

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING
UNIVERSITY EXAMINATIONS FOR:
THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL ENGINEERING
(Y4S1)

ECV4424: FOUNDATION ENGINEERING II

END OF SEMESTER EXAMINATIONS

SERIES: APRIL, 2025

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.**
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Question ONE: Cantilever Reinforced Concrete Retaining Walls

- (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:

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 retaining wall for:

- (i) Bearing failure,
- (ii) Sliding,
- (iii) Overturning about the toe.

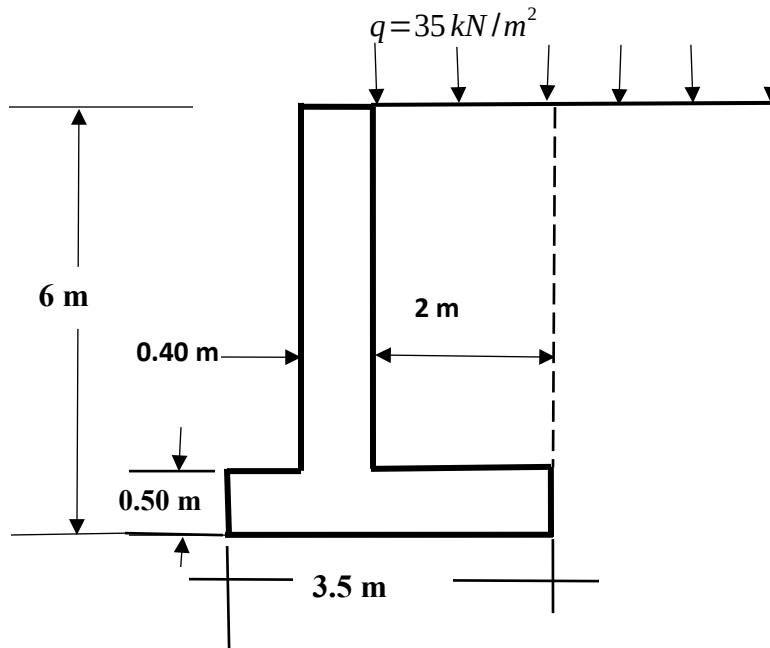


Fig. 1.1: Cantilever retaining wall

(20 marks)

Question TWO: Sheet piles

An excavation 6.0 m deep in a cohesive soil is supported by a vertical cantilever sheet pile wall.

The pile extends to a depth of 4 m below the bottom of the excavation.

Soil properties:

Unit weight $\gamma = 20 \text{ kN/m}^3$

Internal friction $\phi = 30^\circ$

Cohesion $= 10 \text{ kN/m}^2$

Investigate the stability of the wall.

(20 marks)

Question THREE: Strutted excavations

(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)

(b)

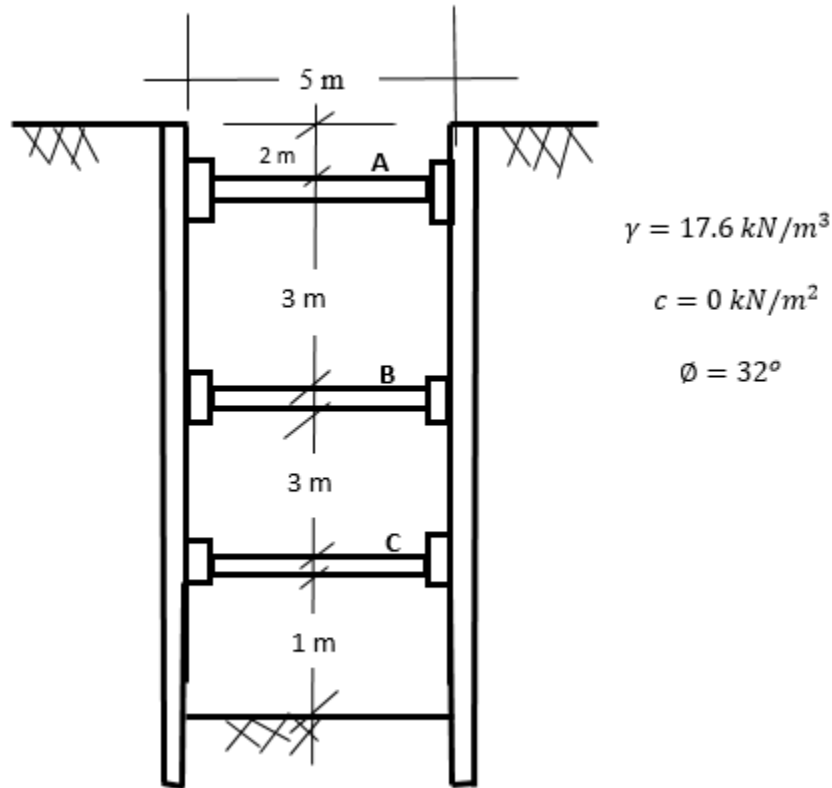


Fig.3.1: Strutted excavation

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

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

(16 marks)

Question FOUR: Foundations

(a) Use a well annotated sketch to show a typical common interaction between a strip footing, sub-structure masonry wall, ground floor slab and a load bearing wall for a traditional building.

(8 marks)

(b) Fig. 4.1 shows an end column along a property line connected to an interior column by a trapezoidal footing. The following data is provided:

Column loads:

$$Q_1 = 2016 \text{ kN}, Q_2 = 1560 \text{ kN}$$

$$\text{Columns: } 0.460 \text{ m} \times 0.460 \text{ m}$$

$$L_c = 5.48 \text{ m}$$

$$\text{Allowable bearing capacity } q_a = 190 \text{ kN/m}^2$$

Determine the dimensions “a” and “b” of the trapezoidal footing.

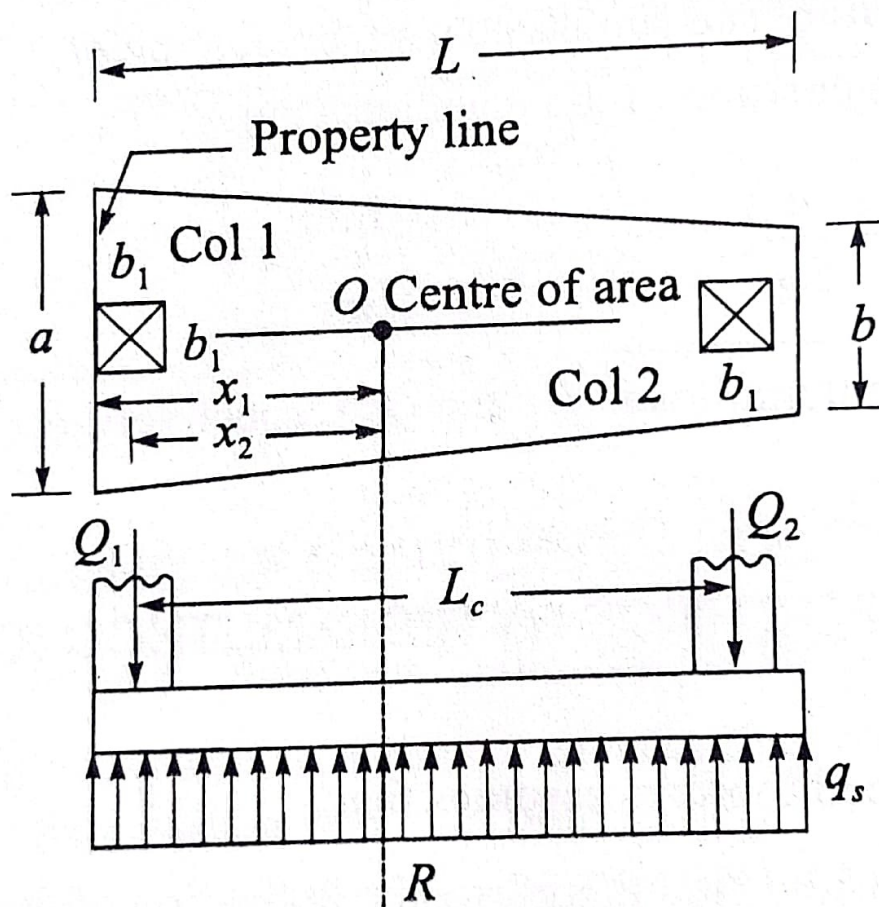


Fig. 4.1: Combined footing (Trapezoidal footing)

(12 marks)