$L_o = 1.56\ T^2 = 1.56 * 8^2 = 100$ m

$d / L_o = 8 / 100 = 0.08$ from table

$d / L = 0.1232$ the $L = 65$ m

$b / L = 130 / 65 = 2 < 5$ (Double Breakwater)

$X / L = 400 / 65 = 6.2$

$Y / L = 200 / 65 = 3.1$

From chart of $b = 2.0\ L$ ➡ $k_d = 0.1$ then

$H_A = k_d * H_i = 0.1 * 2.5$

$H_A = 0.25$ m

For Breakwater Gap of 400 m

$b / L = 400 / 65 = 6.2 > 5$ (Single Breakwater)

$\alpha = 45^o$, $R = 282$ m and $\theta = 90^o$

$R / L = 282 / 65 = 4.34$

From chart of $\theta = 90^o$ or Table (3-2) ➡ $k_d = 0.145$ then

$H_A = k_d * H_i = 0.145 * 2.5$

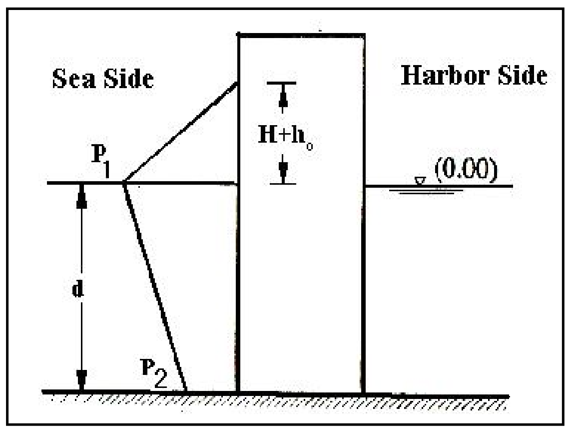
$H_A = 0.36$ m

٤-٣ قوة الأمواج على الحوائط الراسية: Wave Forces

I- Non-Breaking Zone

$$\frac{H}{d} < 1.0$$

Sainflou Formula



$$h_o = \frac{kH^2}{2\tanh(kd)} \quad , \quad k = 2\pi/L$$

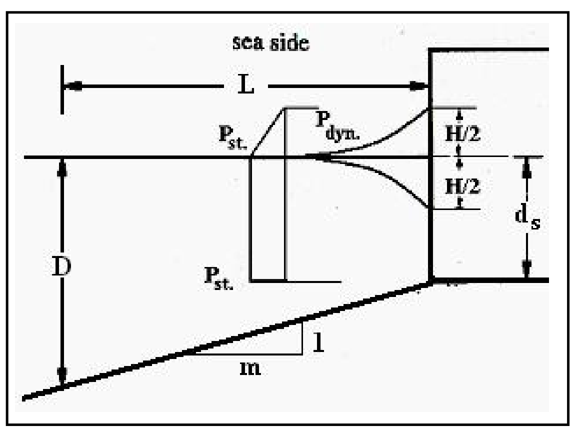
$$P_2 = \frac{\gamma H}{\cosh(kd)}$$

$$P_1 = (\gamma d + P_2)\left(\frac{H + h_o}{H + h_o + d}\right)$$

II- Breaking Zone:

$$\frac{H}{d_s} \geq 1.0$$

Miniken Formula



$$P_{dyn} = 101\gamma \frac{H_b}{L_D} \frac{d_s}{D} (D + d_s)$$

$$P_{st.} = \frac{\gamma H_b}{2}$$

$D = m*L + d_s$

$L : d_s$ طول موجي عند الحاجز على عمق

L_D: طول موجي على عمق D

Example (3-6) :

Calculate the maximum wave impact forces and moments on a vertical wall if the water depth at the breakwater site is 12.0 m, the deep wave height is 5.0 m, and the wave period is 8.0 sec. (k_r = 0.90).

SOLUTION

$L_o = 1.56 * T^2$ → $L_o = 1.56 * (8)^2$

Then, $L_o = 100$ m

***For d = 12 m**

$d / L_o = 12 / 100 = 0.12$ from Table (3-1)

$d / L = 0.1581$ and $k_s = 0.9204$

$L = 76$ m → $k = 2\pi/L = 0.083$

$H = H_o * k_s * k_r = 5.0 * 0.9204 * 0.90 = 4.2$ m

$H / d = 4.2 / 12 = 0.35 < 1.0$ (non - breaking)

Use Sainflou Formula

$$h_o = \frac{kH^2}{2\tanh(kd)} = \frac{0.083 * (4.2)^2}{2 * \tanh(0.083 * 12)}$$

$= 0.96$ m

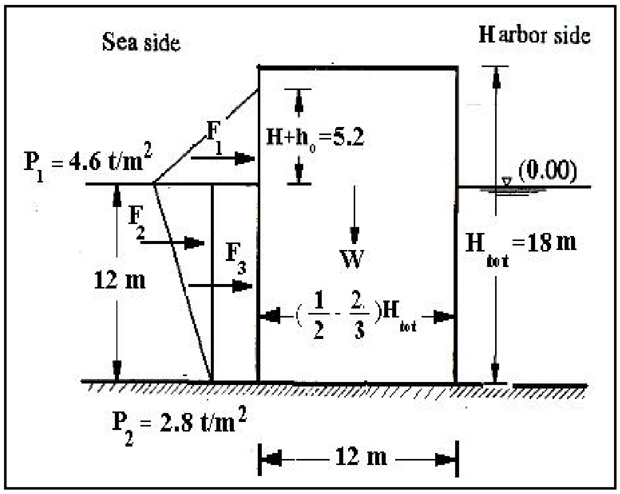
$$P_2 = \frac{\gamma H}{\cosh(kd)} = \frac{1.03 * 4.2}{\cosh(0.083 * 12)}$$

$= 2.81$ t/m^2

$$P_1 = (\gamma d + P_2)\left(\frac{H + h_o}{H + h_o + d}\right)$$

$$= (1.03 * 12 + 2.81)\left(\frac{4.2 + 0.96}{4.2 + 0.96 + 12}\right)$$

$= 4.56$ t/m^2



***Horizontal Force and Over Turning Moment:**

Horizontal Force		y	Moment
F_1= 0.5*4.6*5.2	= 12.0 t/m	13.7	164.4
F_2= 0.5*(4.6-2.8)*12	= 10.8 t/m	8.0	86.4
F_3= 2.8*12	= 33.6 t/m	6.0	201.6
H_{total}	= 56.4 t/m	M_{ov}	452.4