

Effective Stress

Civil Engineering

The idea soil mechanics is built on.

Soil strength and settlement follow effective stress: total stress minus pore water pressure.

$$\sigma' = \sigma - u \cdot u = \gamma_w \times \text{head of water}$$

5 m dry sand, γ 20

No pore water.

$\sigma' = 100 \text{ kPa}$

Same, water at surface

100 – 49.

$\sigma' = 51 \text{ kPa}$

Rapid drawdown

Slope failures.

u stays, σ' collapses

THE COMMON MISTAKE

✗ Adding standing water to σ' as well

✓ It raises σ and u equally

Free water above the ground surface increases total stress and pore pressure by the same amount, so effective stress at depth does not change.

Educational reference. Terzaghi's principle underpins geotechnical design, which remains work for a qualified engineer.