



TECHNICAL UNIVERSITY OF MOMBASA
SCHOOL OF ENGINEERING AND TECHNOLOGY
Department of BUILDING & Civil engineering
UNIVERSITY EXAMINATION FOR:

THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECV 4424: FOUNDATION ENGINEERING II

END OF SEMESTER EXAMINATIONS
SERIES: AUGUST, 2024
TIME: 2 HOURS

INSTRUCTIONS TO THE CANDIDATE:

1. You should have the following for this examination:
 - **Answer booklet.**
 - **Mathematical Table/Pocket Calculator.**
2. This paper consists of **FOUR** questions.
3. Answer question **ONE (Compulsory)** and any other **TWO** questions.
4. This paper consists of **FIVE** printed pages.
5. **Do not write on the question paper.**

Question ONE: Cantilever Reinforced Concrete Retaining Walls (20 marks)

- (a) A cantilever reinforced concrete wall is to be designed. The height of earth fill to be retained is 5.0 m. Use a neat well labelled sketch to illustrate a suitable geometry of the wall.

(10 marks)

- (b) A section of a cantilever retaining wall is shown in Fig.1.1. The backfill has the following properties:

(10 marks)

Cohesion $c = 0 \text{ kN/m}^2$, Internal friction $\phi = 41^\circ$, $\gamma = 16 \text{ kN/m}^3$

Angle of friction δ between the base of the wall $\wedge$ the soil $= \left(\frac{2}{3}\right)\phi$

Unit weight of concrete $= 24 \text{ kN/m}^3$

Safe bearing capacity of the soil below the base $= 200 \text{ kN/m}^2$

Investigate the stability of the retaining wall.

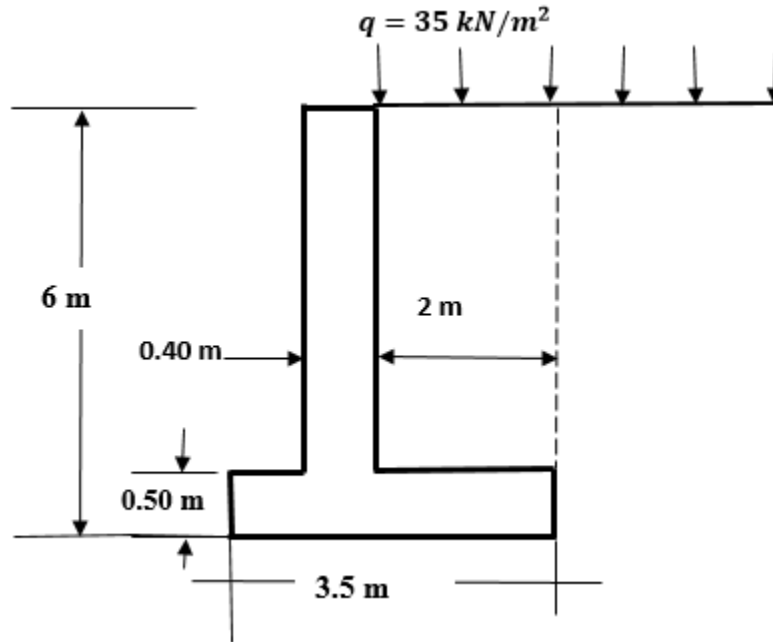


Fig. 1.1: Cantilever retaining wall

Question TWO: Stability of sheet piles

An excavation 5.5 m deep in cohesionless soil is supported by a vertical cantilever sheet pile wall. The pile extends to a depth of 3.6 m below the bottom of the excavation.

Soil properties:

Unit weight $\gamma = 19.2 \text{ kN/m}^3$

Internal friction $\phi = 33^\circ$

Investigate the stability of the wall.

Question THREE: Strutted excavations (20 marks)

- (a) Using a sketch, show the lateral active earth pressure profile on the back of a sheet pile in a strutted trench excavation. **(4 marks)**

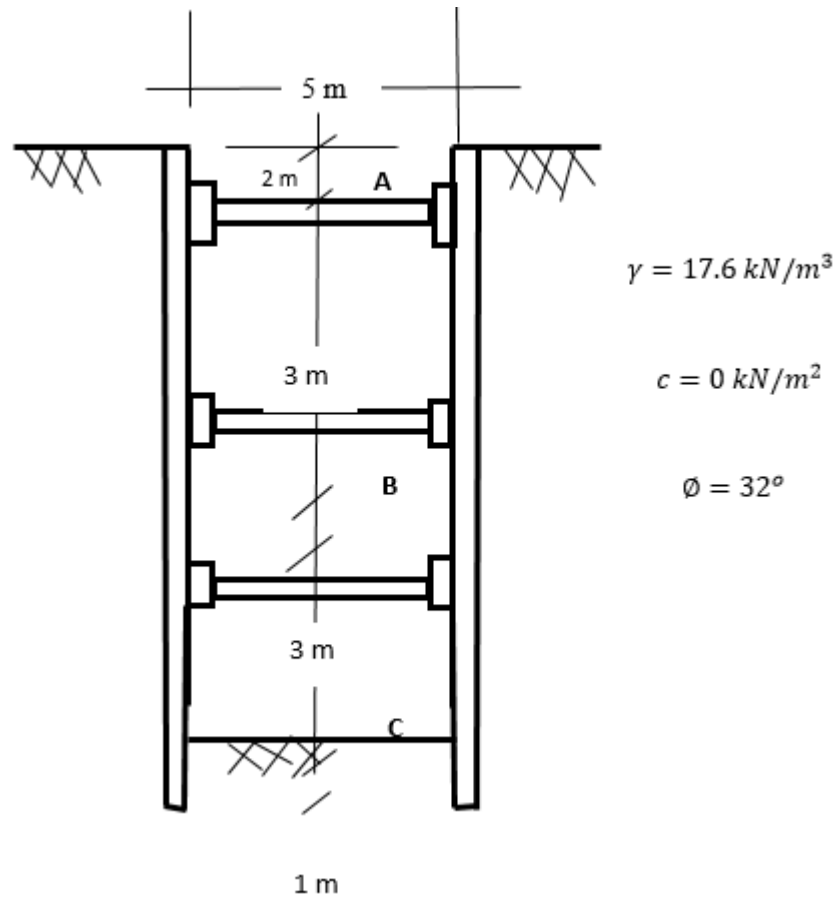


Fig.3.1: Struttred excavation

Fig.3.1 shows a braced excavation. The struts are located at 4 m centering on plan.

- (a) Draw the earth pressure envelope,
- (b) Determine the strut loads at levels A, B and C.

(16 marks)

Question FOUR: Foundations types (20 marks)

- (a) State and explain:
 - (i) Two common types of shallow foundations,
 - (ii) Two common types of deep foundations

(8 marks)

(b) Fig. 4.1 shows a column carrying 900 kN dead load, 450 kN live load and major axis moment $M = 150 \text{ kNm}$. The safe bearing capacity of the soil $q_{safe} = 300 \text{ kN/m}^2$. Investigate the base against sinking. (12 marks)

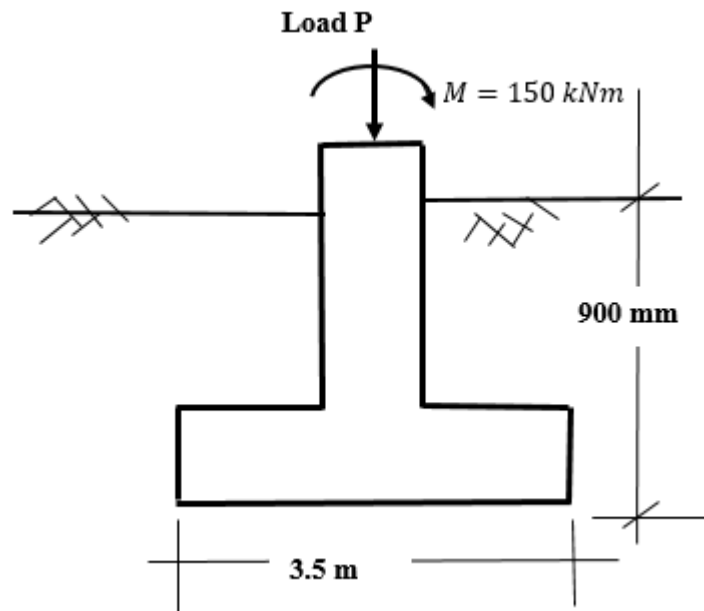


Fig. 4.1: Column pad foundation: load and single moment