TEGANGAN YANG BEKERJA PADA PONDASI

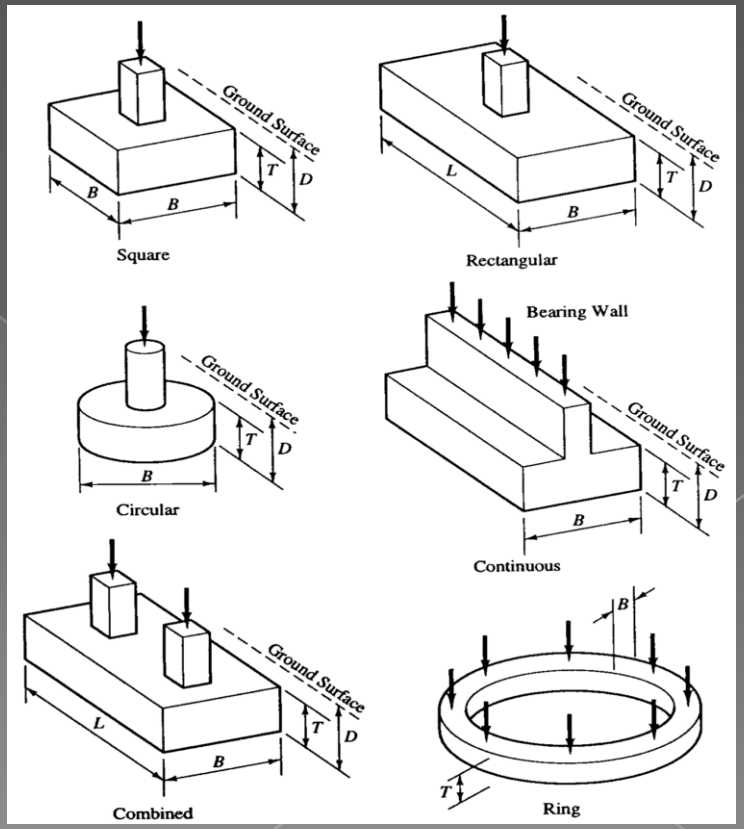
TEGANGAN TANAH

- Tujuan akhir : Untuk menghitung penurunan
- Sudah pernah dipelajari di Mekanika Tanah 1 → Lihat lagi pelajaran mekanika tanah di Semester 2 tentang " Stress Distribution in Soils"
- Yang dipelajari (diulangi) di Pondasi 1 hanya akibat beban merata, dan tegangan vetikal tanah (over burden pressure, total/efektif)

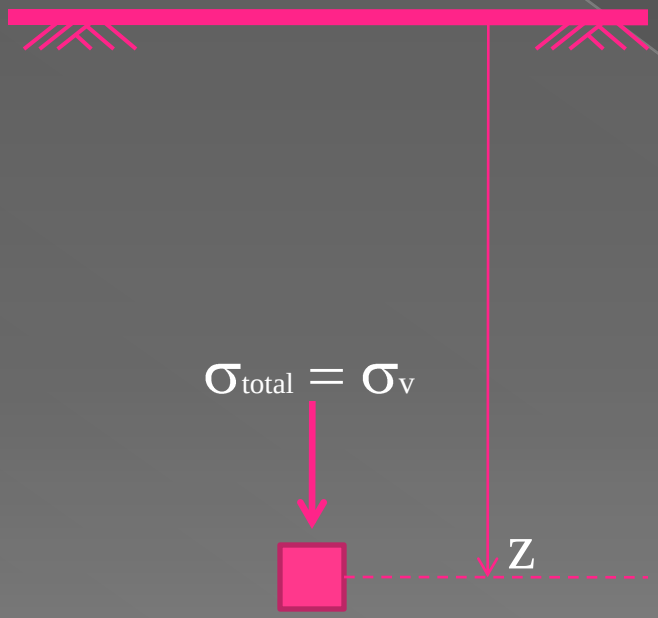
JENIS BEBAN

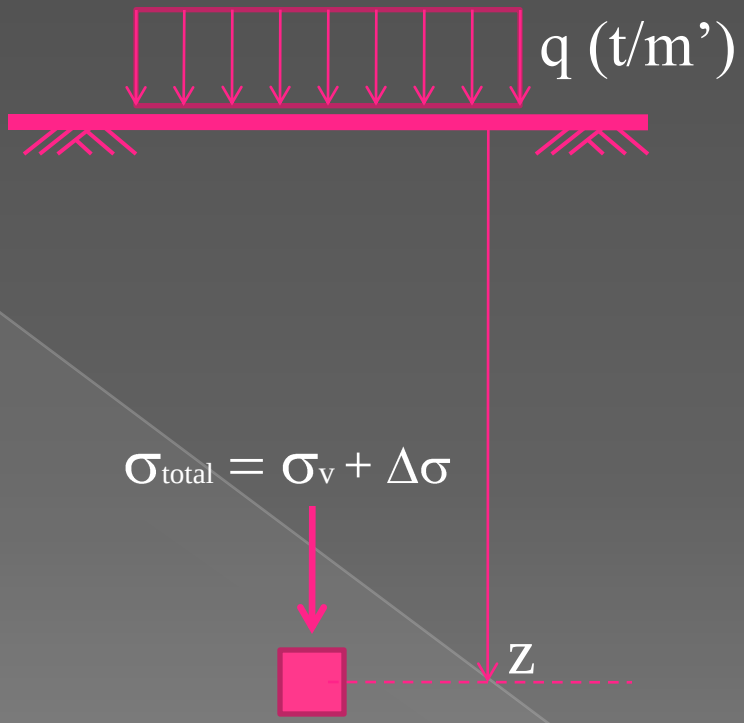
Jenis-jenis beban pada pondasi :

- Beban merata persegi
- Beban merata lingkaran



EFEK BEBAN KE TANAH





METODE PERHITUNGAN

Metode menghitung distribusi tegangan :

- Boussinesq
- Westergaard
- Sederhana
- 2 : 1

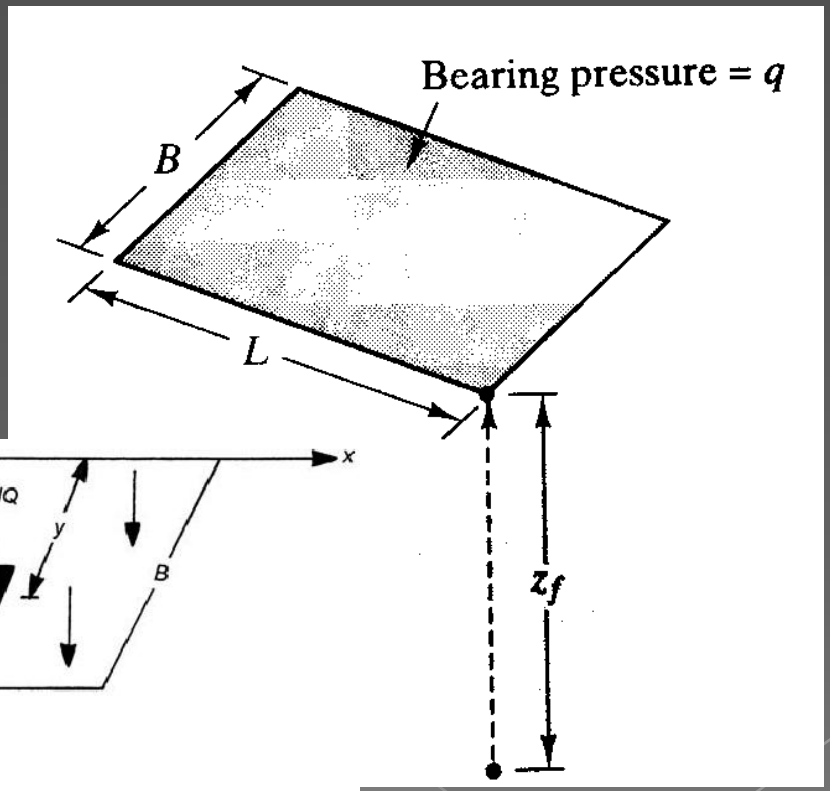
METODE BOUSSINESQ PONDASI SETEMPAT

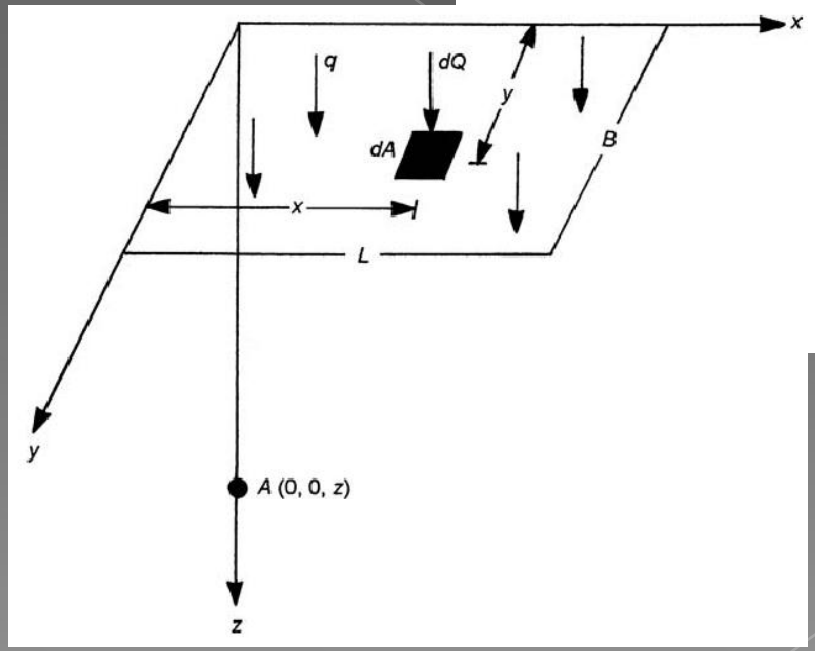
METODE BOUSSINESQ

ASUMSI : Tanah adalah isotropik (Tegangan ke segala arah sama, $K_0 = 1$)

$m = B/z$

$n = L/z$





METODE BOUSSINESQ

- Jika $m^2 + n^2 + 1 < m^2 n^2$

$$\Delta\sigma_v' = \frac{q'}{k\pi}\left[\frac{2mn\sqrt{m^2+n^2+1}}{m^2+n^2+1+m^2n^2}\cdot\frac{m^2+n^2+2}{m^2+n^2+1} + \pi - \sin^{-1}\left(\frac{2mn\sqrt{m^2+n^2+1}}{m^2+n^2+1+m^2n^2}\right)\right]$$

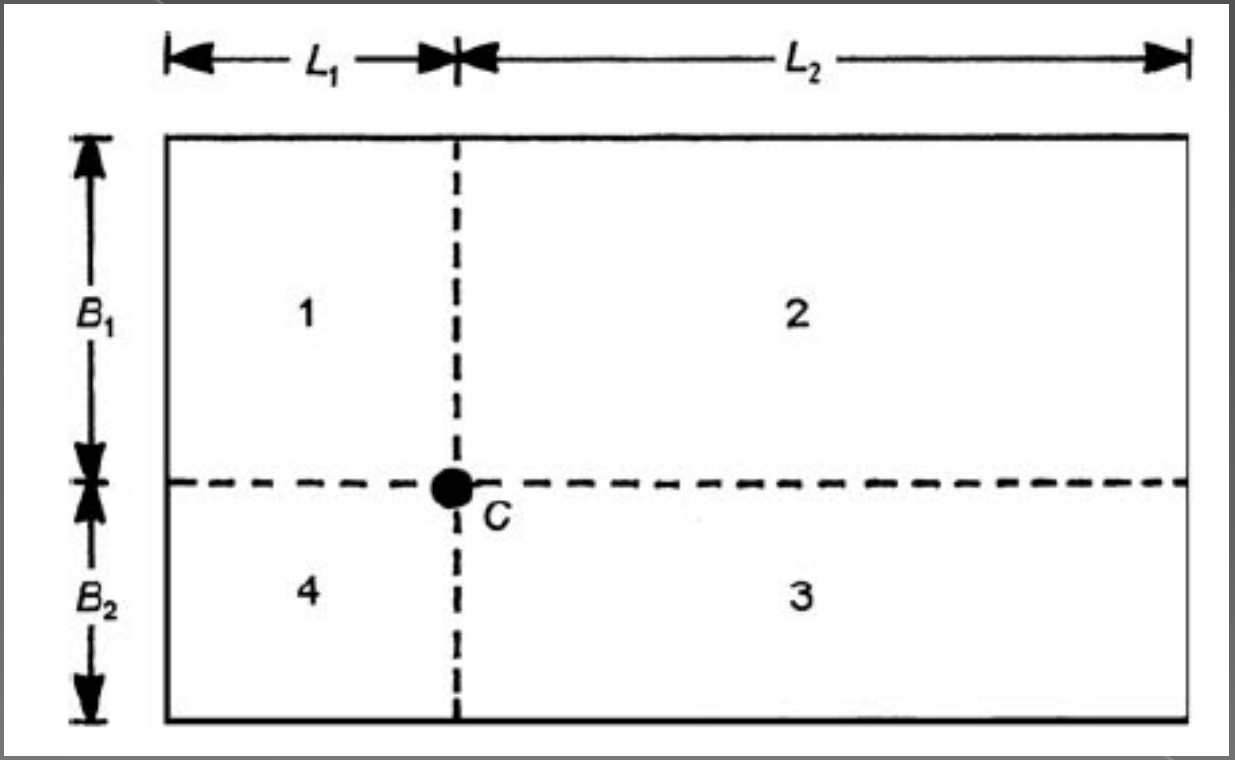
- Jika $m^2 + n^2 + 1 > m^2 n^2$

$$\Delta\sigma_v' = \frac{q'}{k\pi}\left[\frac{2mn\sqrt{m^2+n^2+1}}{m^2+n^2+1+m^2n^2}\cdot\frac{m^2+n^2+2}{m^2+n^2+1} + \sin^{-1}\left(\frac{2mn\sqrt{m^2+n^2+1}}{m^2+n^2+1+m^2n^2}\right)\right]$$

k = 4, untuk beban persegi dan titik di sudut

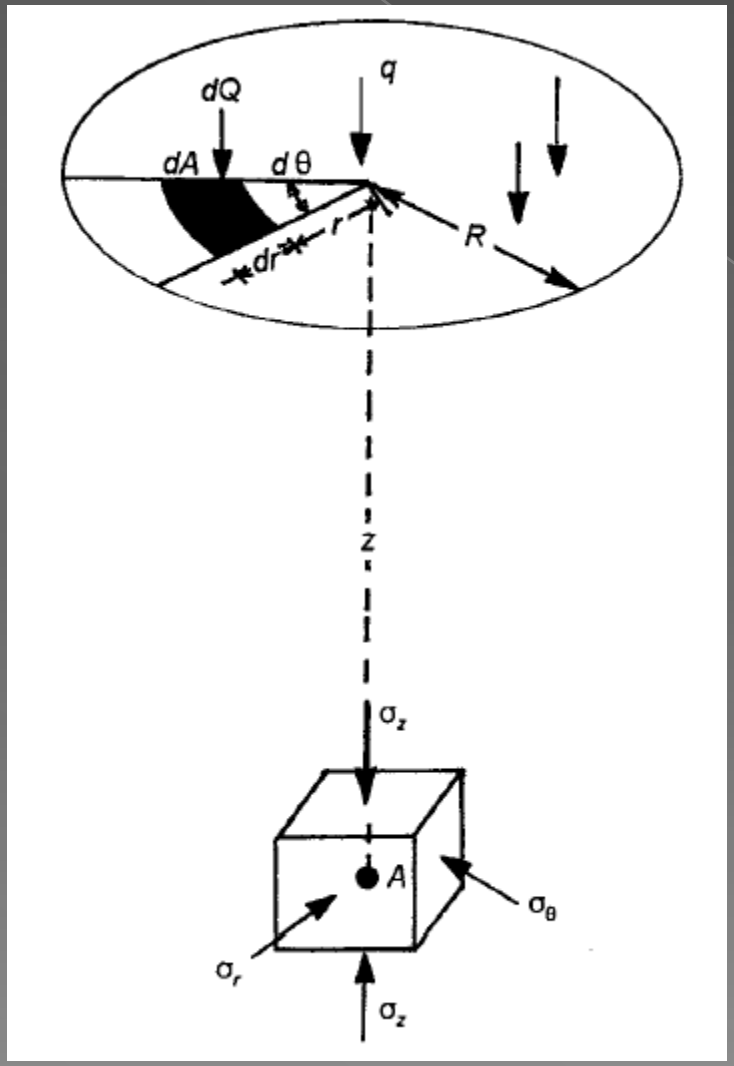
$\Delta\sigma$ = penambahan beban = q x I

METODE BOUSSINESQ



$\Delta\sigma = q \times (I_1 + I_2 + I_3 + I_4)$

METODE BOUSSINESQ



$$\sigma_z = q\left[1 - \frac{z^3}{(R^2 + z^2)^{3/2}}\right]$$

METODE BOUSSINESQ PONDASI MENERUS

METODE BOUSSINESQ

Untuk pondasi menerus :

- Jika $m > 1$:

$$\Delta\sigma_v' = \frac{q'}{k\pi}\left[\frac{2m}{1+m^2} + \pi - \sin^{-1}\left(\frac{2m}{1+m^2}\right)\right]$$

- Jika $m < 1$:

$$\Delta\sigma_v' = \frac{q'}{k\pi}\left[\frac{2m}{1+m^2} + \sin^{-1}\left(\frac{2m}{1+m^2}\right)\right]$$

Catatan : $\sin^{-1}$ dinyatakan dalam radian

METODE BOUSSINESQ

SHAPE	POSITION	k	m	n
Square	Corner	1	0.5 x B/z	0.5 x L/z
Square	Midpoint of edge	2	0.5 x Bz	L/z
Square	Corner	4	B/z	L/z
Rectangular	Corner	1	0.5 x B/z	0.5 x L/z
Rectangular	Midpoint of short edge	2	0.5 x B/z	L/z
Rectangular	Midpoint of long edge	2	B/z	0.5 x L/z
Rectangular	**Corner**	**4**	**B/z**	**L/z**
Continuous	Corner line	1	0.5 x B/z	
Continuous	**Edge**	**2**	**B/z**	

METODE WESTERGAARD

ASUMSI : Tanah adalah material lunak yang elastis, bisa untuk tanah anisotropi

$$\Delta\sigma_v' = \frac{2q'}{k\pi}\cot^{-1}\sqrt{\left(\frac{1-2\nu_p}{2-2\nu_p}\right)\left(\frac{1}{m^2}+\frac{1}{n^2}\right)+\left(\frac{1-2\nu_p}{2-2\nu_p}\right)\left(\frac{1}{m^2n^2}\right)}$$

dimana :

ν_p = Poisson's ratio ($\upsilon_p < 0.5$)

Cot^{-1} dinyatakan dalam radian

Untuk pondasi segi empat

METODE SEDERHANA

Untuk pondasi segi empat atau bujursangkar :

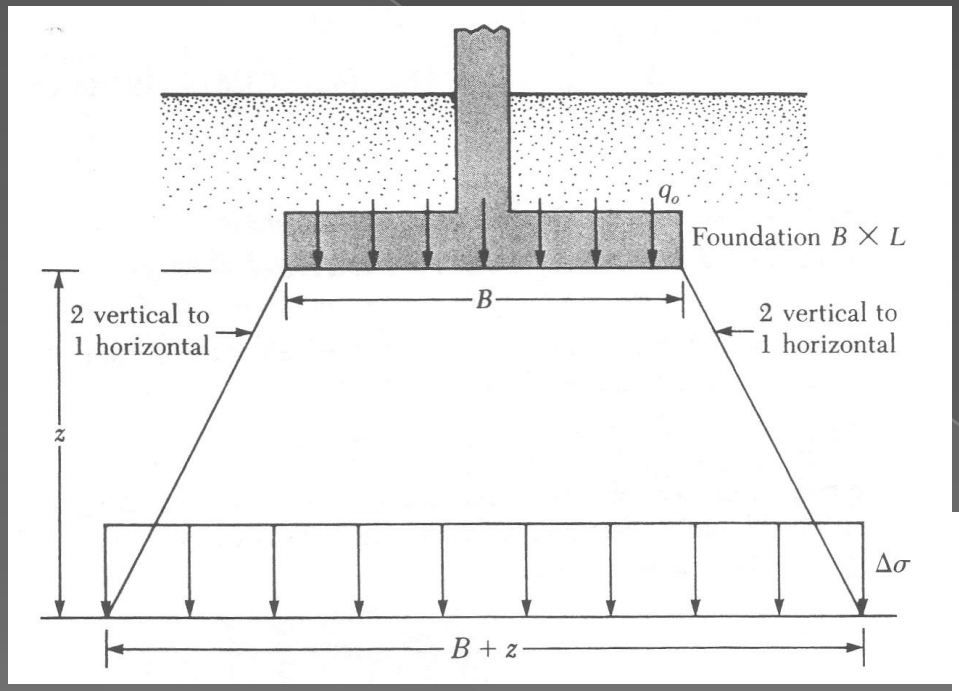
$$\Delta\sigma_v' = \left(\frac{1.7P}{(B+z_f)(L+z_f)}\right) - 0.05q' \qquad 0 \le \Delta\sigma_v' \le q'$$

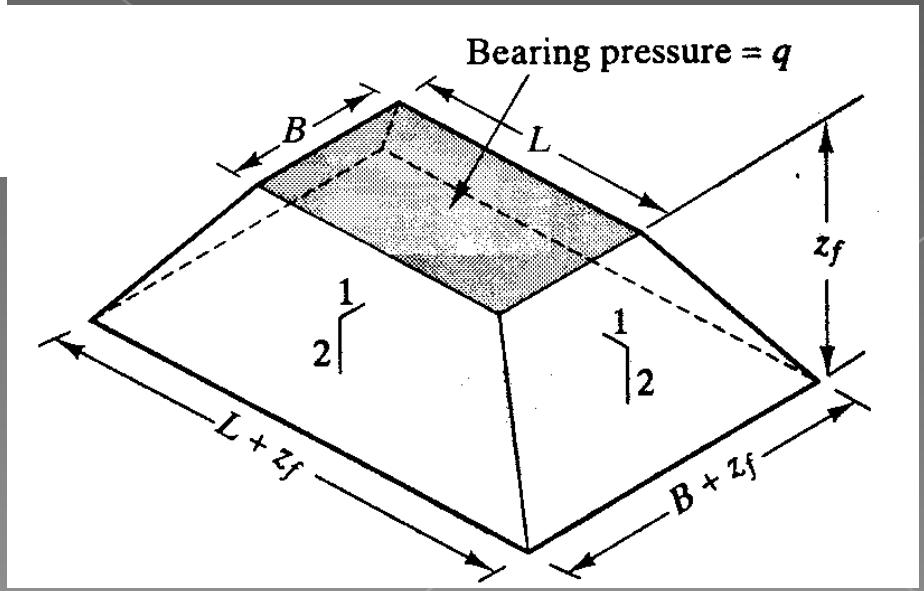
Untuk pondasi menerus :

$$\Delta\sigma_v' = \left(\frac{1.4\frac{P}{b}}{(B+1.3z_f}\right) - 0.05q' \qquad 0 \le \Delta\sigma_v' \le q'$$

$\Delta\sigma_v'$	= peningkatan tegangan vertikal di titik yang ditinjau pada tengah pondasi
P	= beban kolom
P/b	= beban dinding per satuan panjang
B	= lebar pondasi
L	= panjang pondasi
z_f	= kedalaman dihitung dari dasar pondasi
q'	= beban kerja

METODE 2 : 1 (Fled)





METODE 2 : 1 (Fled)

$$\Delta\sigma = \frac{q_o \; x \; B \; x \; L}{(B + z)\,(L + z)} \text{ atau } \Delta\sigma = \frac{Q}{(B + z)\,(L + z)}$$

dimana :

$\Delta\sigma$ = peningkatan tegangan (t/m^2)

q_o = ground pressures (t/m^2)

B = lebar pondasi (m)

L = panjang pondasi (m)

z = kedalaman (m)

Q = beban kerja (ton)

Formula ini mempunyai asumsi bahwa tegangan pondasi menyebar melalui garis dengan kemiringan vertikal terhadap horisontal sebesar 2 : 1,