KOMPRESIBILITAS TANAH
Komponen:

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Settlement/Penurunan Tanah

Bila suatu struktur dibangun di atas tanah, maka tanah akan mengalami deformasi (perubahan bentuk) *elastis* dan *plastis*

Dalam praktek rekayasa, perubahan bentuk ini disebut ***settlement*** *(penurunan tanah)* atau *heave* *(kenaikan muka tanah)* tergantung arah pembebanan.

Deformasi yang terjadi dalam areal yang luas dapat diasumsikan sebagai 1 dimensi

Komponen Penurunan Tanah

$$S = S_i + S_c + S_s$$

S_i = *Penurunan elastis (seketika)*
S_i = *Penurunan akibat pemadatan (seketika)*
S_c = *Penurunan akibat konsolidasi*
S_s = *Penurunan akibat penyusutan*

Immediate Settlement (Penurunan seketika)

Immediate settlement is time – independent and results from shear strain that occur at constant volume as the load is applied to the soil.

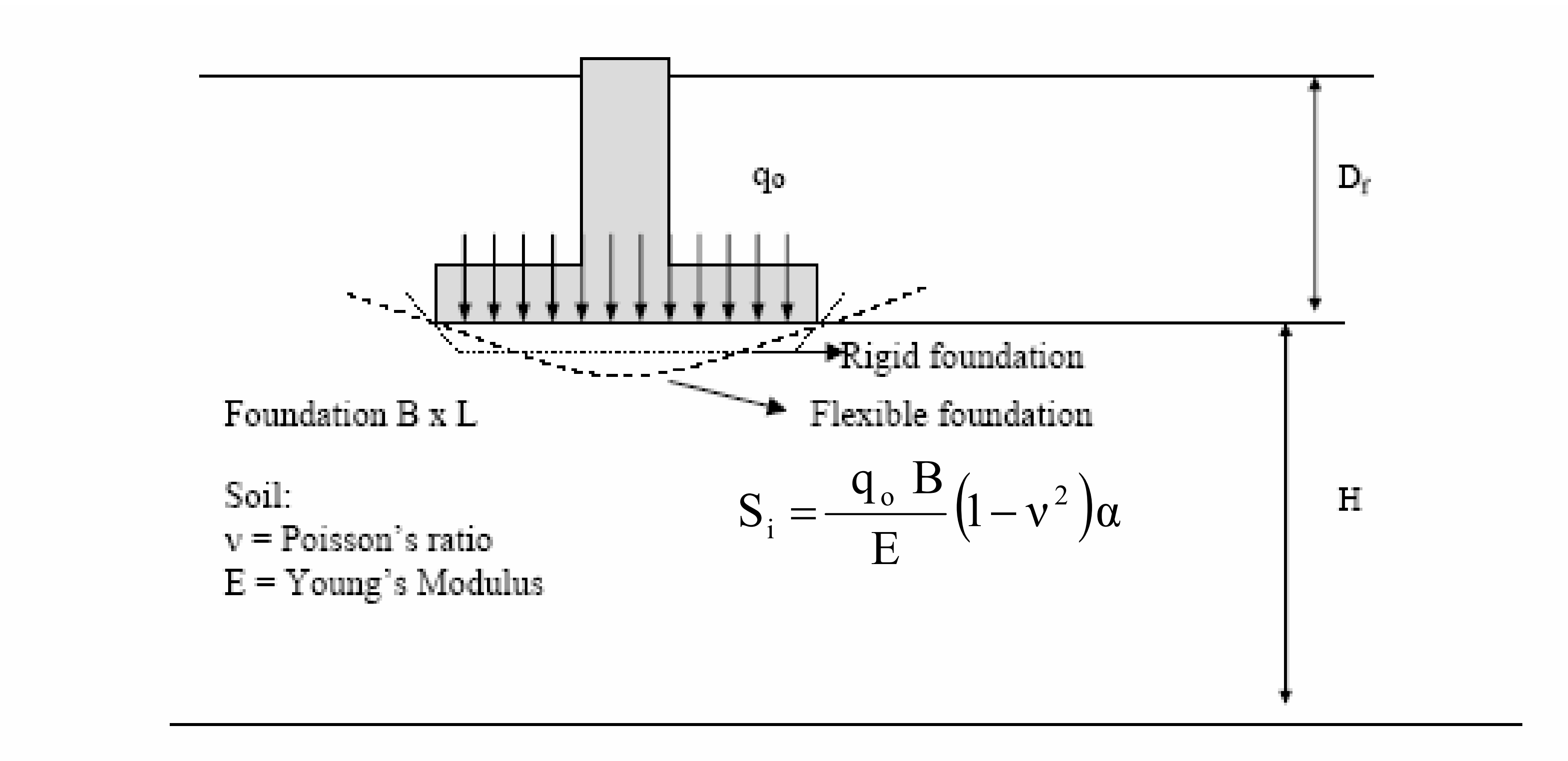
It is due to elastic Deformation of soil grain → *small and negligible*

Soil grains are not elastic → but generally calculated using elastic theory for cohesive soils

involves some assumptions such as homogeneity and isotropic which are not actually representative of natural soil properties.

Penurunan Seketika

ELASTIS



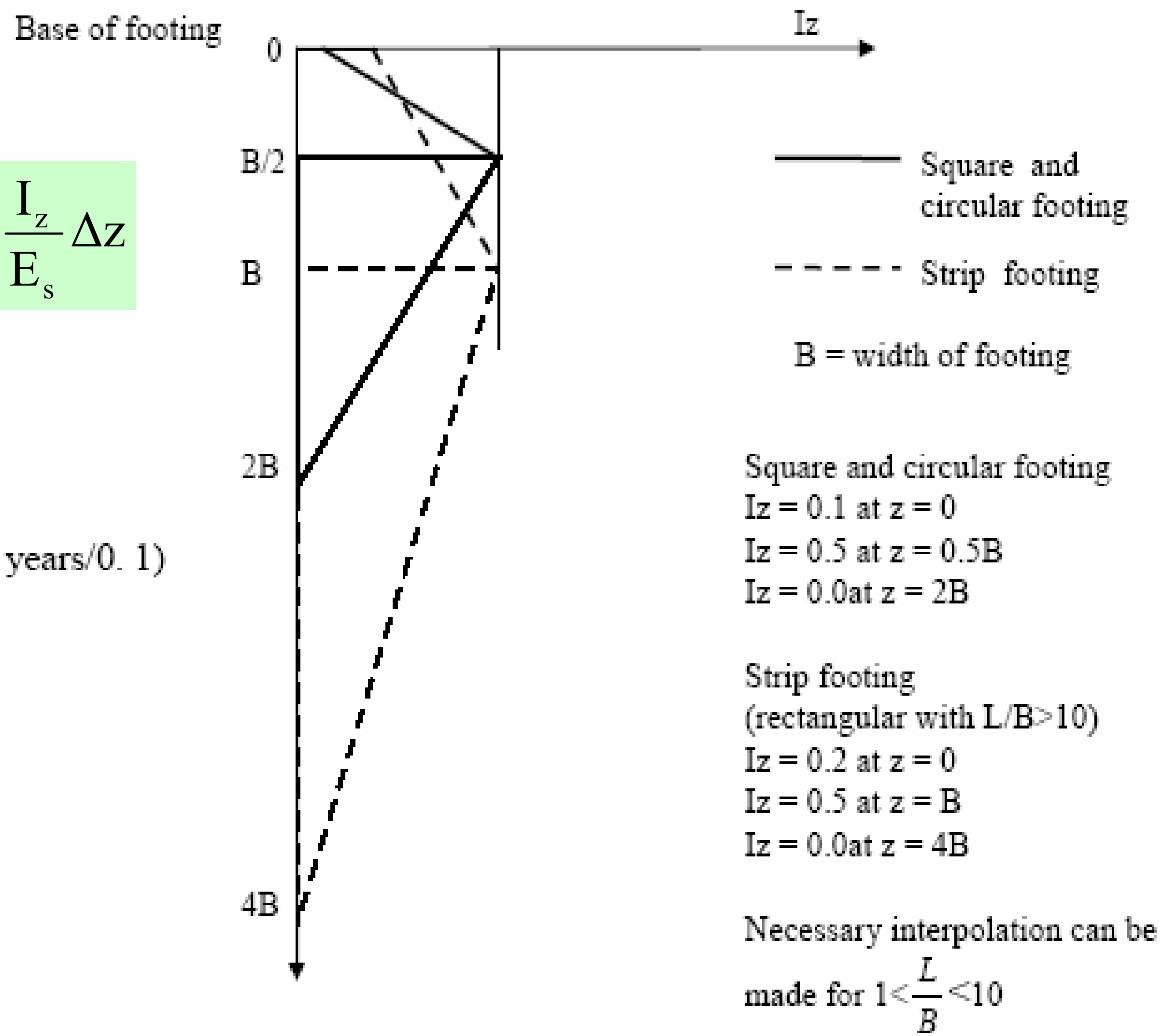
Penurunan Seketika

Metode Schmertmann

$$S_i = C_1 C_2 (q_o - q) \sum_{0}^{2B} \frac{I_z}{E_s} \Delta z$$

$$C_1 = 1 - 0.5 \left(\frac{q}{q_o - q} \right)$$

$$C_2 = 1 + 0.2 \log(\text{time in years}/0.1)$$



Influence factors for vertical displacement under footing on soil layer of infinite depth

Table 4.1 Influence factors for vertical displacement under footing on soil layer of infinite depth

Shape of footing base	α			
	Center	Edge/sides	Corner	Average
<u>Flexible foundations:</u>				
Circle	1.00	0.64	-	0.85
Square	1.12	0.76	0.56	0.95
Rectangular $L/B = 2$	1.53	1.12	0.76	1.30
Rectangular $L/B = 5$	2.10	1.68	1.05	1.82
Rectangular $L/B = 10$	2.56	2.10	1.28	2.24
<u>Rigid foundations:</u>				
Circle	0.79	0.79	-	0.79
Square	0.82	0.82	0.82	0.82
Rectangular $L/B = 2$	1.12	1.12	1.12	1.12
Rectangular $L/B = 5$	1.60	1.60	1.60	1.60
Rectangular $L/B = 10$	2.00	2.00	2.00	2.00

Influence factors for vertical displacement under footing on soil layer of limited depth

Table 4.2 Influence factors for vertical displacement under footing on soil layer of limited depth

Shape of footing base	α				
	$H/B = 1$	$H/B = 2$	$H/B = 5$	$H/B = 10$	$H/B = \infty$
Flexible foundations:					
Square $L/B = 1$	0.15	0.29	0.44	0.48	0.56
Rectangular $L/B = 2$	0.12	0.29	0.52	0.64	0.76
Rectangular $L/B = 5$	0.10	0.27	0.55	0.76	1.05
Rectangular $L/B = 10$	0.04	0.26	0.54	0.77	1.28
Rectangular $L/B = \infty$	0.04	0.26	0.52	0.73	-
Rigid foundations:					
Circle	0.35	0.54	0.69	0.74	0.79

Modulus Tanah

Masalah terbesar dalam perhitungan penurunan elastis adalah bagaimana mendapatkan modulus elastis tanah dengan tepat / akurat. Ada dua jenis modulus tanah (berdasarkan kondisi aliran air dalam tanah) yaitu:

- Undrained modulus (E_u)
- Drained / Deformation Modulus (E_d)

Undrained Modulus

Didapat dari:

Stress strain curve from Triaxial Test (not accurate)

Plate Load Test (Quick loading) (better)

Pressuremeter Test ($E_p \neq E_u \neq E_d$) (be careful)

Dilatometer Test (suggested)

Korelasi

Drained Modulus

Didapat dari:

- Oedometer Test

$$E_d = \frac{1}{m_v} = \frac{(1+e_o)}{\alpha_v} = \frac{(1+e_o)\sigma_{av}}{0.435C_c}$$

- Plate Load Test (Slow Loading) (better)
- Korelasi

Korelasi Modulus

Berdasarkan hasil penyelidikan Lapangan

Untuk hasil sondir/CPT, Schmertman (1978) menyarankan $E_s = 2.5\ q_c$ untuk podasi setempat, dan $E_s = 3.5\ q_c$ untuk pondasi menerus

Untuk hasil SPT, hubungan empiris yang disarankan adalah:
$E_s = 766\ N\ (kN/m^2)$

Untuk hasil vane shear test (VST) data (c_u):
$E_u = 500 – 1500\ c_u$

Modulus & Angka Poisson

Berdasarkan Jenis Tanah

Table 4.3 Values of Modulus and Poisson's ratio

Soil Type	Cohesion (kPa)	Young's modulus *E* (MPa)	Poisson's ratio ν
Soft clay	< 25	2.5 - 15	0.40 – 0.50
Medium to stiff clay	25 – 100	15 – 50	0.45 – 0.50
Very Stiff to hard clay	> 100 kPa	50 – 100	0.45 – 0.50
Sandy Clay		25 – 250	
Silty Sand		5 – 20	
Loose sand		10 – 25	0.20 – 0.40
Dense sand		50 – 81	
Silt		2 - 20	