STUDY AID

The concrete dam as shown as a width of 10m and has a volumetric weight of 25 kN/m3. If the friction force is: $F_f = \mu N$ where μ is the coefficient of friction, determine:

a. The resultant pressure force on the dam and its location.
b. The minimum coefficient to prevent sliding.

$\theta = \tan^{-1}\left(\frac{5}{4}\right) = 51.3^0, \sin\theta = \frac{4}{L}; L = \frac{4}{\sin\theta} = 5.123m$

$Area_{submerged\ plate} = LxW = 5.123mx10m = 51.23m^2$

$\sin\theta = \frac{h_c}{\frac{L}{2}}; h_c = \sin\theta x\frac{L}{2} = 2.0m$

$y_c = \frac{L}{2} = 2.56m$

$F_r = \gamma h_c A = 1x10^6 N, y_r = y_c + \frac{I_{xc}}{y_c A}; I_{xc} = \frac{bh^3}{12} = \frac{(10)(5.125^3)}{12} = 112m^4$

$y_r = 3.14m > y_c$

$F_{ry} = -F_r\cos\theta, F_{rx} = +F_r\sin\theta, \uparrow \sum F_y = 0 = N - W - F_r\cos\theta$

$N = W + F_r\cos\theta$

$\gamma_{dam} = 25kN/m3$

$Volume = 1/2x4x5x10 + 2x5x10 = 200m^3, W = Vol\ x\ \gamma_{dam} = 5000kN$

$N = 5000,000 + 1x10^6\cos(51.3) = 5.63x10^6 N$

$\vec{\sum} F_x = 0 = +F_r\sin\theta - F_f = +F_r\sin\theta - \mu N = 0$

$\mu = \frac{F_r\sin\theta}{N} = \frac{7.8x10^5}{5.6x10^6} = 0.14$