Exercise Problem 1

A concrete gravity dam 15 m height will be constructed with the dimensions shown in the figure below. The dam is composed of three blocks of equal heights. It is intended to implement an internal drainage facility, which would reduce uplift pressure by about 20%. Considering unusual loading, carry out a stability analysis for the upper block.

Unusual loading: Hydrostatic force at full reservoir level, uplift force, dead loads, and silt load.

Given data:
- There is no tailwater
- Compressive strength of concrete, $\sigma_c = 35000$ kN/m$^2$
- Shear strength of concrete, $\tau_s = 5000$ kN/m$^2$
- Coefficient of friction between concrete blocks and concrete-foundation, $f = 0.75$
- Specific weight of water, $\gamma_w = 10$ kN/m$^3$
- Specific weight of concrete $\gamma_c = 24$ kN/m$^3$
- Depth of sediment accumulation, $h_s = 3$ m,
- Angle of repose $\theta = 32^\circ$
- Specific weight of sediment $\gamma_s = 11$ kN/m$^3$
Exercise Problem 2
Using the simplified arch rib analysis, design an arch dam 150 m height for a trapezoidal canyon having widths of 50 m at the bottom and 200 m at the top of the cross-section. Upstream face is vertical. Determine
(a) the maximum thickness of the arch dam and its location from the reservoir surface, and
(b) the thickness of the arch dam at the bottom.

Given Data
- Thickness at the crest is 3 m,
- Allowable compressive stress for concrete, $\sigma_{all}=4000\,\text{kN/m}^2$,
- Central angle $\theta_a=130^\circ$.
- Specific weight of water, $\gamma_w = 10\,\text{kN/m}^3$. 