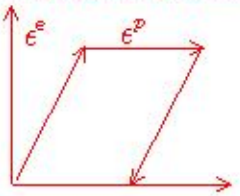
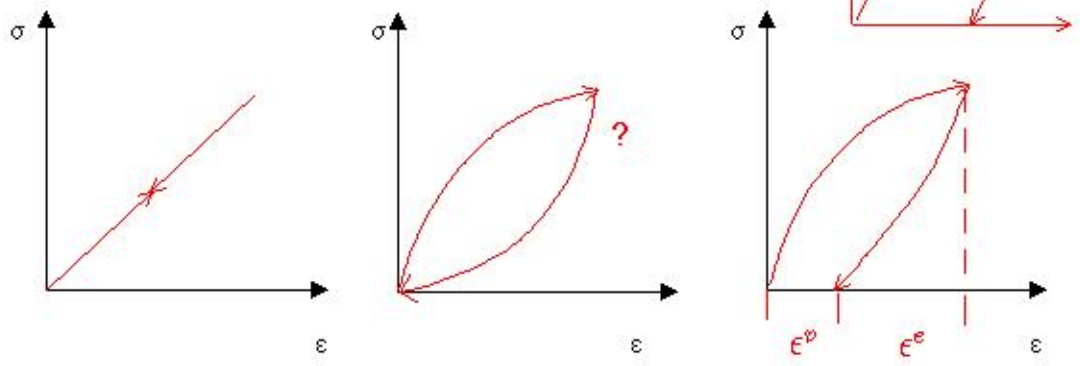
1. Stress-strain relationship

linear elastic-perfectly plastic



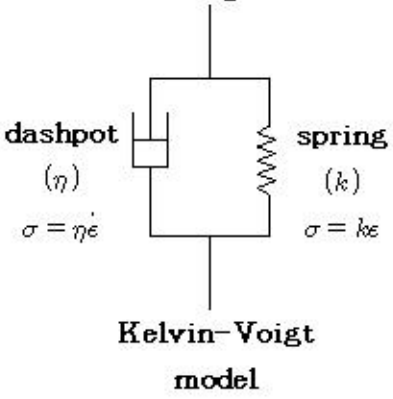
○ Time independent



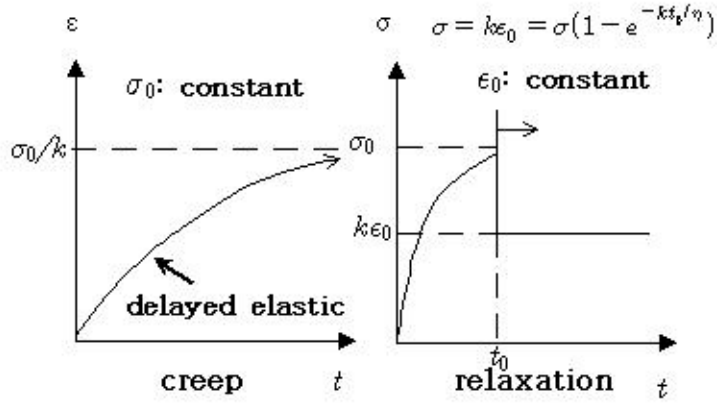
linear-elastic nonlinear-elastic nonlinear elastic-plastic

○ Time dependent (Visco-elastic)

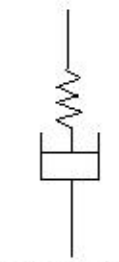
-Rheological-



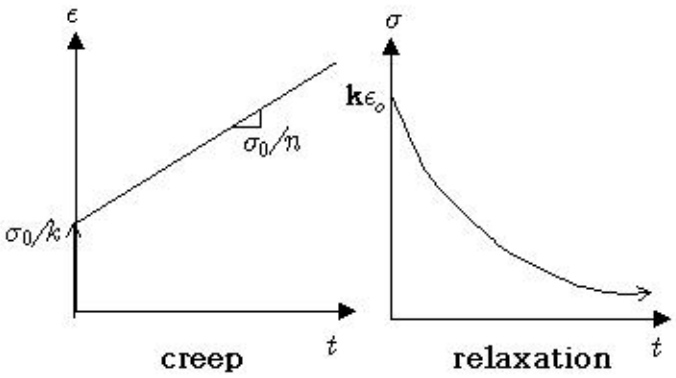
Kelvin-Voigt model



K-V model



Maxwell model



Maxwell model

○ Linear elastic, isotropic, & homogeneous case

$$\varepsilon_x = \frac{1}{E}(\sigma_x - \nu\sigma_y - \nu\sigma_z)$$

$$\varepsilon_y = \frac{1}{E}(\sigma_y - \nu\sigma_z - \nu\sigma_x)$$

$$\varepsilon_z = \frac{1}{E}(\sigma_z - \nu\sigma_x - \nu\sigma_y)$$

E : **Young's modulus**

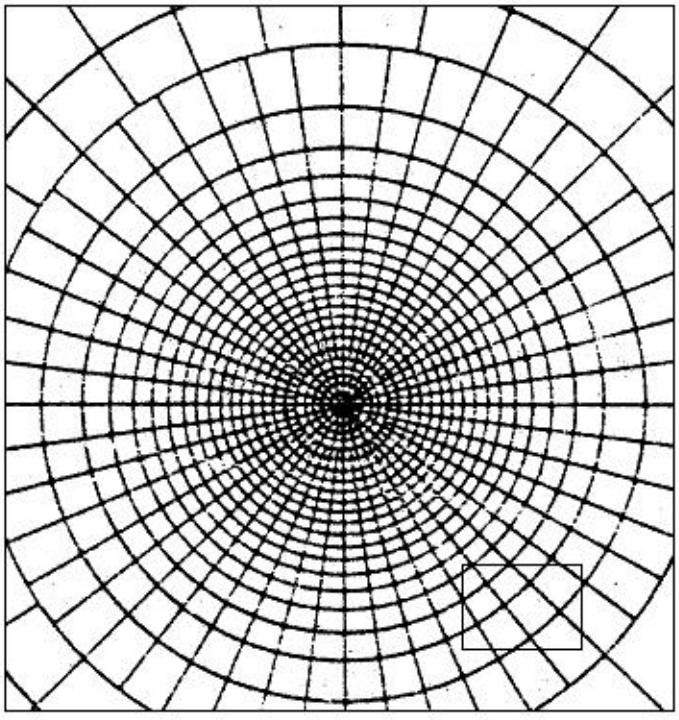
ν : **Poisson's ratio**

2. Stress distribution [Point, line, strip, distributed loads](보충자료1)

◎ Analytical methods

- ○ Point load (Eqs. 2-15, 2-16, Fig. 2.8) p.44
- ○ Line load (Eqs. 2-17, 2-18, Figs. 2.9, 2.10) **p.45 Eq.2-19 : rigid case** $2\times p_z$
- ○ Strip load (Eq. 2-21, Fig. 2.11) **p.46**

◎ Newmark influence chart (p.50, Ex.2.4)



A ——— B

Scale

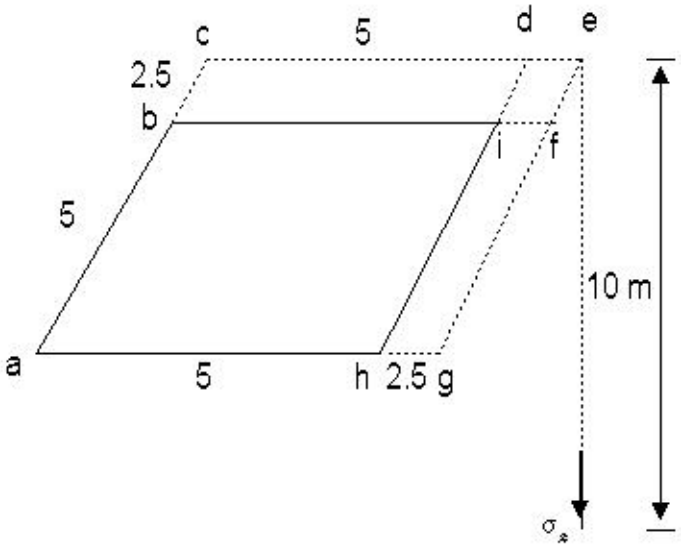
$\overline{AB}$ = depth to the pt of interest

Influence value=0.001

(Fig. 2.24)

$\sigma_z = 0.001 \times p \times N$

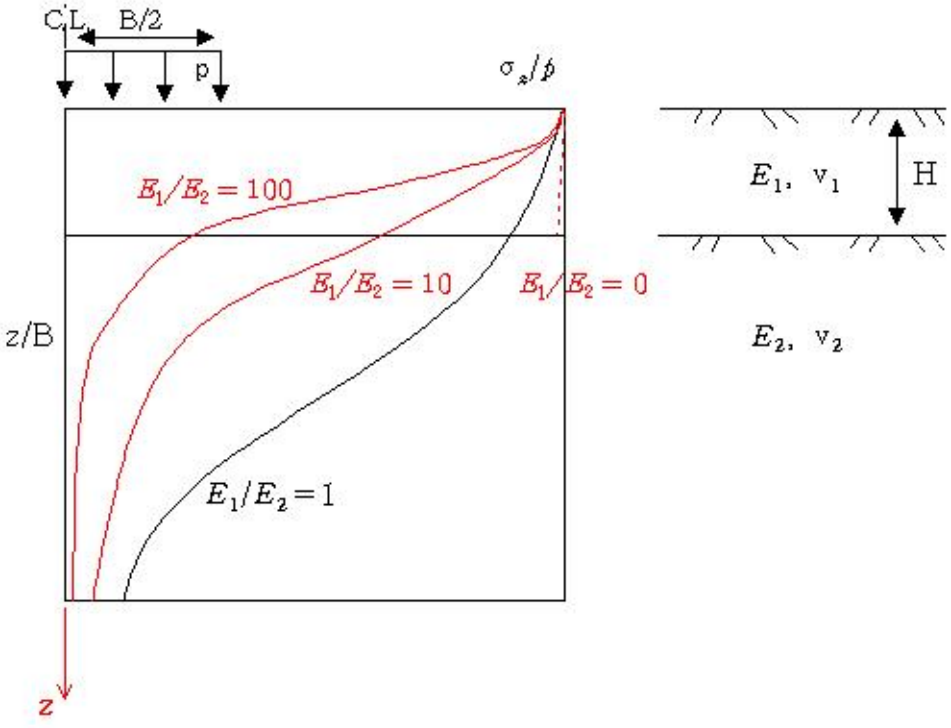
◎ Fadum's influence diagram (Fig. 2.13) (Ex.2.4)



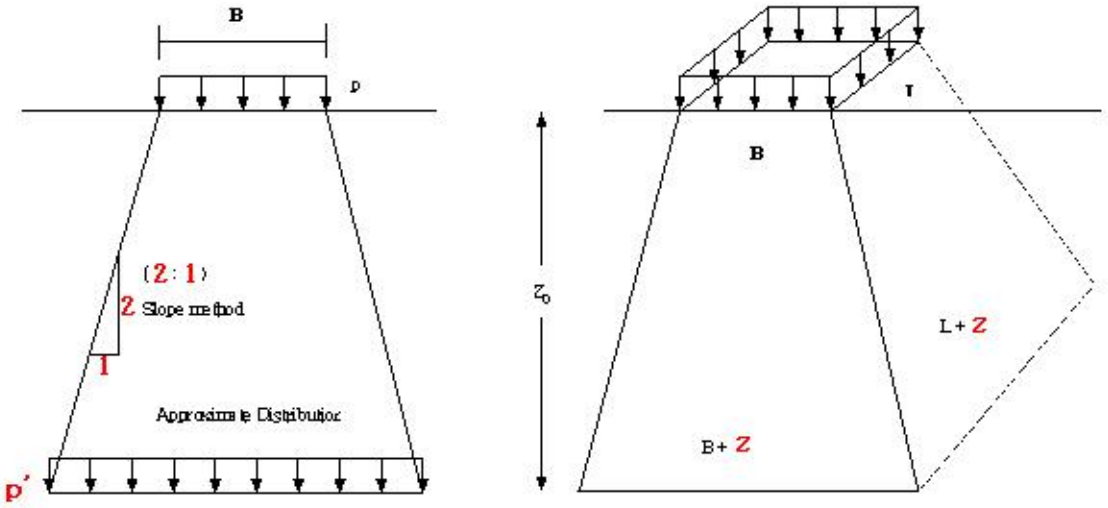
	m	n	
	B/z	L/z	I
abcdefgha	0.75	0.75	**0.137**
bcdefib	0.25	0.75	**0.060**
defghid	0.75	0.25	**0.060**
defid	0.25	0.25	**0.027**
total			**0.044**

$$\sigma_z = I \cdot p$$

3. Effects of Layered System



4. Approximate Stress distribution



$$p \times BL = p' \times (B+z)(L+z)$$

5. Elastic Settlements

○ $S = S_e + S_c + S_s$

S_e : Elastic (Immediate, Distortion) Settlement

S_c : Consolidation Settlement

S_s : Secondary Compression Settlement

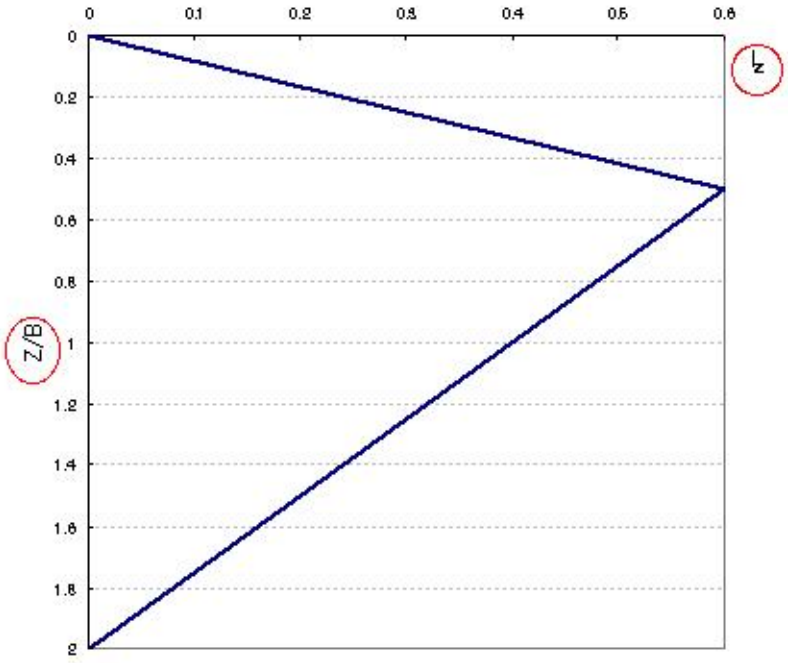
○ $S_e = C_s \Delta q B \frac{1-\nu^2}{E}$

C_s : influence factor (Table 2.1)

Δq : net contact pressure

B : least dimension of foundation

6. Schmertman's method



(2B-0.6 distribution)

$$S_e = \int_{z=0}^{\infty} \varepsilon_z \, dz$$

$$\varepsilon_z = \frac{q}{E} I_z$$

$$S_e = \Delta q \int_0^{2B} \left(\frac{I_z}{E}\right) dz$$

$$= C_1 C_2 \Delta q \sum_{i=1}^{n} \left(\frac{I_z}{E}\right)_i \Delta zi$$

$$C_1 = 1 - 0.5\left(\frac{\bar{\sigma}_o}{\Delta q}\right) \geq 0.5$$

$$C_2 = ?$$

* Modifications of 1978 (보충자료 2)

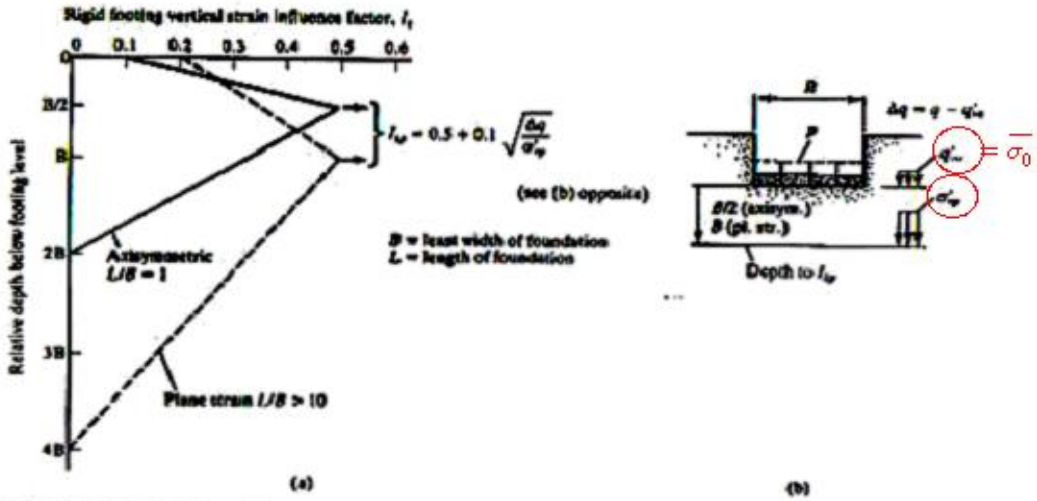


Fig. 5.14 Modified strain influence factor diagrams for use in Schmertmann method for estimating settlement over sand. (a) Simplified strain influence factor distributions. (b) Explanation of pressure terms in equation for I_{zp}. (Schmertmann, 1978.)

7. Allowable Settlements (보충자료 3)