

**Homework 3: MATLAB GUI**

(Version 1.0)

**Release Date:** 23.11.2016**Due On:** 10.12.2016 @ 23:55**(LATE Submissions for ANY reasons will NOT be accepted)****Version history:**

v1.0: Homework 3 is released.

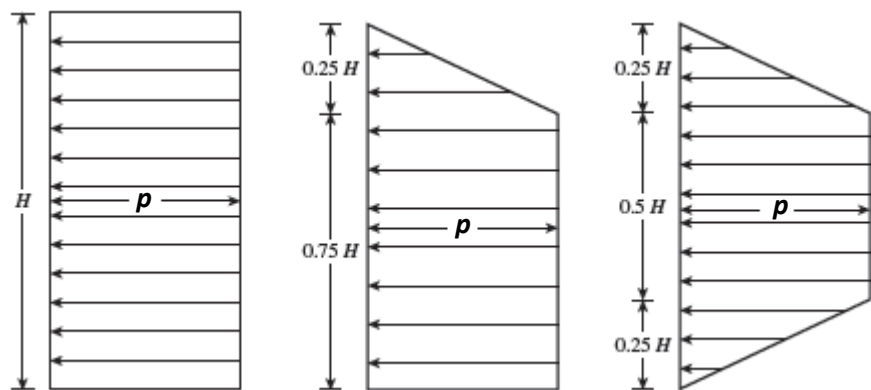
**Submission Rules:**

**Each student must submit individual solutions for these homework problems.** You may use any source at your disposal—paper, electronic, or human—but you must cite every source that you use. Submit your solutions through **ODTUCCLASS**. While submitting, you should include the “.m” (for MATLAB) files with your printed results (i.e., screen shots) in a compressed file (\*.zip, \*.rar, etc.).

**WRITE COMMENTS IN YOUR CODES, USE VARIABLE NAMES AS DESCRIBED IN THE CLASS!**

- (100 pts)** The distribution of lateral earth pressure on retaining walls is dependent on whether the structure is single supported (strut or ground anchor) or not. While the single supported retaining walls pretty much respect Rankine's Lateral Earth Pressure Theory, the ones behind multi – supported retaining walls are quite different.

Lateral earth pressure distribution in a multi – supported retaining wall is dependent on not only soil parameters, but also construction method and wall height as well as groundwater. In 1969, Peck suggested stress envelopes for granular and cohesive soils in dry condition. These envelopes are still widely used to determine the strut loads in preliminary design of such structures.

**Cohesionless Soils**

$$p = 0.65K_a\gamma H$$

$$K_a = \tan^2(45 - \frac{\phi'}{2})$$

**Soft to Medium Clays**

$$\frac{\gamma H}{c_u} > 4$$

$$p = (1 - \frac{4c_u}{\gamma H})\gamma H$$

**Stiff Clays**

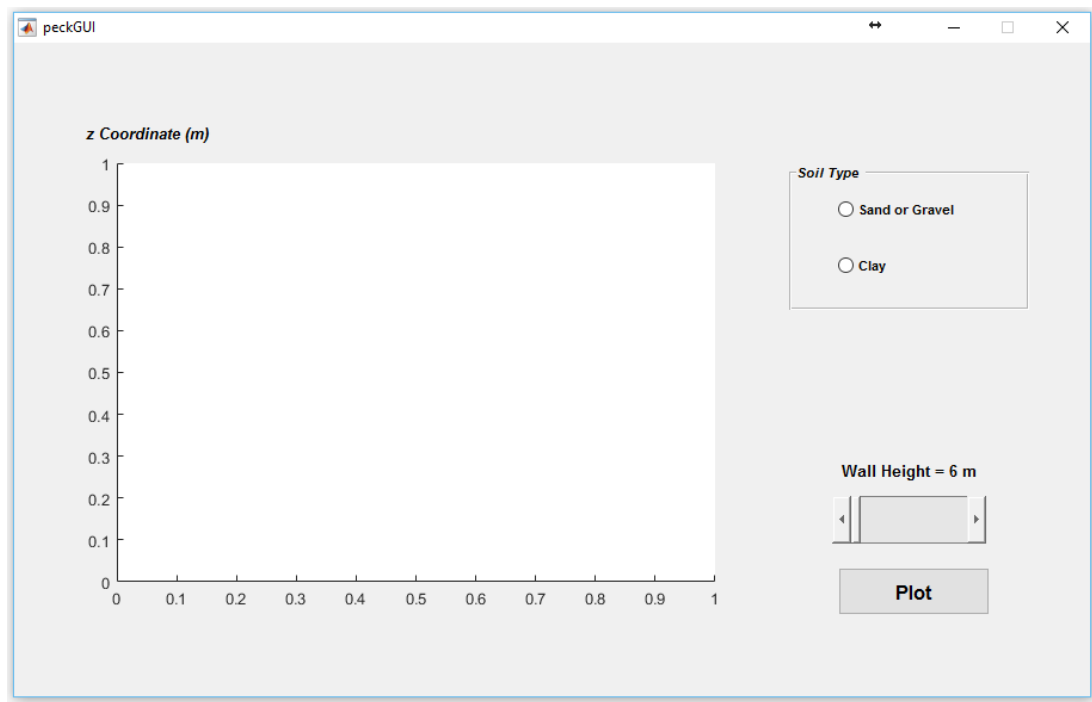
$$\frac{\gamma H}{c_u} < 4$$

$$p = (0.2 \sim 0.4)\gamma H$$

\*You can take it as 0.3

- $p$  : apparent pressure
- $K_a$  : Rankine's active lateral earth pressure coefficient
- $\gamma$  : Bulk unit weight of soil
- $H$  : Wall height (only the height above excavation is considered)
- $\phi'$  : Effective internal friction angle of soil
- $c_u$  : Undrained shear strength of soil

For this homework, you are required to prepare a MATLAB GUI that takes soil type, soil parameters and wall height as input and draws a representative pressure envelope with the retaining wall.



Your GUI should have the following objects and properties:

- **Radio Buttons** to enter soil type (Hint: Use a 'Button Group')
- Two **Panels** to take soil parameter input. When Clay is chosen, a panel named 'Cohesive Soil Parameters' should appear; when Sand or Gravel is chosen, previous panel should disappear and a panel named 'Granular Soil Parameters' should appear.
- In each panel there should be 2 **Static Text Boxes** and 2 **Edit Text Boxes** to enter soil parameters.
- A **Slider** to input wall height. The value of slider should be shown with a text box. (Set minimum value of wall height to 6 m and maximum to 40 or 50 m).
- An **Axes** to plot the figure.
- Figure should draw a representative soil body and a retaining wall.
- In the figure, there z coordinate (depth) should be to the scale. There is no need to have scale in lateral direction.
- A **Push Button** to plot the figure.
- Figure should display pressure value either on the axis or with the help of a text box.

Some example GUI screenshots are given below so that you can test your code with these input combinations:

