What is Slope Stability Analysis?

Worksheet

Slope stability analysis evaluates whether a slope will fail or remain stable using methods like limit equilibrium (Fellenius, Bishop) and finite element analysis. A factor of safety > 1.3 generally indicates stability.

Questions

1. Factor of safety (FS) = 1.5 means:

A) The slope will fail in 1.5 years
B) Resisting force is 1.5 driving force
C) The slope is marginally unstable
D) Water pressure is 1.5 times effective stress

2. Which increases the risk of slope failure most?

A) Higher friction angle
B) Heavy rainfall (pore pressure increase)
C) Steeper slope angle decrease
D) Soil compaction

3. Fellenius method is:

A) A numerical finite element approach
B) A limit equilibrium method for slope stability
C) A type of foundation failure
D) Only used for circular slopes

4. Critical slope angle (no cohesion, = 35):

A) 25
B) 30
C) 35
D) 45

5. A slope has 15 m height, 30 angle, cohesion 20 kPa, friction angle 35, =18 kN/m. Estimate stability.

6. After heavy rain, pore pressure increases. How does this affect slope stability?

7. Compare a 25 slope vs. a 40 slope in the same soil. Which is more stable?

8. Define: What is slope stability analysis?

9. Define: Factor of safety in slope stability?

10. Define: Main methods for slope stability?

Answer Key

1. B) Resisting force is 1.5 driving force - FS = Resisting/Driving. 1.5 means resisting forces are 1.5 stronger than driving forces-stable.

2. B) Heavy rainfall (pore pressure increase) - Water pressure reduces effective stress, directly lowering shear strength.

3. B) A limit equilibrium method for slope stability - Fellenius is an equilibrium method; it divides slopes into slices and sums forces.

4. C) 35 - Critical angle . At = 35, tan(35) 0.7; equilibrium is FS=1 at 35.

5. Driving force component: Wsin(30) load down slope Resisting shear: = c + tan(35) = 20 + 0.7 If factor of safety (Resisting/Driving) > 1.3 stable

6. Rising water reduces effective stress: ' = u Lower effective stress lower shear strength (= c + 'tan) Factor of safety decreases slope more prone to failure

7. Driving force = Wsin(angle) At 25: Wsin(25) 0.42W At 40: Wsin(40) 0.64W 40 slope has 52% more driving force less stable

8. An engineering assessment of whether a slope will remain stable or fail, using equilibrium or numerical methods.

9. FS = Resisting force / Driving force. FS > 1.3 usually means stable; FS < 1.0 means failure is imminent.

10. Limit equilibrium (Fellenius, Bishop) and finite element method (FEM). Limit equilibrium is simpler; FEM is more accurate.