Homework Assignment 1
Due Wednesday, August 28th

To help answer the questions and to prepare for Wednesday’s and Friday’s classes read Chapter 1 (pp. 1 – 9), parts of Chapter 9 (pp. 153-157; pp. 169-172) and part of Chapter 12 (pp. 231 – 238) all of which are from the 15th edition of the Design and Control of Concrete Admixtures, Portland Concrete Association. These chapters are available on the course website to view/download. Also read parts of Chapter 1 in the McCormac & Brown textbook (pp. 1-13; pp. 22-26) as part of this assignment. If you want to get ahead for next week, review Chapter sections 2.1, 2.2, and 2.3 the McCormac & Brown textbook, as well as go over ES 230 review topics and examples sent by email.

Perform the following calculations:
Assume that unreinforced concrete weighs 145 lb/ft³

How much will one cubic yard of unreinforced concrete weigh? __________
What area will one cubic yard of concrete cover if poured 5” deep? __________
How much concrete do you need to mix in the lab to fill eight concrete test cylinders that have a height of 8 inches and a diameter of four inches in cubic yards? ___________ in cubic feet? ____________

We have a 4” diameter by 8” tall concrete cylinder test sample that we want to test to determine its maximum axial compressive strength. An axial load, P, is applied to the cylinder and the load is increased until the cylinder concrete crushes when the compressive stress created in the cylinder due to the axial load P reaches the concrete’s maximum compressive strength, f’c.
If the concrete’s f’c is 3000 psi, what load P is required to crush the concrete? __________
If the concrete’s f’c is 8000 psi, what load P is required to crush the concrete? _____________

Assume that reinforced concrete weighs 150 lb/ft³
A building has overall floor dimensions of 60 feet by 80 feet. The floor slab that covers the entire floor area is 6” thick. What is the self-weight of the floor slab (dead load) in lbs? _____ in kips? _____
What is the area dead load in psf of the floor slab? _______ psf (used to calculate beam or column loads)

Answer the following questions based on the readings and other information:

What are the raw materials of cement?

What are the raw materials of concrete?

Concrete hardens through the process of drying. True or False? _________
Give three reasons why different types of Portland cement are produced.

You can either use a maximum coarse aggregate size (1”) or a maximum coarse aggregate size (1/2”). Which coarse aggregate would require less cement paste per cubic yard of mixed concrete?

Your boss wantsto use 3” diameter aggregate in a concrete mix for a concrete building’s beams and floor slabs. What do you tell them?

How many days does it take for concrete to reach its design strength? __________
Can this time be reduced?
What is permeability? Why might a low permeability be desired for concrete structures? Why might a high permeability be desired?

Briefly describe what air-entraining a concrete mix means. Identify one construction situation in which you would say it would be okay not to use air-entrained concrete. Identify one construction situation in which you would insist that air-entrained concrete be used.

Sketch a graph that clearly shows the relationship between w/c ratio and concrete compressive strength for non-air-entrained concrete and for air-entrained concrete. Summarize the effect that the w/c ratio has on concrete strength and also the effect that air entrainment has on concrete strength.

List four benefits typically provided by a concrete with a low water-cement ratio (w/c).

The modulus of elasticity for A36, A992, and many other grades of steel is $E = 29,000 \text{ ksi}$. For concrete, the modulus of elasticity, $E_c$, depends on the compressive strength of the concrete, $f'_c$. How can you calculate the modulus of elasticity, $E_c$? What is the $E_c$ for a concrete with $f'_c = 4000 \text{ psi}$?

What is the nominal diameter of a #4 reinforcing bar (rebar)?
What is the cross-sectional area of a #4 rebar?

What is the nominal diameter of a #9 rebar?
What is the cross-sectional area of a #9 rebar?

What are the largest and smallest bar sizes available?