Poulos & Davis (1974)

Chapter 5
SURFACE LOADING OF A FINITE LAYER UNDERLAIN BY A RIGID BASE

5.1 Loading on an Infinite Strip

5.1.1 ~~UNIFORM~~ VERTICAL LOADING (Fig.5.1)

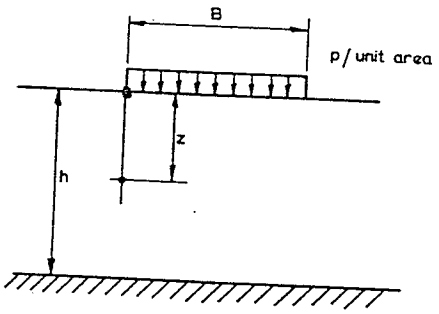

FIG.5.1

Influence factors for the vertical displacement ρ_z and the horizontal displacement ρ_x beneath the edge of the strip, obtained by Poulos (1967b), are shown in Figs. 5.2 and 5.3.

Influence factors for the vertical stress σ_z, bulk stress θ and shear stress τ_{xz} beneath the edge are shown in Figs. 5.4 and 5.5, for four values of ν. The interface between the layer and the base is rough ("adhesive").

The horizontal stresses σ_x and σ_y may be evaluated as follows:

$$\sigma_x = \frac{\theta}{1+\nu} - \sigma_z \qquad \ldots (5.1)$$

$$\sigma_y = \nu(\sigma_x+\sigma_z) \qquad \ldots (5.2)$$

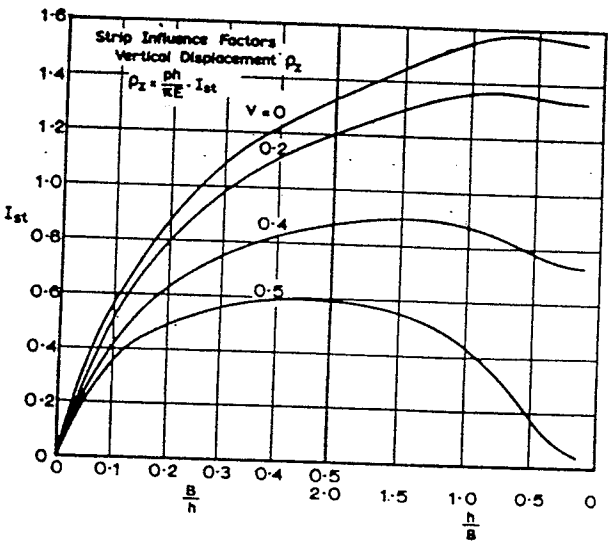

FIG.5.2 Strip curves for ρ_z.

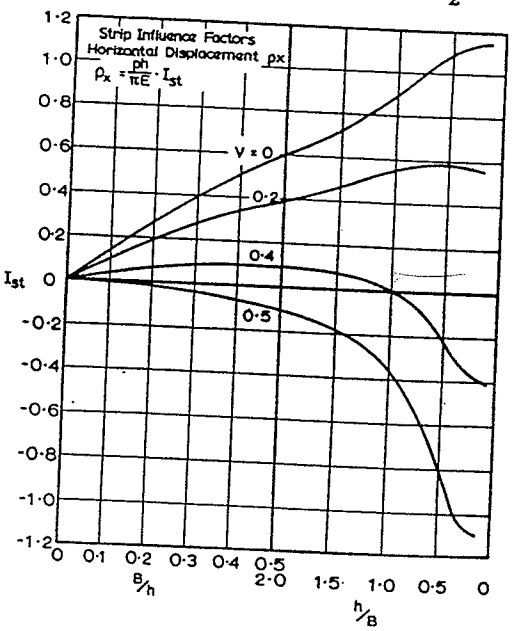

FIG.5.3 Strip curves for ρ_x.

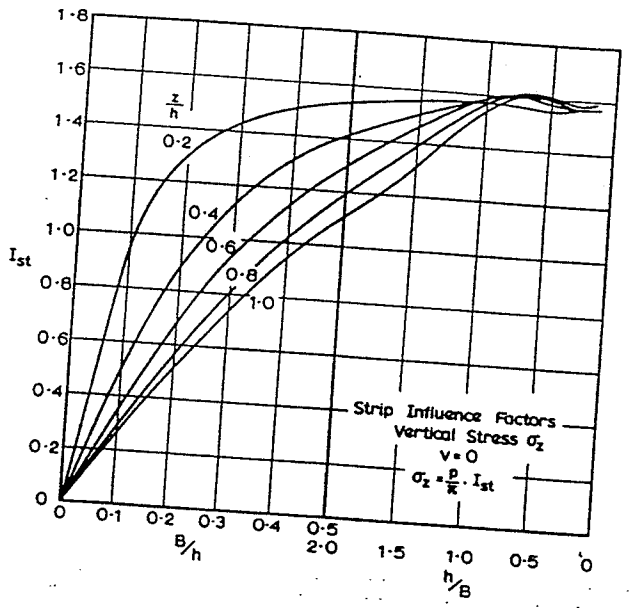

FIG.5.4 Strip curves for σ_z. ν=0.

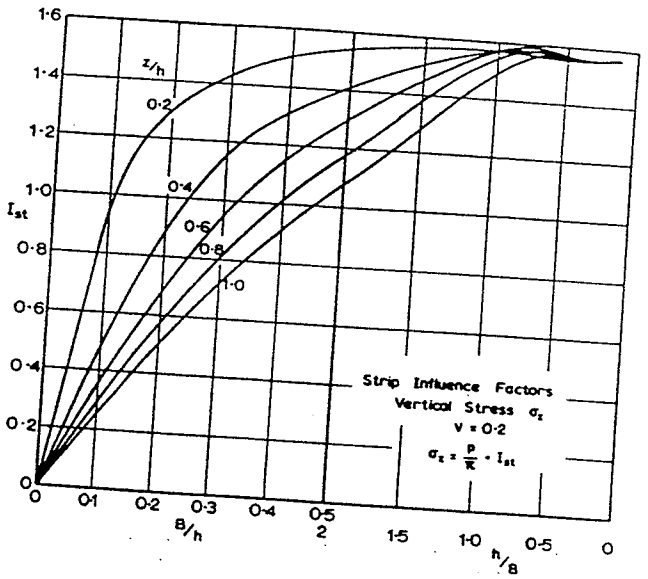

FIG.5.5 Strip curves for σ_z. ν=0.2.

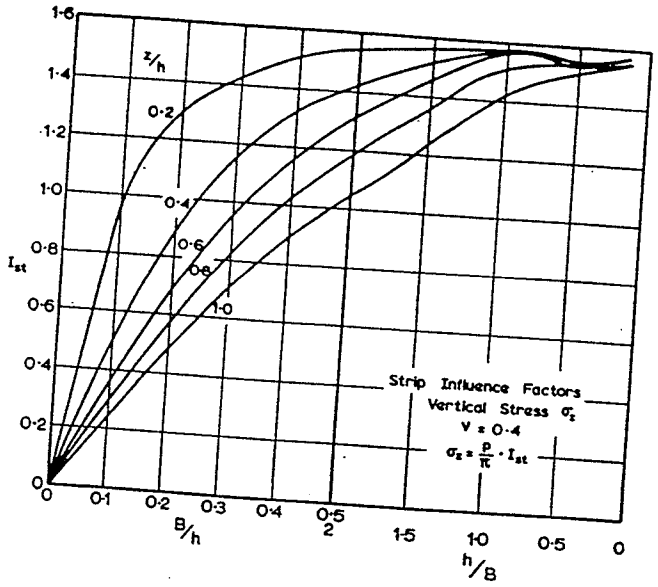

FIG.5.6 Strip curves for σ_z. ν=0.4.

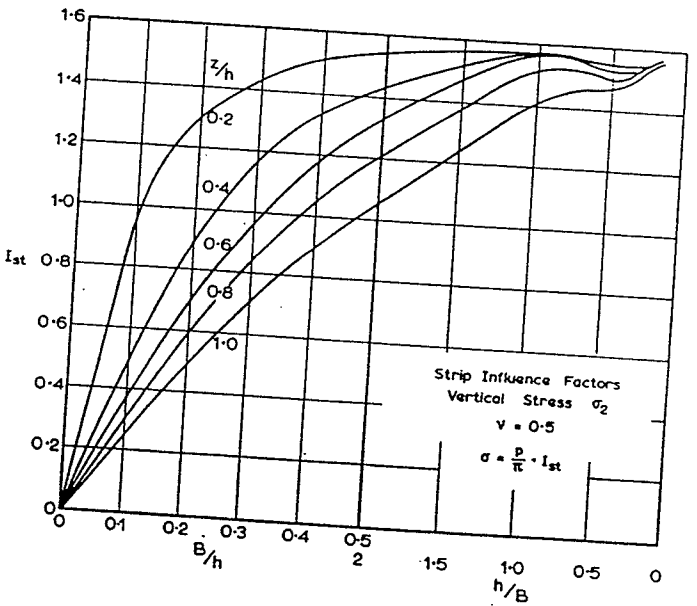

FIG.5.7 Strip curves for σ_z. ν=0.5.

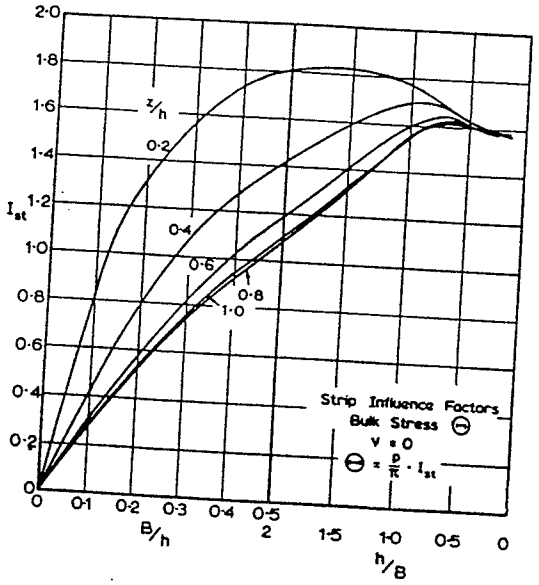

FIG.5.8 Strip curves for θ. ν=0.

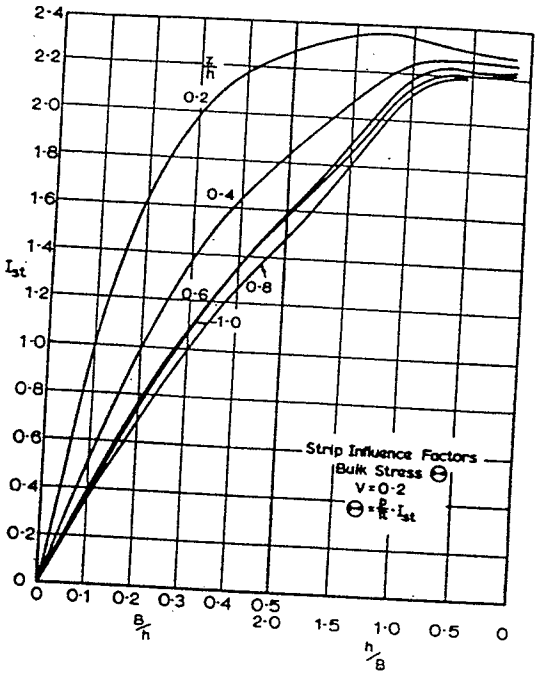

FIG.5.9 Strip curves for θ. ν=0.2

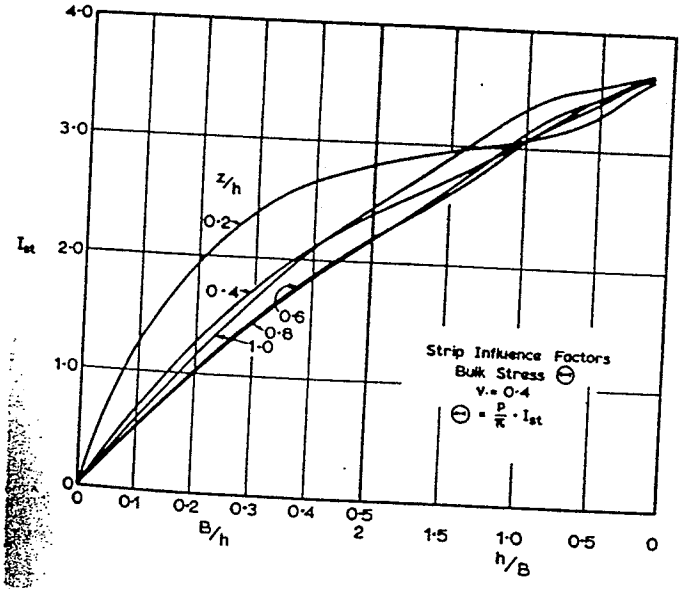

FIG.5.10 Strip curves for θ. ν=0.4.

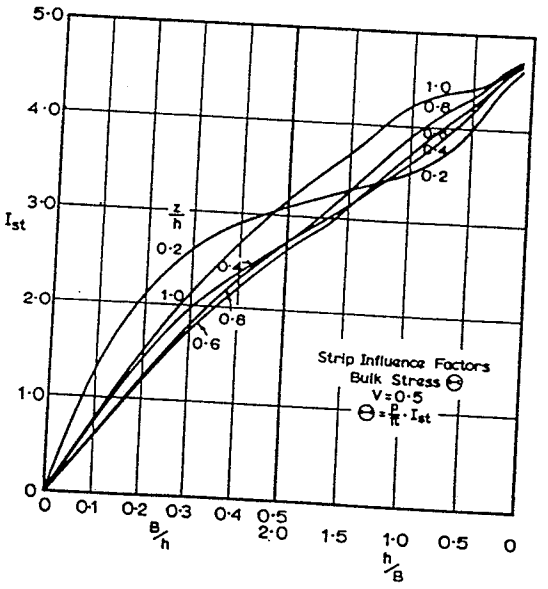

FIG.5.11 Strip curves for θ. ν=0.5.

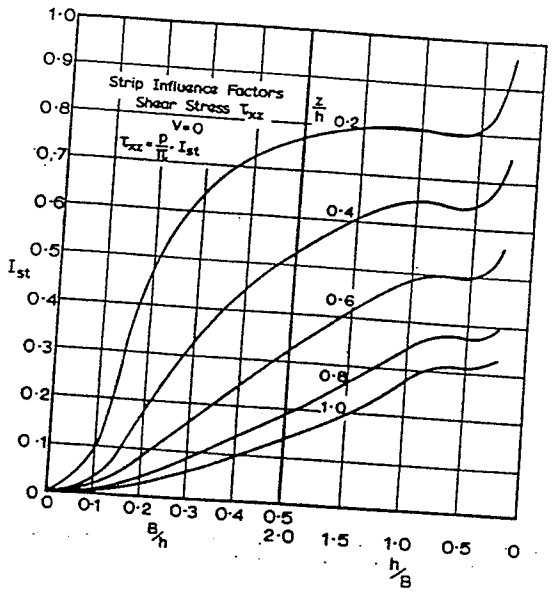

FIG.5.12 Strip curves for τ_{xz}. ν=0.

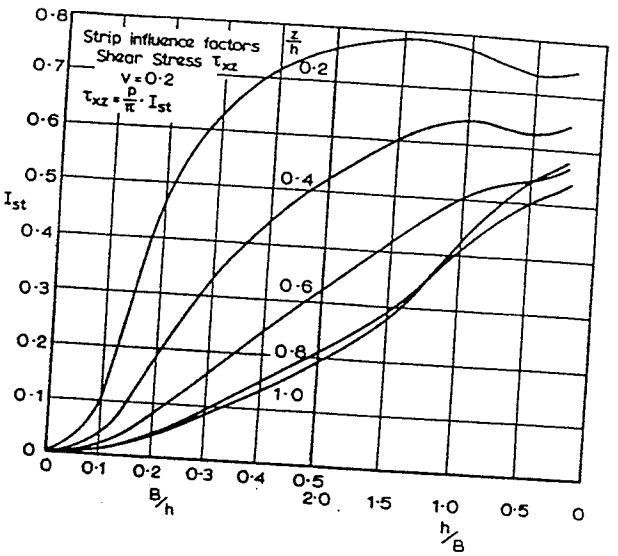

FIG.5.13 Strip curves for τ_{xz}. ν=0.2.

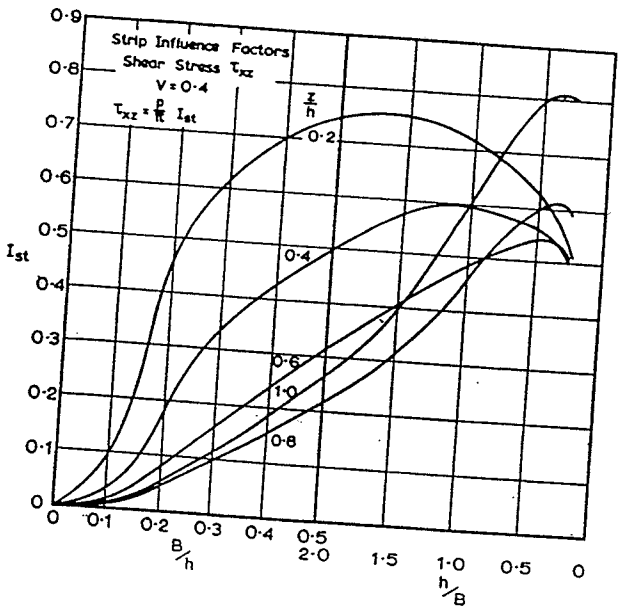

FIG.5.14 Strip curves for τ_{xz}. ν=0.4.

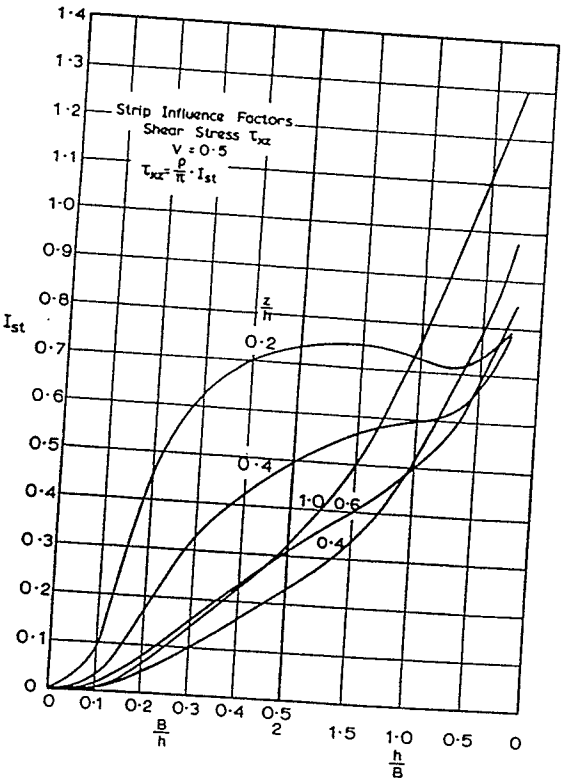

FIG.5.15 Strip curves for τ_{xz}. ν=0.5.

Ueshita and Meyerhof (1968) have also obtained influence factors for ρ_z beneath the edge of the strip, considering both a rough rigid base (adhesive interface) and a smooth rigid base (smooth interface). These influence factors, reproduced in Fig. 5.16, show that the effect of the interface is considerable for $\nu=0.5$ but almost negligible for $\nu=0$.

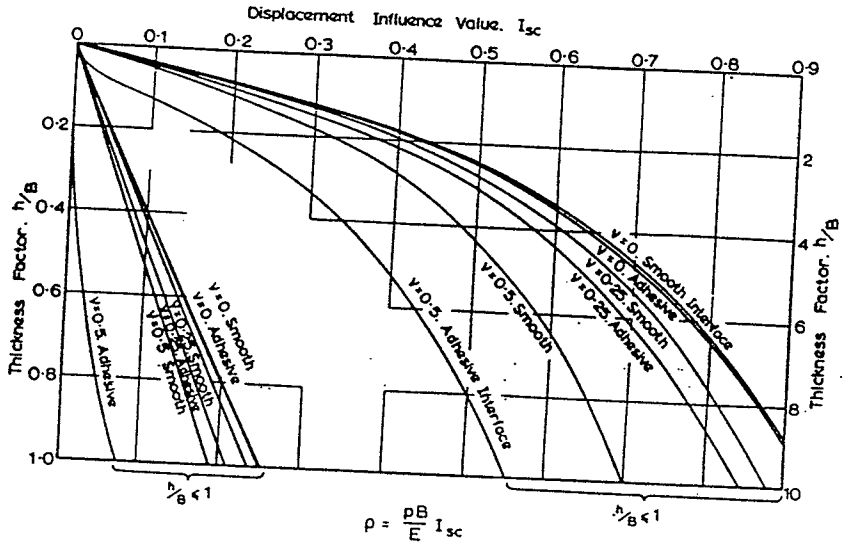

FIG.5.16 Displacement factors for edge of strip (Ueshita and Meyerhof, 1968).

5.1.2 TRIANGULAR VERTICAL LOADING (Fig.5.17)

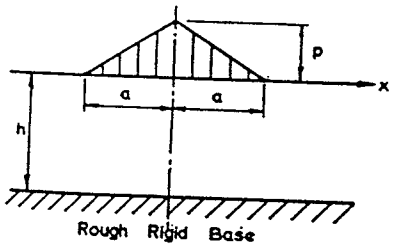

FIG.5.17

Solutions for the stresses within the layer have been obtained by Giroud and Watissee (1972). Some solutions for σ_z, σ_x and τ_{xz} beneath the centre and edge of the loading are shown in Figs.5.18 to 5.20 for $\nu=0.3$.

Giroud (1970) expresses the vertical surface displacement as

$$\rho_z = \frac{pa}{E} \cdot r_H \qquad \ldots (5.3)$$

Values of r_H are plotted in Figs. 5.21 to 5.25 for five values of ν.

The solutions for triangular loading may be superposed to determine solutions for "embankment" or trapezoidal loading.