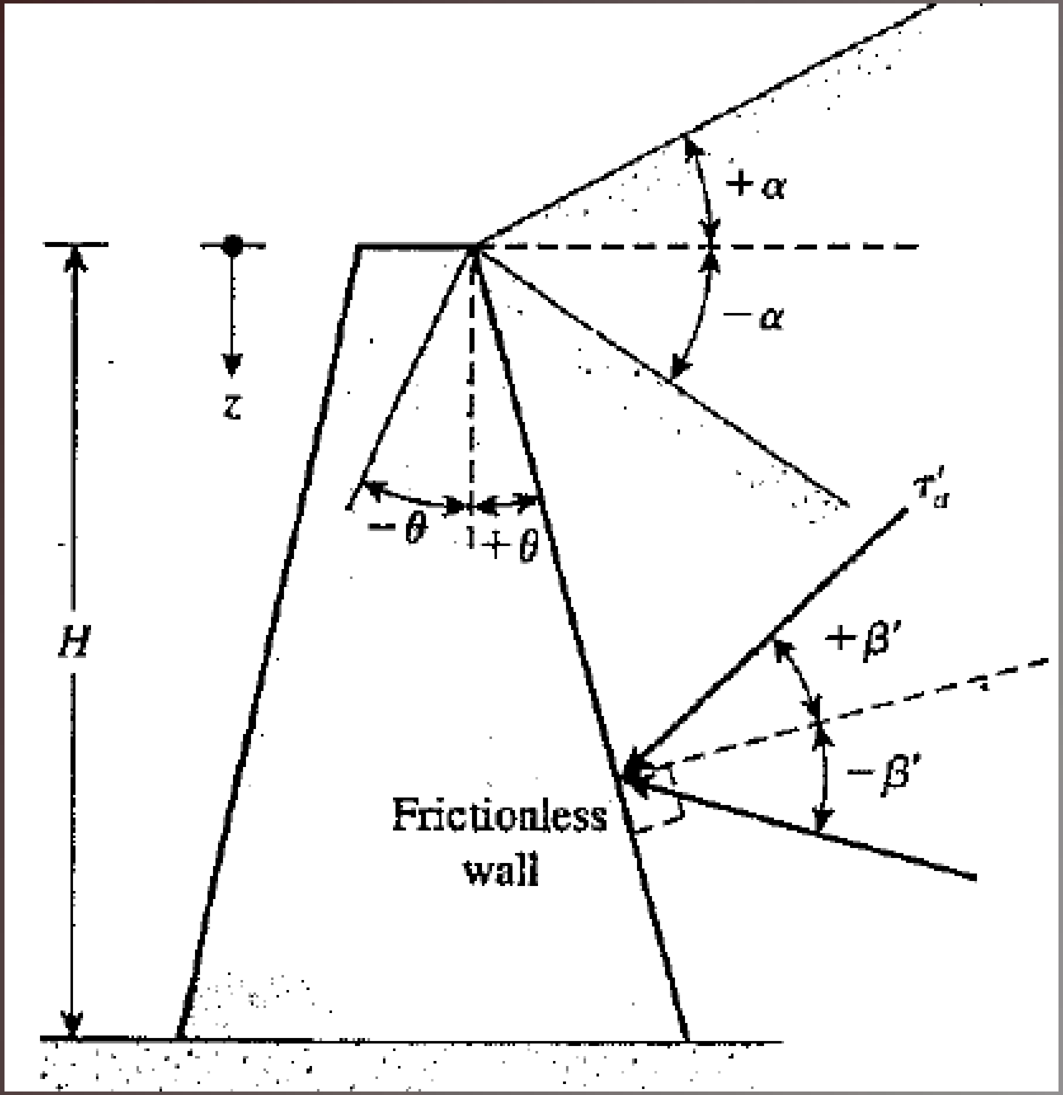
RANKINE – AKTIF – NON KOHESIF



General Case

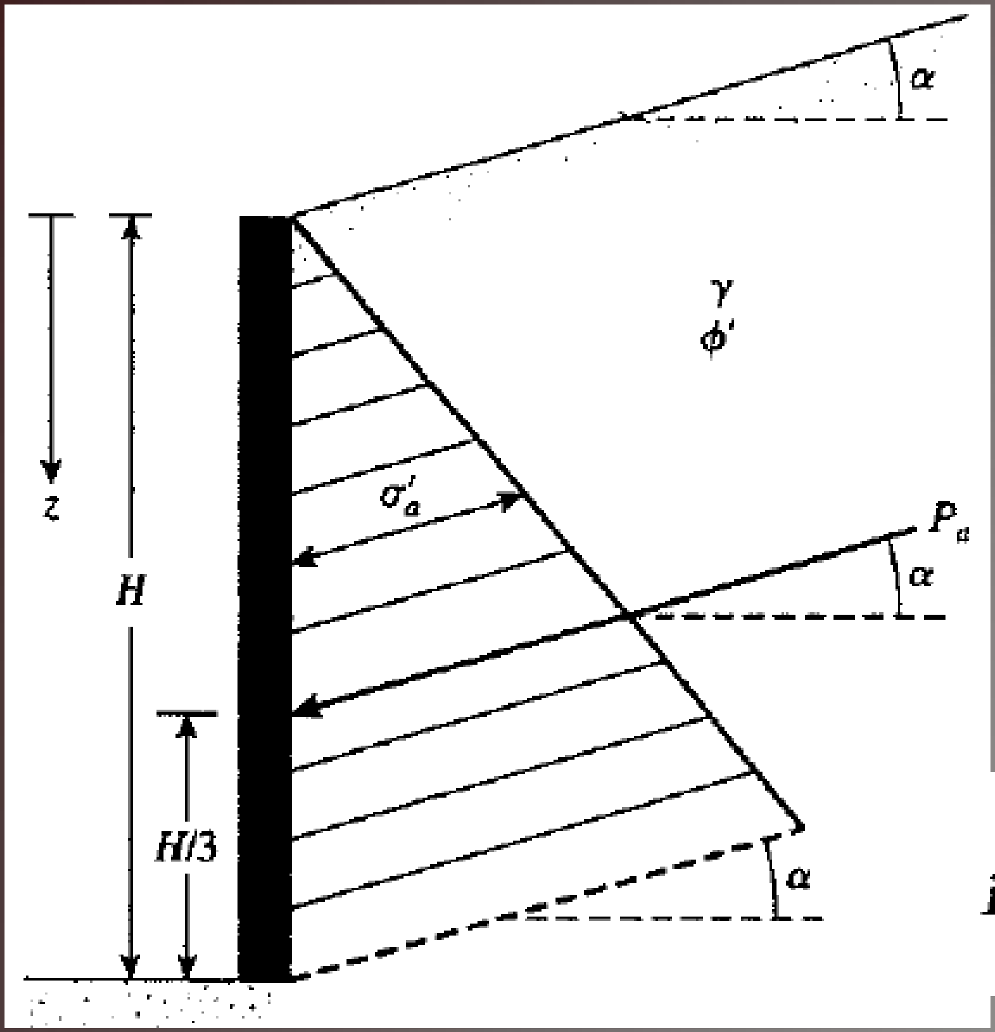
RANKINE – AKTIF – NON KOHESIF

$$K_a = \frac{\cos(\alpha - \theta)\sqrt{1 + \sin^2\phi' - 2\sin\phi'\cos\psi_a}}{\cos^2\theta\left(\cos\alpha + \sqrt{\sin^2\phi' - \sin^2\alpha}\right)}$$

General Case

where $\psi_a = \sin^{-1}\left(\frac{\sin\alpha}{\sin\phi'}\right) - \alpha + 2\theta.$

RANKINE – AKTIF – NON KOHESIF



Vertical Back Wall

$$K_a = \cos\alpha \frac{\cos\alpha - \sqrt{\cos^2\alpha - \cos^2\phi'}}{\cos\alpha + \sqrt{\cos^2\alpha - \cos^2\phi'}}$$

RANKINE – AKTIF – c and ϕ Soil

$$K'_a = \frac{1}{\cos^2\phi'}\left\{\begin{array}{l} 2\cos^2\alpha + 2\left(\frac{c'}{\gamma z}\right)\cos\phi'\sin\phi' \\ -\sqrt{\left[4\cos^2\alpha(\cos^2\alpha - \cos^2\phi') + 4\left(\frac{c'}{\gamma z}\right)^2\cos^2\phi' + 8\left(\frac{c'}{\gamma z}\right)\cos^2\alpha\sin\phi'\cos\phi'\right]}\end{array}\right\} - 1$$

$$z_c = \frac{2c'}{\gamma}\sqrt{\frac{1+\sin\phi'}{1-\sin\phi'}}$$

Ingat tanah c → Tension Crack

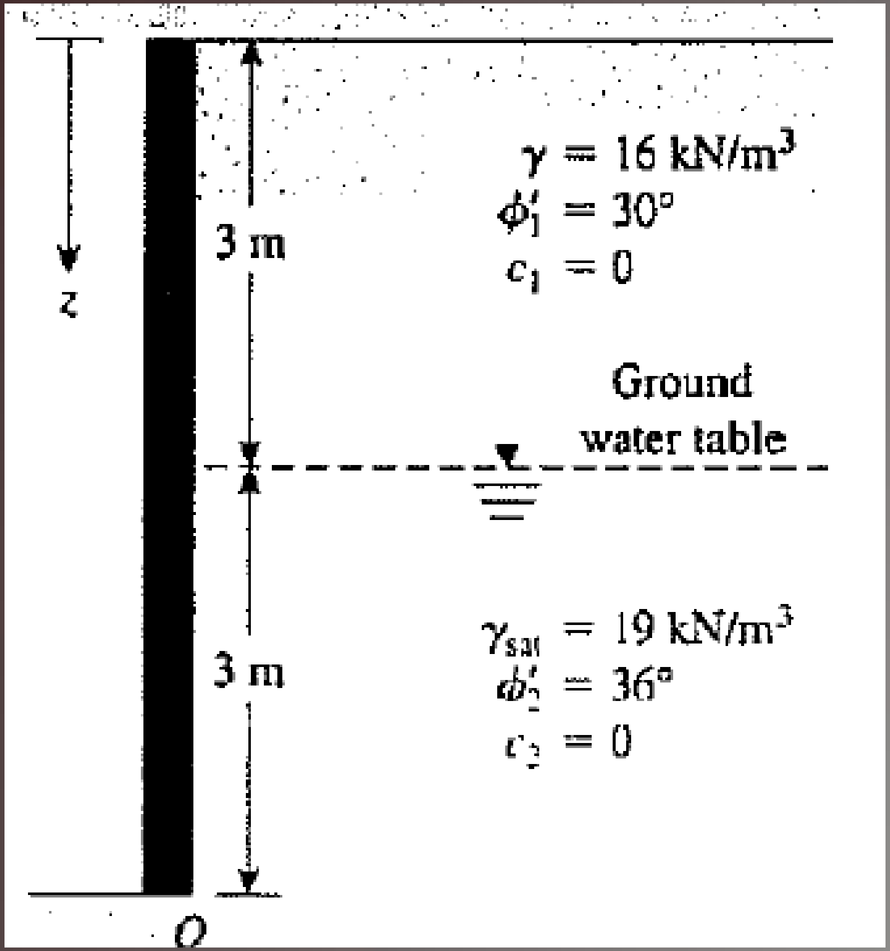
RANKINE – AKTIF – c and ϕ Soil

Table 7.2 Values of K'_a

ϕ' (deg)	α (deg)	$\frac{c'}{\gamma z}$ = 0.025	0.05	0.1	0.5
15	0	0.550	0.512	0.435	−0.179
	5	0.566	0.525	0.445	−0.184
	10	0.621	0.571	0.477	−0.186
	15	0.776	0.683	0.546	−0.196
20	0	0.455	0.420	0.350	−0.210
	5	0.465	0.429	0.357	−0.212
	10	0.497	0.456	0.377	−0.218
	15	0.567	0.514	0.417	−0.229
25	0	0.374	0.342	0.278	−0.231
	5	0.381	0.348	0.283	−0.233
	10	0.402	0.366	0.296	−0.239
	15	0.443	0.401	0.321	−0.250
30	0	0.305	0.276	0.218	−0.244
	5	0.309	0.280	0.221	−0.246
	10	0.323	0.292	0.230	−0.252
	15	0.350	0.315	0.246	−0.263

RANKINE – AKTIF

Contoh :

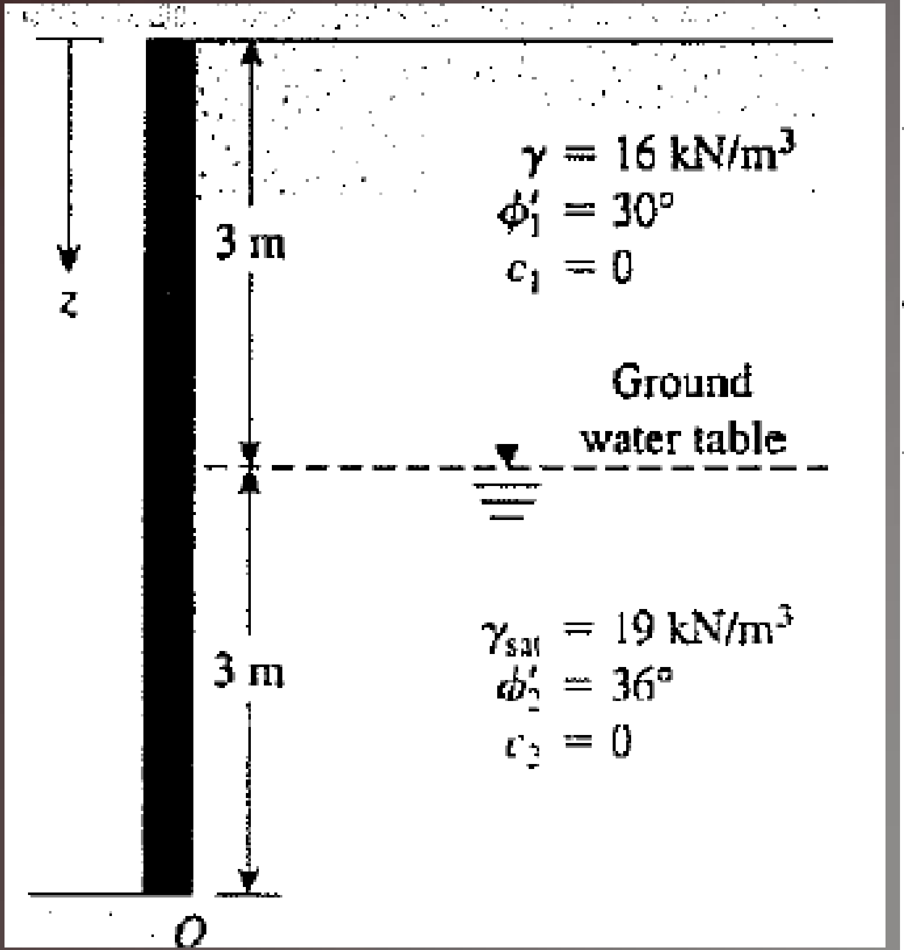


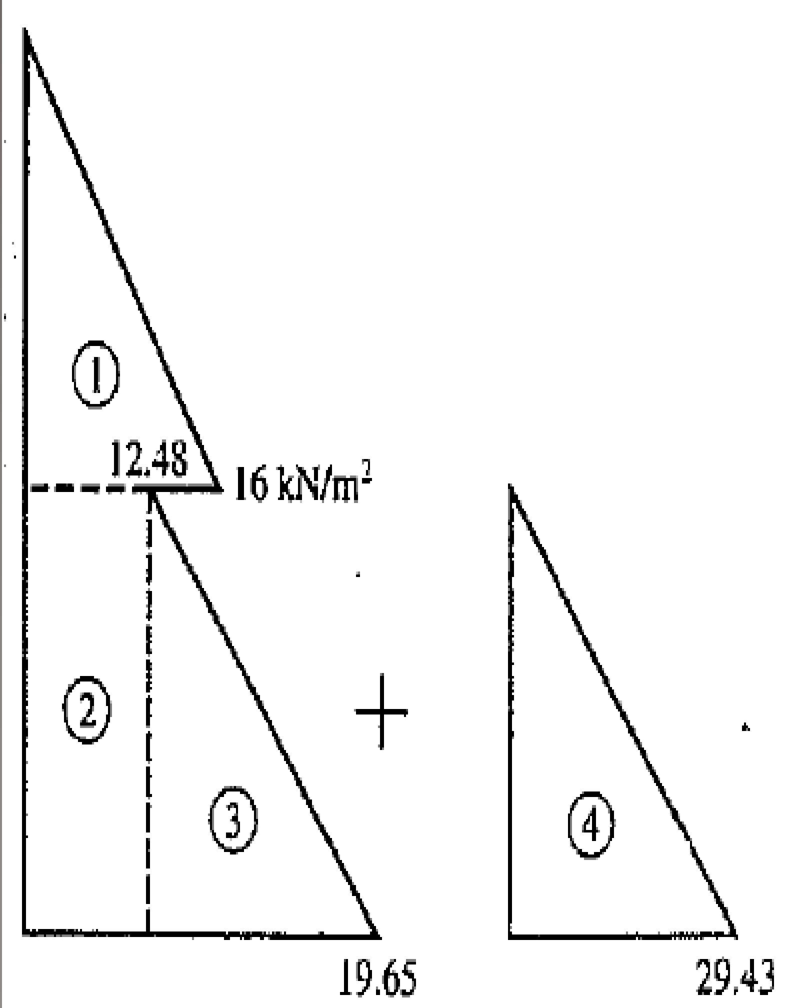
Ditanyakan :

- Gambar distibusi tegangan
- Nilai resultant gaya
- Titik tangkap

RANKINE – AKTIF

Contoh :





RANKINE – AKTIF

For the top soil layer, $\phi'_1 = 30°$, so

$$K_{a(1)} = \tan^2\left(45 - \frac{\phi'_1}{2}\right) = \tan^2(45 - 15) = \frac{1}{3}$$

Similarly, for the bottom soil layer, $\phi'_2 = 36°$, and

$$K_{a(2)} = \tan^2\left(45 - \frac{36}{2}\right) = 0.26$$

Because of the presence of the water table, the effective lateral pressure and the hydrostatic pressure have to be calculated separately.

At $z = 0$, $\sigma'_O = 0$, $\sigma'_a = 0$
At $z = 3$ m, $\sigma'_O = \gamma z = (16)(3) = 48$ kN/m^2

At this depth, for the top soil layer,

$$\sigma'_a = K_{a(1)}\sigma'_O = (\tfrac{1}{3})(48) = 16 \text{ kN/m}^2$$

Similarly, for the bottom soil layer,

$$\sigma'_a = K_{a(2)}\sigma'_O = (0.26)(48) = 12.48 \text{ kN/m}^2$$

RANKINE – AKTIF

At $z = 6$ m,

$$\sigma'_O = (\gamma)(3) + (\gamma_{sat} - \gamma_w)(3) = (16)(3) + (19 - 9.81)(3)$$
$$= 48 + 27.57 = 75.57 \text{ kN/m}^2$$

$$\sigma'_a = K_{a(2)}\sigma'_O = (0.26)(75.57) = 19.65 \text{ kN/m}^2$$

The hydrostatic pressure u is zero from $z = 0$ to $z = 3$ m. At $z = 6$ m, $u = 3\gamma_w = 3(9.81) = 29.43$ kN/m^2. The pressure distribution diagram is plotted in Figure 7.9b. The force per unit length

$$P_a = \text{Area 1} + \text{Area 2} + \text{Area 3} + \text{Area 4}$$
$$= \tfrac{1}{2}(3)(16) + (3)(12.48) + \tfrac{1}{2}(3)(19.65 - 12.48) + \tfrac{1}{2}(3)(29.43)$$
$$= 24 + 37.44 + 10.76 + 44.15 = 116.35 \text{ kN/m}$$

The distance of the line of action of the resultant from the bottom of the wall ($\bar{z}$) can be determined by taking the moments about the bottom of the wall (point O in Figure 7.9a), or

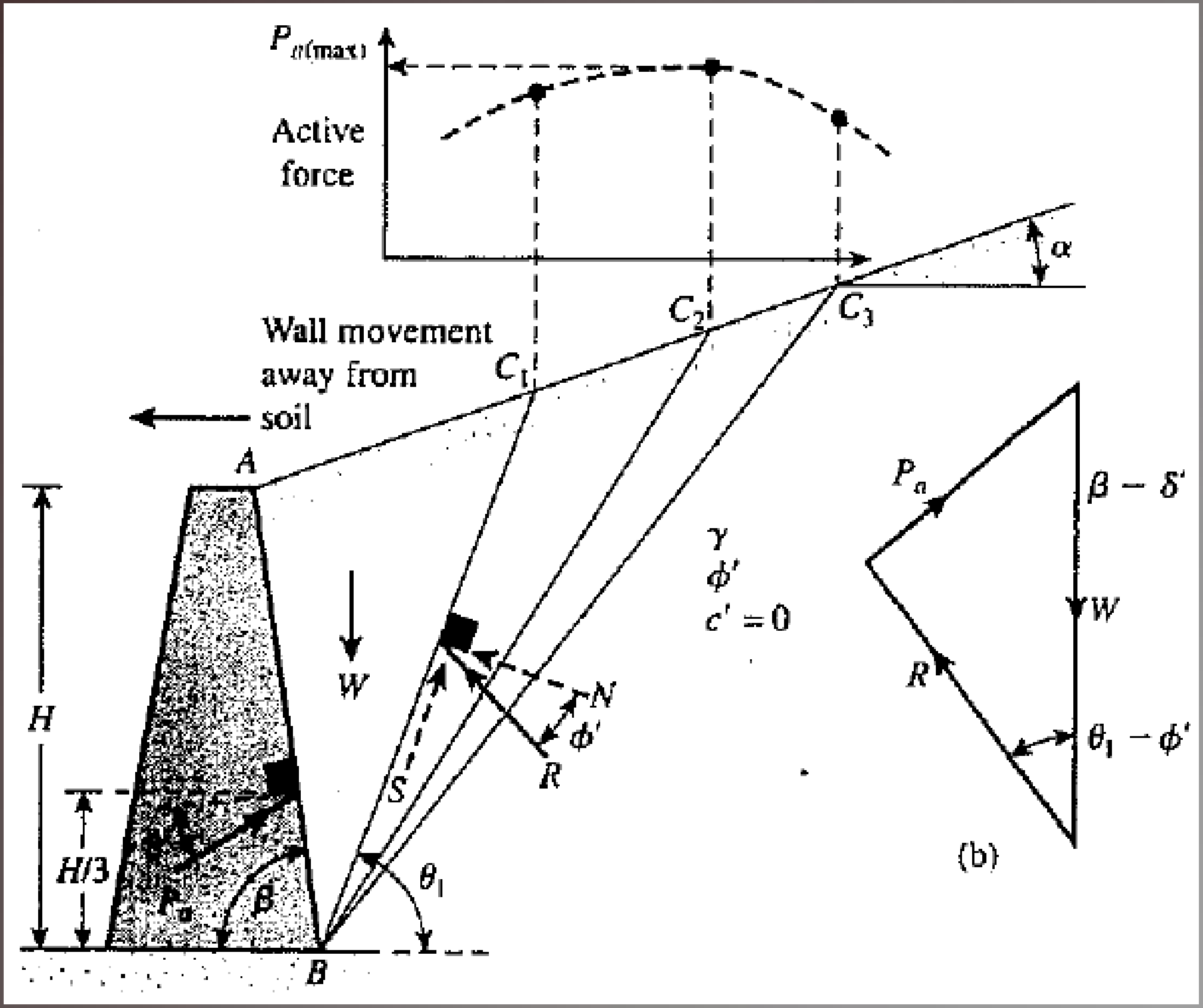
RANKINE – AKTIF

$$\bar{z} = \frac{(24)\left(3 + \frac{3}{3}\right) + (37.44)\left(\frac{3}{2}\right) + (10.76)\left(\frac{3}{3}\right) + (44.15)\left(\frac{3}{3}\right)}{116.35}$$

$$= \frac{96 + 56.16 + 10.76 + 44.15}{116.35} = \mathbf{1.779\ m}$$

■

COULOMB–AKTIF–NON KOHESIF



COULOMB–AKTIF–NON KOHESIF

K_a = Coulomb's active earth pressure coefficient

$$= \frac{\sin^2(\beta + \phi')}{\sin^2\beta \sin(\beta - \delta')\left[1 + \sqrt{\frac{\sin(\phi' + \delta')\sin(\phi' - \alpha)}{\sin(\beta - \delta')\sin(\alpha + \beta)}}\right]^2}$$

In the actual design of retaining walls, the value of the wall friction angle δ' is assumed to be between $\phi'/2$ and $\frac{2}{3}\phi'$. The active earth pressure coefficients for various values of ϕ', α, and β with $\delta' = \frac{1}{2}\phi'$ and $\frac{2}{3}\phi'$ are respectively given in Tables 7.4 and 7.5. These coefficients are very useful design considerations.

COULOMB–AKTIF–NON KOHESIF

Table 7.3 Values of K_a [Eq. (7.26)] for $\beta = 90°$ and $\alpha = 0°$

	δ' (deg)					
ϕ' (deg)	0	5	10	15	20	25
28	0.3610	0.3448	0.3330	0.3251	0.3203	0.3186
30	0.3333	0.3189	0.3085	0.3014	0.2973	0.2956
32	0.3073	0.2945	0.2853	0.2791	0.2755	0.2745
34	0.2827	0.2714	0.2633	0.2579	0.2549	0.2542
36	0.2596	0.2497	0.2426	0.2379	0.2354	0.2350
38	0.2379	0.2292	0.2230	0.2190	0.2169	0.2167
40	0.2174	0.2098	0.2045	0.2011	0.1994	0.1995
42	0.1982	0.1916	0.1870	0.1841	0.1828	0.1831

COULOMB–AKTIF–NON KOHESIF

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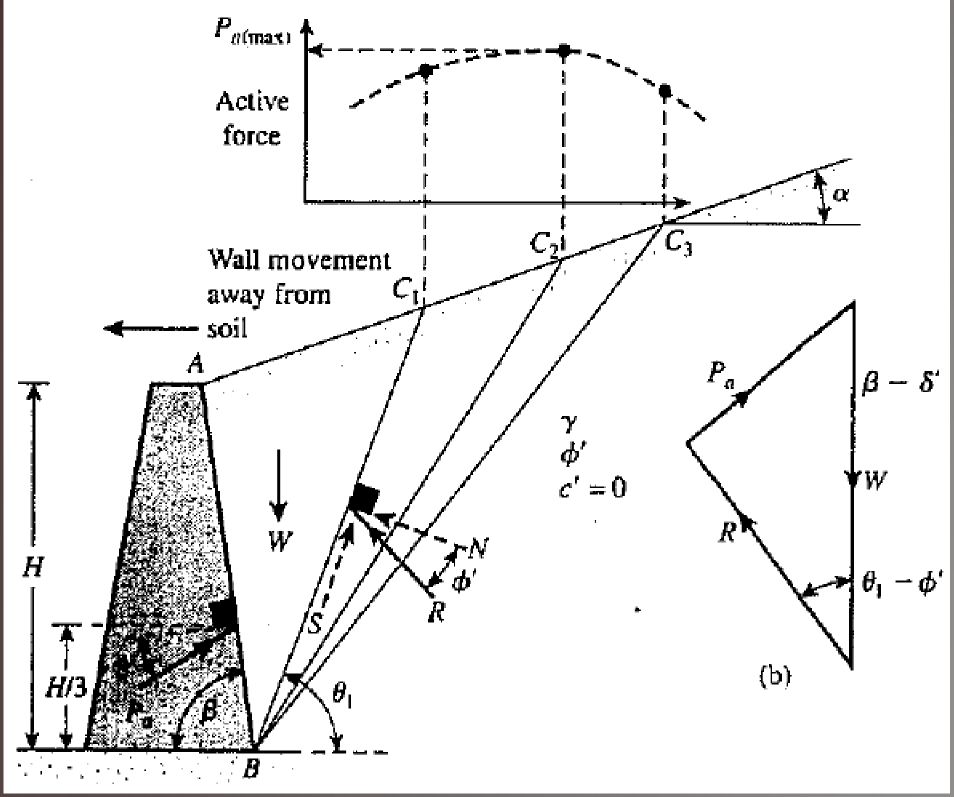
40	0.2174	0.2098	0.2045	0.2011	0.1994	0.1995
42	0.1982	0.1916	0.1870	0.1841	0.1828	0.1831

Contoh

Consider the retaining wall shown in Figure 7.10a. Given: $H = 4.6$ m; unit weight of soil = 16.5 kN/m^3; angle of friction of soil = 30°; wall friction-angle, $\delta' = \frac{2}{3}\phi'$, soil cohesion, $c' = 0$; $\alpha = 0$, and $\beta = 90°$. Calculate the Coulomb's active force per unit length of the wall.



Contoh

$$P_a = \frac{1}{2}\gamma H^2 K_a$$

, for $\alpha = 0°, \beta = 90°, \phi' = 30°$, and $\delta' = \frac{2}{3}\phi' = 20°, K_a = 0.297$. Hence,

$$P_a = \frac{1}{2}(16.5)(4.6)^2(0.297) = \mathbf{51.85\ kN/m}$$