured 28-day compressive strength ( $f'_c$ ) with

- specified minimum strength of your mix.
  - 28-day compressive strength vs. w/c ratio (include other groups' data)
4. Ratio of measured split cylinder strength ( $f_{sp}$ ) to the square root of the average compressive strength
  5. Approximate concrete unit weight (average of all cylinders tested)
  6. Assessment of adequacy of the mix for use in a concrete pavement (note any short comings, ways to improve mix, and if possible reduction in cement to reduce cost of mix)

Mix Trial Batches					
	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
F' c (psi)	3000	3500	4000	3500	4000
Coarse Agg. (lb)	102	102	102	95	95
Fine Agg. (lb)	55	49	43	56	50
Water (lb)	17	17	17	17	17
Cement (lb)	31	34	37	34	37
AEA (ml)	22	28	34	22	28

## T2) AASHTO T 199-00: Air Content of Freshly Mixed Concrete by the Chace Indicator.

### *Equipment needed:*

- Alcohol
- Air entrainment pycnometer and bottom plug

### *Material:*

- Concrete mortar from batch

### *Procedure:*

1. Fill the sampler/plug with concrete mortar absent of coarse aggregate
2. Insert the sampler/plug into the pycnometer to the insertion line
3. Fill the rest of the pycnometer with alcohol
4. Agitate the sample with finger over opening so that the alcohol mixes with the mortar
5. Remove finger and repeat step 4 until alcohol is completely mixed
6. Report amount of air that was absorbed in mortar (each tick mark is 1%)

### **T3) ASTM C 143-90a: Slump of Hydraulic Cement Concrete.**

#### ***Equipment needed:***

- Cone Mold
- Tamping Rod
- trowel

#### ***Material:***

- Concrete from batch

#### ***Procedure: Procedure:***

1. Dampen the mold and place on flat non-absorbent surface
2. Fill the cone with hydraulic concrete in three equal lifts rod each layer 25 times
3. Add additional concrete to fill the cone and trowel off any excess
4. Lift mold vertically at a constant rate of  $5 \pm 2$  seconds per foot with no lateral or torsional motion
5. Complete entire test within 2.5 minutes of starting
6. Immediately measure slump of concrete by measuring the amount of vertical displacement of the top of the concrete cone (If shearing off of the concrete from one side or portion of the mass occurs disregard the test and repeat test)

#### ***Report Requirements:***

- Evaluation of the mix workability