

Exam Type Questions

Plane Translational Slip



Question 1

A natural slope composed of fissured overconsolidated clay is inclined at 15° to the horizontal. The water table is located at the surface, with seepage occurring approximately parallel to the slope. A failure plane has formed parallel to the surface at a depth of 6 m. The saturated unit weight (γ_{sat}) of the clay is 19 kN/m^3 . The peak strength parameters of the clay are $c' = 12 \text{ kN/m}^2$ and $\phi' = 28^\circ$. Determine the Factor of Safety (FoS) along the slip plane.



Question 2

A long natural slope composed of overconsolidated clay is inclined at 10° to the horizontal. The water table is at the surface, and seepage is approximately parallel to the slope. A failure has developed along a slip plane parallel to the surface at a depth of 4.5 m. The saturated unit weight of the clay is 18.5 kN/m^3 , and the effective shear strength parameters are $c' = 14 \text{ kN/m}^2$ and $\phi' = 30^\circ$. Determine the Factor of Safety (FoS) along the slip plane.



Question 3

A slope consisting of fissured overconsolidated clay is inclined at 20° to the horizontal. The groundwater table is at the surface, and seepage is nearly parallel to the slope. A failure plane has formed parallel to the surface at a depth of 7 m. The clay has a saturated unit weight of 21 kN/m^3 , and the effective strength parameters are $c' = 8 \text{ kN/m}^2$ and $\phi' = 25^\circ$. Calculate the Factor of Safety (FoS) for the slip surface.



Question 4

A long natural slope in an overconsolidated clay is inclined at 14° to the horizontal. The water table is 1 m below the surface, and seepage is approximately parallel to the slope. A failure has developed along a slip plane parallel to the surface at a depth of 6 m. The saturated unit weight of the clay is 19 kN/m^3 , and the unit weight of the clay above the water table is 17 kN/m^3 . The effective shear strength parameters are $c' = 13 \text{ kN/m}^2$ and $\phi' = 29^\circ$. Determine the Factor of Safety (FoS) along the slip plane.



Question 5

A natural slope in an overconsolidated clay is inclined at 12° to the horizontal. The water table is 1.5 m below the surface, and seepage is approximately parallel to the slope. A failure plane has developed parallel to the surface at a depth of 5.5 m. The saturated unit weight of the clay is 18.8 kN/m^3 , while the unit weight above the water table is 16.5 kN/m^3 . The effective shear strength parameters are $c' = 15 \text{ kN/m}^2$ and $\phi' = 31^\circ$. Determine the Factor of Safety (FoS) along the slip plane.



Question 6

A slope made of overconsolidated clay is inclined at 18° to the horizontal. The groundwater table is located 1.2 m below the surface, with seepage roughly parallel to the slope. A slip failure has occurred along a plane parallel to the surface at a depth of 6 m. The saturated unit weight of the clay is 19.5 kN/m^3 , and the unit weight above the water table is 17.0 kN/m^3 . The effective strength parameters of the clay are $c' = 8 \text{ kN/m}^2$ and $\phi' = 24^\circ$. Compute the Factor of Safety (FoS) along the failure plane.

Exam Type Questions

Rotational Slip



Question 1

A (45°) slope is excavated to a depth of 9 m in a deep layer of saturated clay with a unit weight of 18.5 kN/m^3 .

The shear strength parameters of the clay are $c_u = 60 \text{ kN/m}^2$ and $\phi_u = 0^\circ$.

Determine the Factor of Safety (FoS) for a given failure surface.

The cross-sectional area of the sliding mass is 75 m^2 .

The centroid of the mass is located 4.8 m from O.

The angle is 90° , and the radius is 13.2 m.

The arc length is 20.5 m.



Question 2

A (45°) slope is excavated to a depth of 10 m in a deep layer of saturated clay with a unit weight of 19.2 kN/m^3 .

The shear strength parameters of the clay are $c_u = 50 \text{ kN/m}^2$ and $\phi_u = 0^\circ$.

Determine the Factor of Safety (FoS) for a given failure surface.

The cross-sectional area of the sliding mass is 80 m^2 .

The centroid of the mass is located 5.2 m from O.

The angle is 92° , and the radius is 14.5 m.

The arc length is 22.3 m.



Question 3

A (45°) slope is excavated to a depth of 12 m in a deep layer of saturated clay with a unit weight of 20.0 kN/m^3 .

The shear strength parameters of the clay are $c_u = 35 \text{ kN/m}^2$ and $\phi_u = 0^\circ$.

Determine the Factor of Safety (FoS) for a given failure surface.

The cross-sectional area of the sliding mass is 85 m^2 .

The centroid of the mass is located 6.0 m from O.

The angle is 95° , and the radius is 15.0 m.

The arc length is 25.0 m.

Exam Type Questions

Embodied Carbon



Question 1

Calculate the embodied carbon for a simple rectangular concrete wall that will be used as part of a structural partition in a small building.

The wall is 6m long, 3m high, and has a thickness of 0.15m.

The concrete mix used for the wall has the following embodied carbon factors: Cement 0.85kg CO₂ per kg, Aggregates 0.004kg CO₂ per kg, and Water 0.0003kg CO₂ per kg.

The mix proportions per cubic metre of concrete are: Cement 320kg, Aggregates 1900kg, and Water 175kg



Question 2

Calculate the embodied carbon for a simple rectangular concrete beam that will be used in the construction of a small building.

The beam is 4m long, 0.3m wide, and has a depth of 0.5m.

The concrete mix used for the beam has the following embodied carbon factors: Cement 0.85kg CO₂ per kg, Aggregates 0.004kg CO₂ per kg, and Water 0.0003kg CO₂ per kg.

The mix proportions per cubic metre of concrete are: Cement 350kg, Aggregates 1900kg, and Water 160kg.