53:139 Foundation Engineering

Department of Civil & Environmental Engineering

The University of Iowa

Assignment #8

**Book Problems**: From Chapter 9, solve problems: 1, 5, 8, 9, 16, and 17.

Supplemental Problem #1:

For a vertical retaining wall of height H and a sloping granular backfill of unit weight γ and friction angle φ, making angle α with respect to the horizontal, the resultant Rankine active and passive forces acting on the wall are given by the following relations:

$$P_a = \frac{\gamma H^2}{2} \cos \alpha \left[\frac{\cos \alpha - \left(\cos^2 \alpha - \cos^2 \phi \right)^{1/2}}{\cos \alpha + \left(\cos^2 \alpha - \cos^2 \phi \right)^{1/2}} \right]$$

$$P_p = \frac{\gamma H^2}{2} \cos \alpha \left[\frac{\cos \alpha + \left(\cos^2 \alpha - \cos^2 \phi \right)^{1/2}}{\cos \alpha - \left(\cos^2 \alpha - \cos^2 \phi \right)^{1/2}} \right]$$

The resultant forces act parallel to the sloping granular backfill that makes angle α with respect to the horizontal. **Derive both of these results using fundamental principles**.
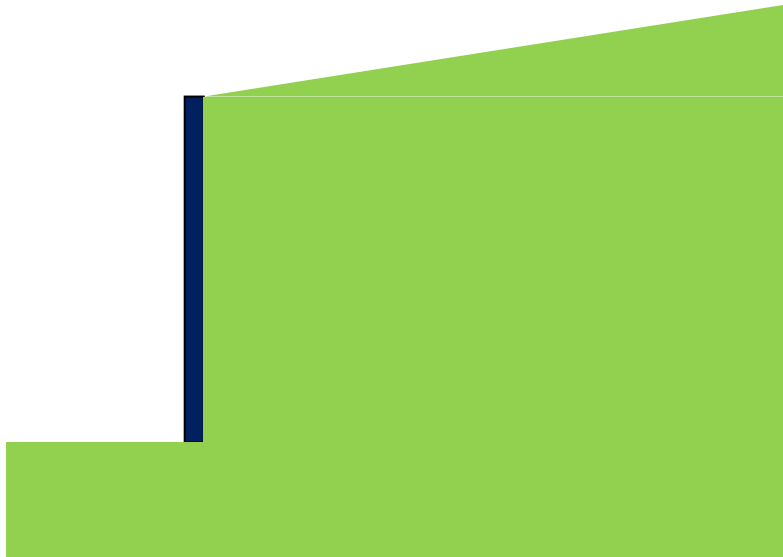
Supplemental Problem #2:

In Section 9.7 of the textbook, the special case of a cantilever wall penetrating a saturated clay soil is considered. Using equilibrium considerations derive Eqs. (9.52) – (9.55). Show all of your work with labeled sketches.