Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	GEOTECHNICS II
COURSE CODE	:	BFC 34402 / BFC 35403
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2021
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTIONS	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) A landslide was reported along the federal road from Kluang to Kota Tinggi on 12 Jan 2021. The extend of landslide was found to have covered 200 m length of road. The soil debris was reported to be 100 m in length and 200 m in height. The condition of landslide is shown in **Figure Q1**.

(i) Based on your understanding and knowledge of geotechnical engineering, analyze, and determine the most probable slope failure mode that occurred in that area by referring to the **Figure Q1**.

(10 marks)

(ii) Propose and explain a most suitable slope stability analysis method that needed to determine its slope stability.

(10 marks)

(b) As a design engineer, you are requested to design a slope and determine the following parameters based on the description given by client.

It was given that the slope is inclined at 20° to the horizontal and the water table is found 1m from the surface of soil. The slope is assumed as cohesive infinite soil slope with 2.5m soil overburden above the underlying stiff stratum. The soil properties are given as:

- Bulk unit weight, γ_{bulk} = 17.5 kN/m^3
- Saturated unit weight, γ_{sat} = 19.5 kN/m^3
- Effective friction angle, ϕ' = 15°
- Effective cohesion, c' = 35 kPa

Determine:

(i) Safety factor against sliding

(5 marks)

(ii) Maximum shear stress developed within the overburden soil (in kPa)

(5 marks)

(iii) Shear strength along the potential failure plane (in kPa)

(5 marks)

(iv) Critical height of overburden soil that would have caused sliding

(5 marks)

Q2 (a) As a design engineer, you are required to determine time or periods required for the subgrade clay soil to achieve 95% of consolidation.

(i) Explain any **ONE (1)** relevant soil test that need to be carried out (3 marks)

(ii) Summarize the soil parameters that need to be determined (6 marks)

(iii) Describe the calculation steps to determine time of consolidation (6 marks)

(b) The recent site investigation showed that the soil profile at site Parit Raja can be broadly divided into two layers and is underlain by bedrock underneath. The water table is reported at 1.5 m from surface of soil. The site will be backfilled and compacted with soil in order to construct new access road. The total load of backfilled soil is estimated as 100 kPa.

The information of soil profile is summarized as below:

Top soil (1st layer):
- Thickness: 4 m
- Type of soil: sand
- Bulk unit weight, γ_{bulk} = 17.8 kN/m^3
- Saturated unit weight, γ_{sat} = 19.8 kN/m^3

2nd layer
- Thickness: 8 m
- Type of soil: normally consolidated clay
- Moisture content = 60%
- Specific gravity = 2.65
- m_v = 0.32 MPa^{-1}
- c_v = 4.9 mm^2/min

Calculate:

(i) The final primary consolidation settlement of clay layer in meter. (5 marks)

(ii) The time required (in day) for the clay layer to achieve 40% consolidation. (5 marks)

(iii) Degree of consolidation of clay layer after one (1) year. (5 marks)

Q3 (a) Sheet pile wall is one of the most common retaining structure that utilized to retain the soil.

As a geotechnical engineer, you are required to describe the steps to calculate

(i) Lateral earth pressure imposed on sheet pile wall

(5 marks)

(ii) The factor of safety for sliding, overturning and base failure

(6 marks)

It is known that the water table of retained soil will raise after heavy downpour.

(iii) Explain the effect of water table on the active lateral earth pressure on the sheet pile wall.

(4 marks)

(b) A row of typical sheet pile was driven into clayey Silt as shown in Figure Q3.

The properties of the soil is given as follow:
- Water content = 40%
- Specific gravity = 2.65
- Permeability = 2.0×10^{-4} cm/s

Calculate:

(i) the flow rate in m^3/s per meter run

(5 marks)

(ii) the pore water pressure at point A in kN/m^2

(5 marks)

(iii) the factor of safety against piping

(5 marks)

–END OF QUESTIONS–

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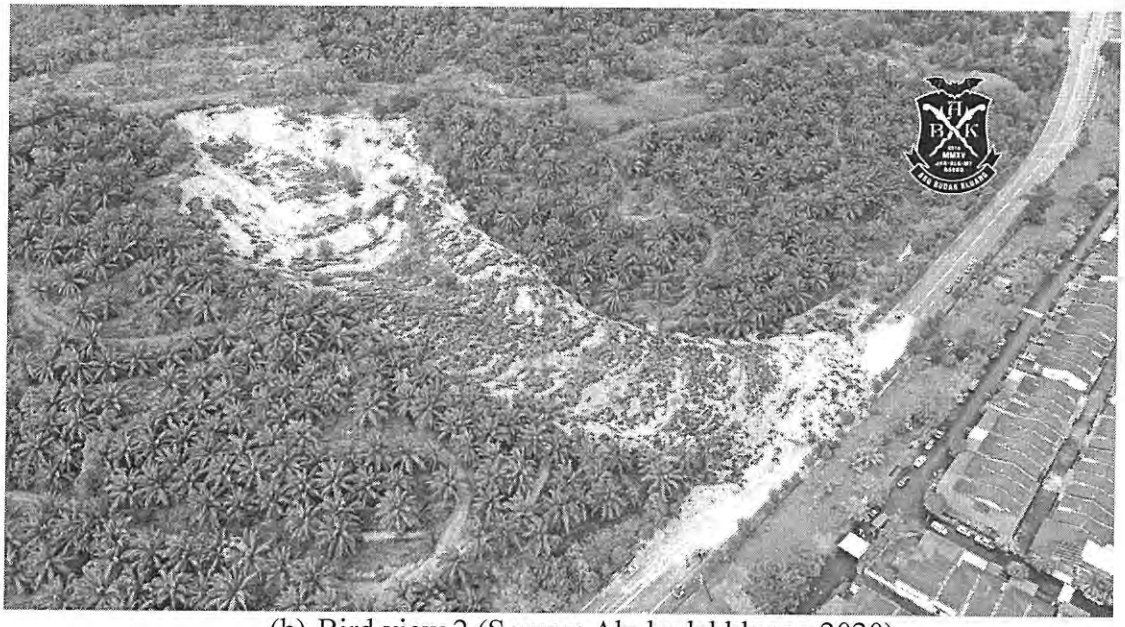
(a) Bird view 1 (Source: Akubudakkluang, 2020)



(b) Bird view 2 (Source: Akubudakkluang,2020)

FIGURE Q1: Bird view of landslide

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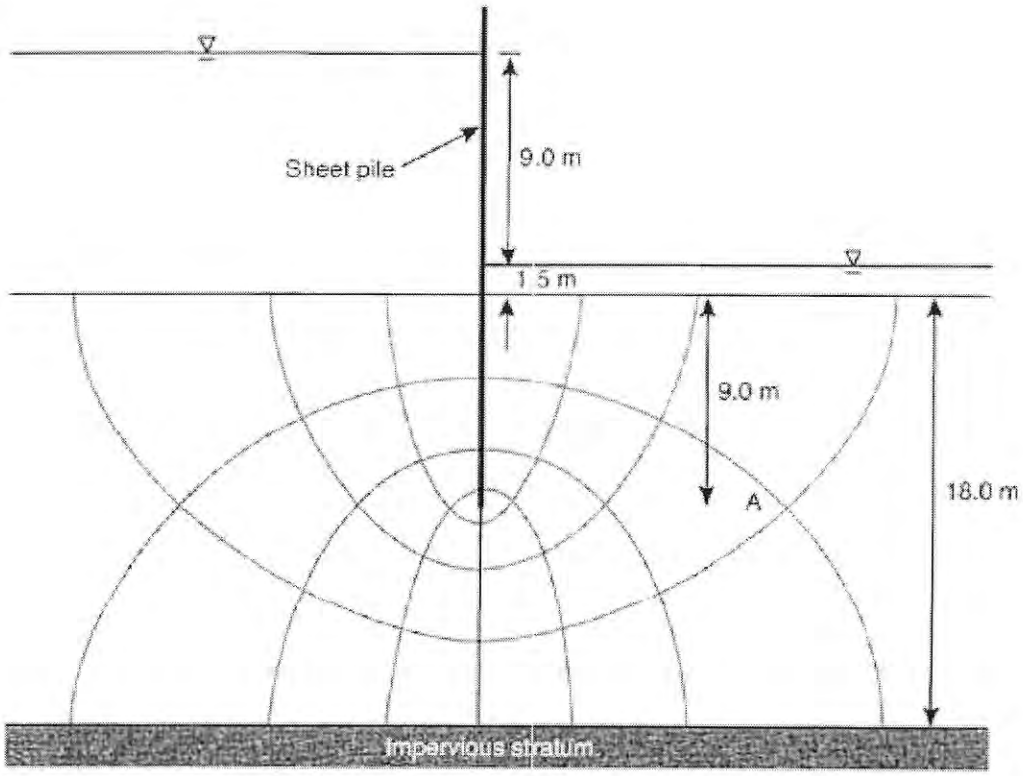

(Source: Sivakugan & Das, 2010)

FIGURE Q3: Flownet and sheet pile wall