

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING
UNIVERSITY EXAMINATIONS FOR:
THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECV 4424: FOUNDATION ENGINEERING II
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: NOVEMBER 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.**
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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) Fig 1.1 shows a section of a gravity retaining wall.

Masonry unit weight $= 24 \text{ kN/m}^3$

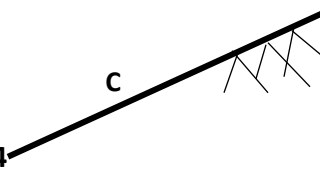
Internal friction $\phi = 33^\circ$

Cohesion $c = 0 \text{ kN/m}^2$

Safe soil bearing capacity $q_{\text{safe}} = 215 \text{ kN/m}^2$

Coefficient of base friction $\mu = 0.65$

Investigate the stability of the wall.



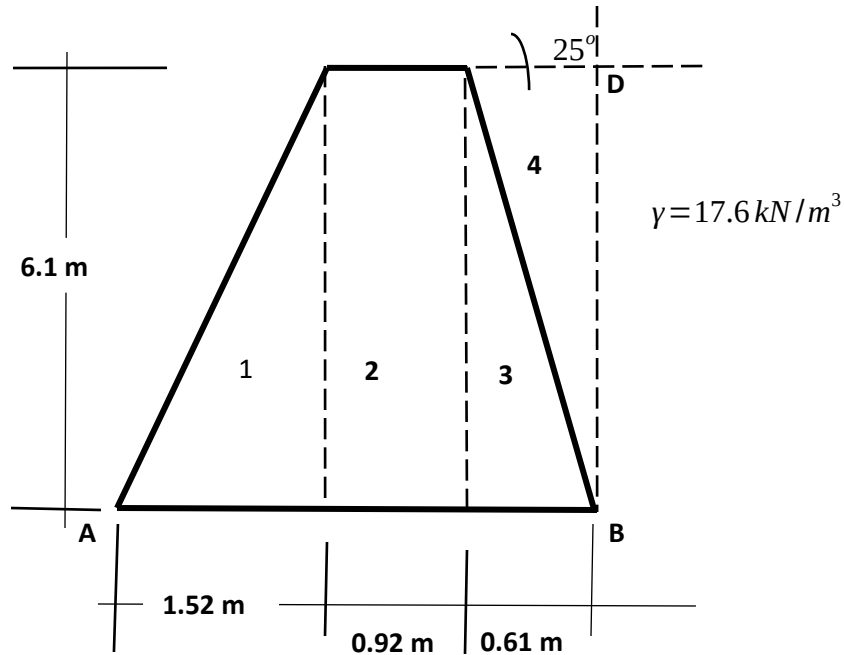


Fig. 1.1: Gravity wall

Hint:

$$K_a = \cos\beta \frac{\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi}}{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}}$$

(20 marks)

Question TWO: Stability of sheet piles

An excavation 6 m deep in cohesionless 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 $\phi = 30^\circ$

Investigate the stability of the wall.

(20 marks)

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)

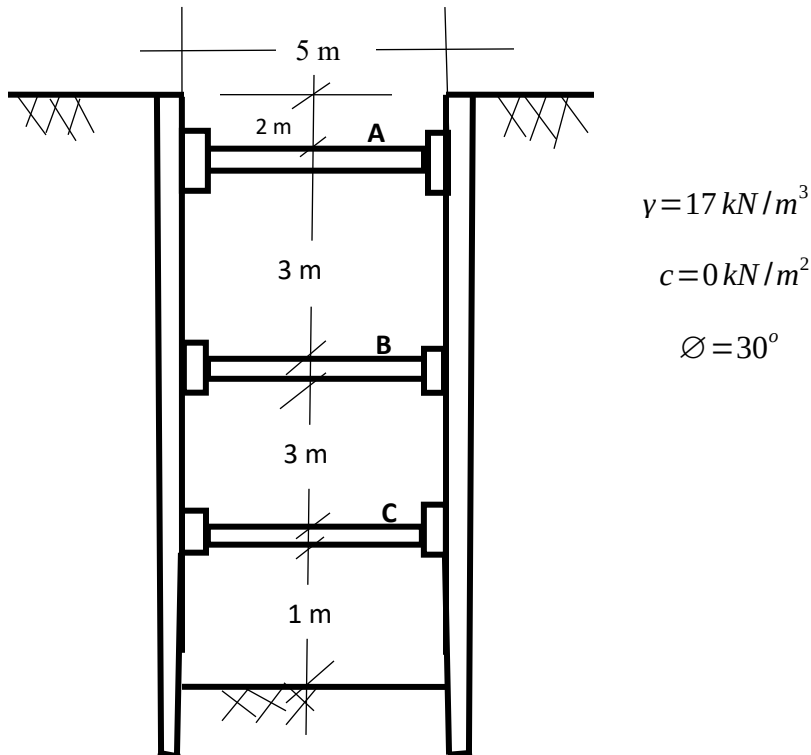


Fig.3.1: Strutted excavation

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

- (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, 500 kN live load and major axis moment $M_{xx} = 100 \text{ kNm}$. The safe bearing capacity of the soil $q_{safe} = 400 \text{ kN/m}^2$. Investigate the base against sinking

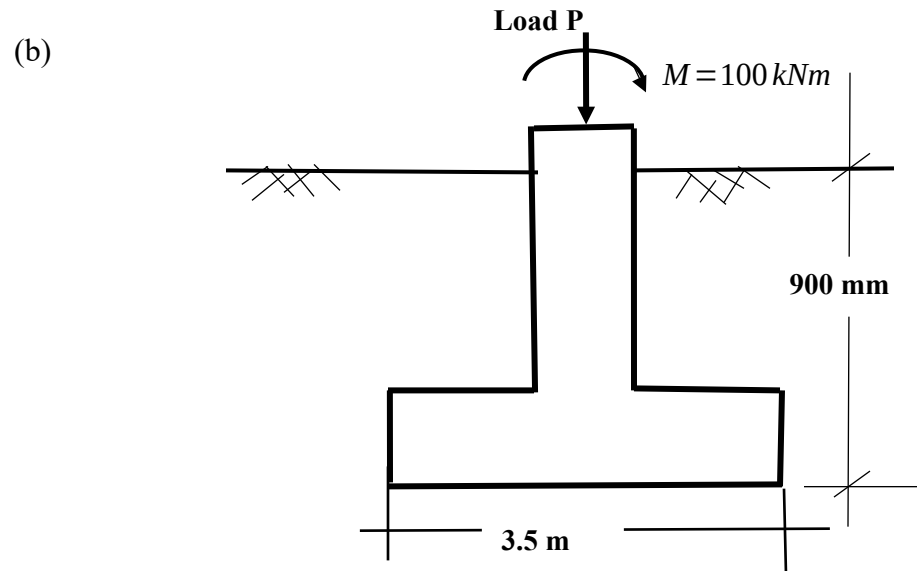


Fig. 4.1: Column pad foundation: load and single moment

(12 marks)