CIVE 530 – Foundation Engineering (Spring 2012)

Assignment No. 3

Assigned: Tuesday 15 May 2012

Due: Tuesday 22 May 2012

Problem 1:

A square precast concrete pile with a side width of 12 inches, is driven to a tip penetration of 40 feet. The pile has f'c=4000 psi. The soil profile is all clay. The water table is at the ground surface. Shear tests were unconfined compression tests using samples taken using 2-inch thin walled samplers (Shelby tubes). The soils had the following stratification:

0-15 feet c_u=750 psf, γ'=30 pcf

15-30 feet c_u=1500 psf, γ'=40 pcf

30-60 feet c_u=2800 psf, γ'=50 pcf

Estimate the axial compressive load using the Alpha and Beta methods. Assume that the local structural codes require the compressive strength in the concrete be limited to 0.3f'c.

Problem 2:

Use the method by Olson and Al-Shafaei to calculate the axial load capacity of a 35-cm square precast concrete pile that is driven to a depth of 7 meters in a sand deposit where the corrected standard penetration resistance averages about 20 along the sides and 40 at the tip. If the pile has f'_c=4500 psi, is it safe structurally? Assume that the local structural codes require the compressive strength in the concrete be limited to 0.3f'c.

Problem 3:

The columns for a 50-storey building will be founded on drilled shafts. The soil profile consists of 80 ft of stiff clay that is underlain by a very stiff clay. The water table is near the ground surface. The stiff clay has an undrained shear strength that increases linearly with depth according to the following equation: su = 700 psf + 15z where z is the depth in feet. The very stiff clay has an undrained shear strength of 9,000 psf.

1. One alternative is straight sided drilled shafts that are 36 inches in diameter and that extend 10 feet into the very stiff clay. Calculate the axial capacity of these shafts. If a factor of safety of 2.5 is used, what is the design column load that the shaft can support?
2. A second alternative is to use belled shafts with a shaft diameter of 36 inches and a bell of 6 feet. The bell angle will be 60 degrees and the base of the bell will be 10 feet into the very stiff clay. Calculate the axial capacity and the maximum design column load (FS = 2.5) for each shaft.
3. Calculate the compressive stresses in the two alternative shaft design at the tip, midspan, and the butt (ground surface).
4. The compressive strength of concrete is 5000 psi and the local structural codes require the compressive strength in the concrete be limited to 0.3f'c. Check the structural capacity of the two shafts.