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A STUDY OF MAT FOOTINGS ON ONE-WAY ELASTIC SUBGRADES FOR STORAGE TANKS

by 1254

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INTRODUCTION

Reinforced concrete tanks resting on mat footings are used as liquid containment vessels. These tanks will generally be underground if the liquid being stored is radioactive. If such is the case the tank will be subjected to internal liquid pressure and active soil pressure in addition to its own dead weight. Furthermore, the liquid may be at high temperature and the tank will then also be subjected to temperature differentials. The tank dead weight, soil loads and liquid weight will be carried by the mat footing. The footing may also be subjected to temperature differentials.

As the footing is subjected to these loads it deforms into the soil and reaction pressures are created. The variation of the reactive soil pressure will be a function of the variation of soil properties as well as the deflection pattern at the soil-structure interface.

In 1946, Hetenyi[1*] treated the footing subgrade as a Winkler foundation. This type of foundation is characterized by the fact that at every point the pressure in the foundation is proportional to the deflection occurring at that point and is unaffected by deflections at adjacent points. Leonards and Harr[2] considered circular slabs of uniform thickness resting on homogeneous foundations whose reaction against the slab was a function of the deflection. The loads and subgrade reaction acted normal to the slab surfaces and were symmetrical with respect to the center of the slab. The slab was subjected to change in temperature also. The idealized foundation was treated by Malter[3] as consisting of

*Superscripts refer to reference listed.

a series of independent springs. Tsai and Westmann[4] assumed that the subgrade of footings was a one-way elastic material and neglected the tensile stress in the soil. Furthermore, Cheng and Furr[5] assumed the subgrade material behaved elastically, either linearly or non-linearly, and its load-deformation relationship was known.

This report presents a method[6] for calculating the elastic reactive soil forces for a slab and footing connected to an axisymmetric underground tank subjected to axisymmetric loading. A computer program, developed by Swartz[7], was used in analyzing the numerical example of an underground tank mat footing for three cases:

(1) Tank, slab and footing subjected to temperature differentials and live loads;

(2) Tank subjected to the same loads as in (1) but the slab and footing subjected to live load only;

(3) Tank subjected to the same loads as in (1) but the slab subjected to no temperature or live load and the footing subjected to live load only.

Case one includes those tanks used for the storage of heated materials which are common for example in nuclear waste containment vessels, case two for those materials commonly stored at normal temperatures and case three for tanks without storage.

METHOD OF ANALYSIS

A method for analyzing the mat footing of storage tanks was developed by Milbradt[6]. The soil was assumed to be a one-way elastic subgrade while the reactive soil forces and the wall footing deformations were considered to be the unknowns with a known active load. These unknowns may be determined by the method of influence coefficients.

An axisymmetric mat footing connected to an axisymmetric tank shell is illustrated in Figure 1. The reactive soil pressures under the footing depend on the deflections of the footing into the soil which are created by the active and reactive soil loads and temperatures in addition to the rotational and horizontal restraints at the shell joint. The footing is subjected to a concentrated force at the shell joint and to a normal load due to the stored material on the slab inside the tank or to the active soil pressure on the footing extension. The final deflections of the footing are due to the combined effects of net pressure acting on the footing, possible temperature differentials, rotation and horizontal displacement at footing-shell wall juncture, and rigid body displacement. These final deflections may be expressed as:

$$Y_a = W_a + \Delta_a + W_a^{\beta=1}\beta + W_a^T + W_a^{u=1} u \qquad (1)$$

where; a = 1,2 for slab and extension respectively.

$$\text{and } Y_a = \begin{bmatrix} y_{a1} \\ y_{a2} \\ \cdot \\ \cdot \\ y_{ana} \end{bmatrix}, W_a = \begin{bmatrix} w_{a1} \\ w_{a2} \\ \cdot \\ \cdot \\ w_{ana} \end{bmatrix}, W_a^{\beta=1} = \begin{bmatrix} w_{a1}^{\beta=1} \\ w_{a2}^{\beta=1} \\ \cdot \\ \cdot \\ w_{ana}^{\beta=1} \end{bmatrix}, W_a^T = \begin{bmatrix} w_{a1}^T \\ w_{a2}^T \\ \cdot \\ \cdot \\ w_{ana}^T \end{bmatrix}$$

$$, W_a^{u=1} = \begin{bmatrix} w_{a1}^{u=1} \\ a_{a2}^{u=1} \\ \cdot \\ \cdot \\ w_{ana}^{u=1} \end{bmatrix}, \Delta_a = \begin{bmatrix} \delta_{a1} \\ \delta_{a2} \\ \cdot \\ \cdot \\ \delta_{ana} \end{bmatrix} = \delta_a \begin{bmatrix} 1 \\ 1 \\ \cdot \\ \cdot \\ 1 \end{bmatrix}$$

In the above,

y_{ai} = final deflection at point i in slab or extension

w_{ai} = deflection of ith point due to net pressure at ith point in slab or extension

This is

$$w_{ai} = \sum_{\substack{i=1 \\ j=1}}^{N_a} D_{ij}^a \ \bar{P}_{aj} \qquad (2)$$

where D_{ij}^a is the influence coefficient for deflection at point i due to unit pressure at j in slab or extension with the edge and center of the plate clamped;

$\bar{P}_{aj}$ = net pressure at point j in slab or extension

n_a = number of points in slab or extension

$w_{ai}^{\phi=1}$ = deflection at point i in slab or extension due to unit rotation at juncture of shell and footing

w_{ai}^{T} = deflection at point i in slab or extension due to temperature differentials

$w_{ai}^{u=1}$ = deflection at point i in slab or extension due to unit horizontal displacement at juncture of shell and footing

δ_a = rigid displacement of slab or extension

Referring to Figure 1 it is noted that

$$\bar{p}_{aj} = p_{aj} + F_{aj} \tag{3}$$

$$y_{ai} = -k_{ai} F_{ai} \tag{4}$$

where;

k_{ai} = the soil stiffness at point i in slab or extension

and $k_{ai} = k$, if the soil properties are constant

p_{aj} = live load at point j in slab or extension

F_{ai}, F_{aj} = reactive soil pressure at point i or j in slab or extension

F_{ai} is negative and if not the influence of F_{ai} soil reactive force is excluded.

Therefore; substituting Eqns. (2), (3) and (4) into (1):

$$- k_a F_a = D^a (p_a + F_a) + \Delta_a + W_a^{\phi=1} \cdot \phi + W_a^T + W^{u=1} u;$$

or

$$- (D^a + k_a) F_a = D^a p_a + \Delta_a + W_a^{\phi=1} + W_a^T + W^{u=1} u; \tag{5}$$

where

$$k_a = \begin{bmatrix} k_{a1} \\ k_{a2} \\ \vdots \\ k_{ana} \end{bmatrix}, \quad F_a = \begin{bmatrix} F_{a1} \\ F_{a2} \\ \vdots \\ F_{ana} \end{bmatrix}, \quad p_a = \begin{bmatrix} p_{a1} \\ p_{a2} \\ \vdots \\ p_{ana} \end{bmatrix}$$

For the slab:

$$- \left\{ \begin{bmatrix} k_{11} \\ k_{12} \\ \vdots \\ k_{1n_1} \end{bmatrix} + \begin{bmatrix} D^1_{11} & D^1_{12} & \cdots & D^1_{1n_1} \\ D^1_{21} & D^1_{21} & \cdots & D^1_{2n_1} \\ \vdots & \vdots & & \vdots \\ D^1_{n_1 1} & D^1_{n_1 2} & \cdots & D^1_{n_1 n_1} \end{bmatrix} \right\} \cdot \begin{bmatrix} F_{11} \\ F_{12} \\ \\ F_{1n_1} \end{bmatrix} = \begin{bmatrix} D^1_{11} & D^1_{12} & \cdots & D^1_{1n_1} \\ D^1_{21} & D^1_{22} & \cdots & D^1_{2n_1} \\ \vdots & \vdots & & \vdots \\ D^1_{n_1 1} & D^1_{n_1 2} & \cdots & D^1_{n_1 n_2} \end{bmatrix} \begin{bmatrix} p_{11} \\ p_{12} \\ \vdots \\ p_{1n_1} \end{bmatrix}$$

$$+ \delta_1 \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix} + \begin{bmatrix} w^{\beta=1}_{11} \\ w^{\beta=1}_{12} \\ \vdots \\ w^{\beta=1}_{1n_1} \end{bmatrix} \cdot \beta + \begin{bmatrix} w^{T}_{11} \\ w^{T}_{12} \\ \vdots \\ w^{T}_{1n_1} \end{bmatrix} + \begin{bmatrix} w^{u=1}_{11} \\ w^{u=1}_{12} \\ \vdots \\ w^{u=1}_{1n_1} \end{bmatrix} \cdot u \qquad (6)$$

Similarly, for the extension:

$$- \left\{ \begin{bmatrix} k_{21} \\ k_{22} \\ \vdots \\ k_{2n_2} \end{bmatrix} + \begin{bmatrix} D^2_{11} & D^2_{12} & \cdots & D^2_{1n_2} \\ D^2_{21} & D^2_{22} & \cdots & D^2_{2n_2} \\ \vdots & \vdots & & \vdots \\ D^2_{n_2 1} & D^2_{n_2 2} & \cdots & D^2_{n_2 n_2} \end{bmatrix} \right\} \cdot \begin{bmatrix} F_{21} \\ F_{22} \\ \vdots \\ F_{2n_2} \end{bmatrix} = \begin{bmatrix} D^2_{11} & D^2_{12} & \cdots & D^2_{1n_1} \\ D^2_{21} & D^2_{22} & \cdots & D^2_{2n_2} \\ \vdots & \vdots & & \vdots \\ D^2_{n_2 1} & D^2_{n_2 2} & \cdots & D^2_{n_2 n_2} \end{bmatrix} \begin{bmatrix} p_{21} \\ p_{22} \\ \vdots \\ p_{2n_2} \end{bmatrix}$$

$$+\delta_2 \cdot \begin{bmatrix} 1 \\ 1 \\ \cdot \\ \cdot \\ \cdot \\ 1 \end{bmatrix} + \begin{bmatrix} w_{21}^{\phi=1} \\ w_{22}^{\phi=1} \\ \cdot \\ \cdot \\ \cdot \\ w_{2n_2}^{\phi=1} \end{bmatrix} \phi + \begin{bmatrix} w_{21}^{T} \\ w_{22}^{T} \\ \cdot \\ \cdot \\ \cdot \\ w_{2n_2}^{T} \end{bmatrix} + \begin{bmatrix} w_{21}^{u=1} \\ w_{22}^{u=1} \\ \cdot \\ \cdot \\ \cdot \\ w_{2n_2}^{u=1} \end{bmatrix} \cdot u \qquad (7)$$

Since $y_{1n_1} = y_{21}$ (8)

Therefore;

$$- k_{1n_1} F_{1n_1} = -k_{21} F_{21} = \delta_2 \qquad (8)'$$

The forces and moments at the juncture are:

$$V_a = \sum_{i=1}^{N_a} C_{ai} \bar{p}_{ai} = \sum_{i=1}^{N_a} C_{ai} (p_{ai} + F_{ai}) \qquad (a)$$

$$M_a^F = \sum_{i=1}^{N_a} m_{ai}^F \bar{p}_{ai} + M_a^T = \sum_{i=1}^{N_a} m_{ai}^F (p_{ai} + F_{ai}) + M_a^T \qquad (b)$$

$$H_a^F = \sum_{i=1}^{N_a} h_{ai}^F \bar{p}_{ai} + H_a^T = \sum_{i=1}^{N_a} h_{ai}^F (p_{ai} + F_{ai}) + H_a^T \qquad (c)$$

The shears are equilibrated as:

$$V_1 + V_2 + V_s = 0 \qquad (9)$$

$$\text{i.e. } \sum_{i=1}^{N_1} C_{1i} (p_{1i} + F_{1i}) + \sum_{i=1}^{N_2} C_{2i} (p_{2i} + F_{2i}) + V_s = 0 \qquad (9)'$$

where;

C_{ai} = shear stress at juncture of slab and shell due to unit net pressure at point i in slab or extension

M_a^F = fixed-end moment at juncture end of slab or extension

m_{ai}^{F} = fixed-end moment at juncture end of slab or extension due to unit net pressure at point i in slab or extension

M_a^T = fixed-end moment at juncture end of slab or extension due to temperature

H_a^F = fixed-end thrust at juncture end of slab or extension

h_{ai}^F = fixed-end thrust at juncture end of slab or extension due to unit pressure at point i in slab or extension

H_a^T = fixed-end thrust at juncture end of slab or extension due to temperature

V_a = shear force of juncture end of slab or extension

V_s = shear force of shell at juncture of shell and footing.

Consider also the horizontal deflection and rotation at the juncture. Equilibrium of moments and forces at the juncture yields:

$$\begin{cases} M_1 + M_2 + M_s = 0 \\ H_1 + H_2 + H_s = 0 \end{cases}$$

where;

$$\begin{cases} M_1 = M_1^F + M_1^{\phi=1} \cdot \beta + M_1^{u=1} \cdot u \\ M_2 = M_2^F + M_2^{\beta=1} \cdot \beta + M_2^{u=1} \cdot u \\ M_s = M_s^F + M_s^{\beta=1} \cdot \beta + M_s^{u=1} \cdot u \end{cases}$$

$$\begin{cases} H_1 = H_1^F + H_1^{\phi=1} \cdot \beta + M_2^{u=1} \cdot u \\ H_2 = H_2^F + H_2^{\beta=1} \cdot \beta + H_2^{u=1} \cdot u \\ H_s = H_s^F + H_s^{\beta=1} \cdot \beta + H_s^{u=1} \cdot u \end{cases}$$

$$\text{i.e.} \begin{bmatrix} M_1^{\phi=1} + M_2^{\phi=1} + M_s^{\phi=1} & M_1^{u=1} + M_2^{u=1} + M_s^{u=1} \\ H_1^{\phi=1} + H_2^{\phi=1} + H_s^{\phi=1} & H_1^{u=1} + H_2^{u=1} + H_s^{u=1} \end{bmatrix} \begin{bmatrix} \phi \\ u \end{bmatrix} = - \begin{bmatrix} M_1^F + M_2^F + M_s^F \\ H_1^F + H_2^F + H_s^F \end{bmatrix}$$

M_s^F = fixed-end shell moment at juncture of shell and footing

$M_a^{u=1}$ = fixed-end moment at juncture end of slab or extension due to unit horizontal displacement at juncture of shell and footing

$M_a^{\phi=1}$ = fixed-end moment at juncture end of slab or extension due to unit rotation at juncture of shell and footing

H_s^F = fixed-end shell thrust at juncture of shell and footing

$H_a^{u=1}$ = fixed-end thrust at juncture end of slab or extension due to unit horizontal displacement at juncture of shell and footing

$H_a^{\phi=1}$ = fixed-end thrust at juncture end of slab or extension due to unit rotation at juncture of shell and footing

Let $\underset{\sim}{\xi} = \begin{bmatrix} \phi \\ u \end{bmatrix}$

$$K = \begin{bmatrix} M_1^{\phi=1} + M_2^{\phi=1} + M_s^{\phi=1} & M_1^{u=1} + M_2^{u=1} + M_s^{u=1} \\ H_1^{\phi=1} + H_2^{\phi=1} + H_s^{\phi=1} & H_1^{u=1} + H_2^{u=1} + H_s^{u=1} \end{bmatrix}$$

$$F_o = \begin{bmatrix} M_1^F + M_2^F + M_s^F \\ H_1^F + H_2^F + H_s^F \end{bmatrix}$$

then,

$$K \underset{\sim}{\xi} = -F_o \qquad (10)$$

There are $n_1 + n_2 + 4$ unknowns for solving eqns. (6), (7), (8), (9) and (10) simultaneously. These are F_{1i}, F_{2i}, β, u, δ_1, δ_2. The method of solution is to eliminate δ_1 and δ_2 from the eqns. first then assume a value for $\beta = \beta_{assumed}$ and solve Eqns. (6), (7), (8) and (9) for the values of F_{ai}. Using Eqns. (10) with the values of F_{ai} solve for a $\beta_{computed}$ and u. If $\beta_{computed} - \beta_{assumed} >$ error tolerance then assume a new value of $\beta_{assumed}$ and calculate $\beta_{computed}$. Repeat this procedure until convergence is obtained. According to the one-way subgrade assumption, the soil reactive pressure F_{ai} cannot be positive. Therefore, in the computation, the positive reactive pressure values are set equal to zero and the number of unknowns and number of equations within Eqns. (6) and (7) are reduced accordingly. The process in solving for reaction pressures is then repeated using the new reduced matrices. This method of analysis was programmed by Swartz[7]. This computer program is sufficiently general to allow variations of soil moduli from point to point under the footing slab. The flow chart for this program is shown in Fig. 27.

NUMERICAL EXAMPLE AND SUMMARY OF ANALYSIS RESULTS

The data for this numerical example is taken from Milbradt's report[6] and is listed in Table 1 as input data for the computer program. Wherein, the number of slab points in radius n_1 = 11 while the number of extension points n_2 = 6, the radius R_{n1} = 458 in. and R_{n2} = 501.5 in., the thickness of the footing = 15 in. uniformly,

Also,

$$D^1 = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0.00145 & 0.00334 & 0.00380 & 0.00363 & 0.00314 & 0.00249 \\ 0.00454 & 0.00111 & 0.0132 & 0.0127 & 0.0110 & 0.00871 \\ 0.00833 & 0.0213 & 0.0269 & 0.0266 & 0.0231 & 0.0183 \\ 0.0123 & 0.0325 & 0.0431 & 0.0444 & 0.0394 & 0.0312 \\ 0.0162 & 0.0435 & 0.0595 & 0.0640 & 0.0587 & 0.0474 \\ 0.0198 & 0.0536 & 0.0750 & 0.0831 & 0.0789 & 0.0656 \\ 0.0227 & 0.0622 & 0.0884 & 0.0999 & 0.0975 & 0.0839 \\ 0.0251 & 0.0688 & 0.0987 & 0.113 & 0.113 & 0.0992 \\ 0.0265 & 0.0731 & 0.105 & 0.122 & 0.122 & 0.109 \\ 0.0270 & 0.0745 & 0.107 & 0.125 & 0.126 & 0.113 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0.00178 & 0.00111 & 0.00557 & 0.000181 & 0.0000236 \\ 0.00624 & 0.00390 & 0.00195 & 0.000635 & 0.0000825 \\ 0.0131 & 0.00820 & 0.00409 & 0.00133 & 0.000173 \\ 0.0224 & 0.0139 & 0.00699 & 0.00227 & 0.000296 \\ 0.0340 & 0.0212 & 0.0106 & 0.00346 & 0.000449 \\ 0.0478 & 0.0299 & 0.0150 & 0.00487 & 0.000634 \\ 0.0630 & 0.0400 & 0.0200 & 0.00653 & 0.000849 \\ 0.0768 & 0.0504 & 0.0258 & 0.00842 & 0.000109 \\ 0.0868 & 0.0587 & 0.0311 & 0.0105 & 0.00137 \\ 0.0904 & 0.0619 & 0.0334 & 0.0116 & 0.00159 \end{bmatrix}$$

$$D^2 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0.432\times10^{-6} & 0.248\times10^{-5} & 0.591\times10^{-5} & 0.961\times10^{-5} \\ 0.997\times10^{-6} & 0.690\times10^{-5} & 0.188\times10^{-4} & 0.330\times10^{-4} \\ 0.156\times10^{-5} & 0.114\times10^{-4} & 0.335\times10^{-4} & 0.634\times10^{-4} \\ 0.212\times10^{-5} & 0.159\times10^{-4} & 0.484\times10^{-4} & 0.956\times10^{-4} \\ 0.268\times10^{-5} & 0.205\times10^{-4} & 0.632\times10^{-4} & 0.128\times10^{-3} \end{bmatrix}$$

$$\begin{bmatrix} 0 & 0 \\ 0.134\times10^{-4} & 0.768\times10^{-5} \\ 0.480\times10^{-4} & 0.227\times10^{-4} \\ 0.963\times10^{-4} & 0.565\times10^{-4} \\ 0.151\times10^{-3} & 0.903\times10^{-4} \\ 0.208\times10^{-3} & 0.126\times10^{-3} \end{bmatrix}$$

p_{1i} = 17.92 psi uniform pressure

p_{2i} = 35.0 psi uniform pressure

$$W_{1i}^{\phi=1} = \begin{bmatrix} 0. \\ 3.17 \\ 11.1 \\ 23.4 \\ 39.9 \\ 60.6 \\ 85.5 \\ 114 \\ 117 \\ 185 \\ 226 \end{bmatrix}, W_{2i}^{\phi=1} = \begin{bmatrix} 0 \\ 8.68 \\ 17.3 \\ 25.9 \\ 34.6 \\ 43.2 \end{bmatrix}, W_{1i}^{T} = - \begin{bmatrix} 0 \\ 0.00141 \\ 0.00495 \\ 0.0104 \\ 0.0177 \\ 0.0269 \\ 0.0381 \\ 0.0513 \\ 0.0645 \\ 0.0758 \\ 0.0805 \end{bmatrix}, W_{2i}^{T} = \begin{bmatrix} 0 \\ 0.802\times10^{-5} \\ 0.266\times10^{-4} \\ 0.485\times10^{-4} \\ 0.663\times10^{-4} \\ 0.731\times10^{-4} \end{bmatrix}, W_{1i}^{u=1} = W_{2i}^{u=1}$$

$$R_{1i} = \begin{bmatrix} 24 \\ 67.4 \\ 111.8 \\ 154.2 \\ 197.6 \\ 241.0 \\ 284.4 \\ 327.8 \\ 371.2 \\ 414.6 \\ 458.0 \end{bmatrix}, R_{2i} = \begin{bmatrix} 458.0 \\ 466.7 \\ 475.4 \\ 484.1 \\ 492.8 \\ 501.5 \end{bmatrix}$$

for computing $C_{ai} = \dfrac{R_{ai+1}^2 - R_{ai}^2}{4\, R_{n_a}}$

$$K = \begin{bmatrix} 292200 & 4277 \\ 4277 & 1320 \end{bmatrix}, \quad |K| = 0.3677 \times 10^9$$

$M_s^F = -122943$ lb., $H_s^F = -4053$ lb., $F_o = \begin{bmatrix} -122943 + M_1^F + M_2^F \\ -2125-4053-39090 \end{bmatrix}$

$M_1^T = -2788$ in-lb., $H_1^T = -39090$ lb., $M_2^T = -1.852$ in-lb., $H_2^T = -2125$ lb.

$$m_{1i}^F = -\begin{bmatrix} 0.4870\times10^3 \\ 0.1413\times10^4 \\ 0.2236\times10^4 \\ 0.2931\times10^4 \\ 0.3445\times10^4 \\ 0.3729\times10^4 \\ 0.3398\times10^4 \\ 0.2683\times10^4 \\ 0.1532\times10^4 \\ 0.4208\times10^3 \end{bmatrix}, \quad m_{2i}^F = \begin{bmatrix} 0.192\times10^2 \\ 0.775\times10^2 \\ 0.157\times10^3 \\ 0.239\times10^3 \\ 0.324\times10^3 \\ 0.184\times10^3 \end{bmatrix}$$

$h_{1i}^F = h_{2i}^F = 0$

$V_s = 2595$ lb., Soil Modulus = 10 psi/in, $\beta_{initial} = 0.01$, $\Delta\beta = 0.001$

A data printout of this input is given in Table 1.

For the case of no temperature differentials,

$$W_{1i}^T = W_{2i}^T = M_1^T = M_2^T = H_1^T = H_2^T = 0$$

i.e., put lines 45 to 49, the third and fourth number of line 56 and line 57 in Table 1 equal to zero.

For the case of no temperature or live loads,

$$P_{1i} = 0 \quad \text{also,}$$

i.e., put lines 35 to 37 in Table 1 equal to zero in addition to the other lines. For different values of soil modulus, change the second number of the last line in Table 1.

The results are given in Table 2 to 25 and the soil reactive pressures and slab deflections are shown in Fig. 2 to 25. The maximum soil reaction pressures for the three cases are compared in Fig. 26.

There are no negative slab deflections in cases (1) and (2) but there are in case (3). As shown in Fig. 18 to 25, the positive reactive pressure values are set to zero except the first point. The solid lines of those figures are for upward slab deflections only.

CONCLUSIONS

Obviously, as shown in the figures, the reactive soil pressures varied with soil modulus. In other words, the higher the soil stiffness, the higher the maximum soil reactive pressure. As might be expected the lowest reaction pressure of -34.51 psi and the highest one of -138.89 psi were both created in case (3). Case (1) did not have the largest soil reaction pressure for the high stiffness soil because of the smaller angle of rotation at the juncture of the slab and the shell due to the presence of slab loads. The highest soil reaction pressure in each case occurred under the shell or the end of the extension. There is an advantage in concentrating the soil reactions under the shell in that the bending moments and stresses in the footing are limited to relatively insignificant values, if the soil is of sufficient strength for the stress state. The maximum soil pressure for case (1) was 105.24 psi, case (2) was 136.8 psi and case (3) was 138.89 psi. However, the maximum soil pressure could become more uniform if local failure of the soil occurred.

The soil stresses became more evenly distributed as the soil stiffness decreased. Therefore, the uniform thickness of the mat footing used here as an example was suitable for soil of lower stiffness (less than 200 psi/in) only. For a stiffer soil the thickness of concrete or reinforcement of the footing near the shell and extension may be increased to take more soil reaction and slab bending moment at juncture of footing and shell.

The figures show that there was not much difference in soil reaction

and slab deflection variations between cases (1) and (2) but a significant change occurred in case (3). So, apparently temperatures did not have as much effect in this example as live loads especially for upward slab deflections. Since very high temperatures may be involved it is important to note that temperature differentials are not as important as live loads.

NOTATION

C_{ai} - shear stress at juncture of slab and shell due to unit net pressure at point i in slab or extension

D^{a}_{ij} - deflection influence coefficient for point i due to unit net pressure at point j in slab or extension

F_{ai} - reactive soil pressure at point i in slab or extension

h^{F}_{ai} - fixed-end thrust at juncture end of slab or extension due to unit net pressure at point i in slab or extension

H^{F}_{a} - fixed-end thrust at juncture end of slab or extension

H^{F}_{s} - fixed-end shell thrust at juncture of shell and footing

$H^{u=1}_{a}$ - fixed-end thrust at juncture end of slab or extension due to unit horizontal displacement at juncture of shell and footing

$H^{\phi=1}_{a}$ - fixed-end thrust at juncture end of slab or extension due to unit rotation at juncture of shell and footing

H^{T}_{a} - fixed-end thrust at juncture end of slab or extension due to temperature

k_{ai} - soil modulus of point i in slab or extension

m^{F}_{ai} - fixed-end moment at juncture end of slab or extension due to unit net pressure at point i in slab or extension

M^{F}_{a} - fixed-end moment at juncture end of slab or extension

M^{F}_{s} - fixed-end shell moment at juncture of shell and footing

$M^{u=1}_{a}$ - fixed-end moment at juncture end of slab or extension due to unit horizontal displacement at juncture of shell and footing

$M_a^{\phi=1}$ - fixed-end moment at juncture end of slab or extension due to unit rotation at juncture of shell and footing

M_a^T - fixed-end moment at juncture end of slab or extension due to temperature

p_{ai} - live load at point i in slab or extension

$\bar{p}_{ai}$ - net pressure at point i in slab or extension

R_{ai} - distance from center at point i in slab or extension

t - thickness of slab or extension

u - horizontal displacement at juncture of shell and footing

V_a - shear force of juncture end of slab or extension

V_s - shear force of shell at juncture of shell and footing

w_{ai} - deflection at point i in slab or extension due to net pressure at that point

w_{ai}^T - deflection at point i in slab or extension due to temperature

$w_{ai}^{u=1}$ - deflection at point i due to unit horizontal displacement at juncture of shell and footing

$w_{ai}^{\phi=1}$ - deflection at point i due to unit rotation at juncture of shell and footing

y_{ai} - final deflection at point i in slab or extension due to all forces

ϕ - rotation at juncture of shell and footing

δ_a - rigid displacement of slab or extension.

Notations in Output of computer program:

BETA = β U = u

FP (I) = F_{1i} FE (I) = F_{2i}

Y (I) = y_i

VP = V_1 VE = V_2

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Table 1. Input Data of "Soil React" Program with Temperature and Live Load Effect for Soil Modulus = 10 psi/in.

```
 11     6     0
      0.0           0.0           0.0           0.0           0.0
      0.0           0.0           0.0           0.0           0.0
      0.0     -0.145D-2     -0.334D-2     -0.380D-2     -0.363D-2
-0.314D-2     -0.249D-2     -0.178D-2     -0.111D-2     -0.557D-3
-0.181D-3     -0.236D-4     -0.454D-2     -0.111D-1     -0.132D-1
-0.127D-1     -0.110D-1     -0.871D-2     -0.624D-2     -0.390D-2
-0.195D-2     -0.635D-3     -0.825D-4     -0.833D-2     -0.213D-1
-0.269D-1     -0.266D-1     -0.231D-1     -0.183D-1     -0.131D-1
-0.820D-2     -0.409D-2     -0.133D-2     -0.173D-3     -0.123D-1
-0.325D-1     -0.431D-1     -0.444D-1     -0.394D-1     -0.312D-1
-0.224D-1     -0.139D-1     -0.699D-2     -0.227D-2     -0.296D-3
-0.162D-1     -0.435D-1     -0.595D-1     -0.640D-1     -0.587D-1
-0.474D-1     -0.340D-1     -0.212D-1     -0.106D-1     -0.346D-2
-0.449D-3     -0.198D-1     -0.536D-1     -0.750D-1     -0.831D-1
-0.789D-1     -0.656D-1     -0.478D-1     -0.299D-1     -0.150D-1
-0.487D-2     -0.634D-3     -0.227D-1     -0.622D-1     -0.884D-1
-0.999D-1     -0.975D-1     -0.839D-1     -0.630D-1     -0.400D-1
-0.200D-1     -0.653D-2     -0.849D-3     -0.251D-1     -0.688D-1
-0.987D-1     -0.113D00     -0.113D00     -0.992D-1     -0.768D-1
-0.504D-1     -0.258D-1     -0.842D-2     -0.109D-2     -0.265D-1
-0.731D-1     -0.105D00     -0.122D00     -0.122D00     -0.109D00
-0.868D-1     -0.587D-1     -0.311D-1     -0.105D-1     -0.137D-2
-0.270D-1     -0.745D-1     -0.107D00     -0.125D00     -0.126D00
-0.113D00     -0.904D-1     -0.619D-1     -0.334D-1     -0.116D-1
-0.159D-2
      0.0           0.0           0.0           0.0           0.0
      0.0     0.432D-6      0.248D-5      0.591D-5      0.961D-5
 0.134D-4     0.768D-5      0.997D-6      0.690D-5      0.188D-4
 0.330D-4     0.480D-4      0.277D-4      0.156D-5      0.114D-4
 0.335D-4     0.634D-4      0.963D-4      0.565D-4      0.212D-5
 0.159D-4     0.484D-4      0.956D-4      0.151D-3      0.903D-4
 0.268D-5     0.205D-4      0.632D-4      0.128D-3      0.208D-3
 0.126D-3
    17.92         17.92         17.92         17.92         17.92
    17.92         17.92         17.92         17.92         17.92
    17.92
      35.           35.           35.           35.           35.
      35.
      0.0       0.317D1       0.111D2       0.234D2       0.399D2
 0.606D2       0.855D2       0.114D3       0.147D3       0.185D3
 0.226D3
      0.0       0.868D1       0.173D2       0.259D2       0.346D2
 0.432D2
      0.0     -0.141D-2     -0.495D-2     -0.104D-1     -0.177D-1
-0.269D-1     -0.381D-1     -0.513D-1     -0.645D-1     -0.758D-1
-0.805D-1
      0.0     0.802D-5      0.266D-4      0.485D-4      0.663D-4
```

Table 1. (Continued)

24.00	67.40	111.8	154.2	197.6
241.0	284.4	327.8	371.2	414.6
458.0				
458.0	466.7	475.4	484.1	492.8
501.5				
0.2922D6	0.4277D4	0.1320D4	0.3677D9	
-0.122943D6	-0.4053D4	-0.2788D4	-0.3909D5	
-0.1852D1	-0.2125D4			
-0.487D3	-0.1413D4	-0.2236D4	-0.2931D4	-0.3445D4
-0.3729D4	-0.3730D4	-0.3398D4	-0.2683D4	-0.1532D4
-0.4208D3				
0.192D2	0.775D2	0.157D3	0.239D3	0.324D3
0.184D3				
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0				
0.2595D4	1.D1	.1D1	.1D-1	.1D-2

Table 2. Output of "Soil React" Program with Temperature and Live Load Effect for Soil Modulus = 10 psi/in.

```
 BETA=0.41082349D-02      U=0.32935873D 00
FP( 1)=-0.14354178D 02
FP( 2)=-0.14639070D 02
FP( 3)=-0.15394937D 02
FP( 4)=-0.16673473D 02
FP( 5)=-0.18582599D 02
FP( 6)=-0.21251093D 02
FP( 7)=-0.24686686D 02
FP( 8)=-0.28793649D 02
FP( 9)=-0.33284589D 02
FP(10)=-0.37520553D 02
FP(11)=-0.40375949D 02
FE( 1)=-0.40375949D 02
FE( 2)=-0.40730041D 02
FF( 3)=-0.41078002D 02
FE( 4)=-0.41423068D 02
FE( 5)=-0.41771283D 02
FF( 6)=-0.42114998D 02
     NET PRESSURE = 0.356582190 01 AT STATION 1 IN SLAB
     NET PRESSURE = 0.328092960 01 AT STATION 2 IN SLAB
     NET PRESSURE = 0.252506260 01 AT STATION 3 IN SLAB
     NET PRESSURE = 0.124652730 01 AT STATION 4 IN SLAB
     NET PRESSURE =-0.662598660 00 AT STATION 5 IN SLAB
     NET PRESSURE =-0.333109850 01 AT STATION 6 IN SLAB
     NET PRESSURE =-0.676668630 01 AT STATION 7 IN SLAB
     NET PRESSURE =-0.108736490 02 AT STATION 8 IN SLAB
     NET PRESSURE =-0.153645890 02 AT STATION 9 IN SLAB
     NET PRESSURE =-0.196005530 02 AT STATION10 IN SLAB
     NET PRESSURE =-0.224559490 02 AT STATION11 IN SLAB
     NET PRESSURE =-0.537594990 01 AT STATION 1 IN EXTENSION
     NET PRESSURE =-0.573004060 01 AT STATION 2 IN EXTENSION
     NET PRESSURE =-0.607800220 01 AT STATION 3 IN EXTENSION
     NET PRESSURE =-0.642306840 01 AT STATION 4 IN EXTENSION
     NET PRESSURE =-0.677128340 01 AT STATION 5 IN EXTENSION
     NET PRESSURE =-0.711498770 01 AT STATION 6 IN EXTENSION
     Y( 1)= 0.14354178D 01 IN SLAB
     Y( 2)= 0.14639070D 01 IN SLAB
     Y( 3)= 0.15394932D 01 IN SLAB
     Y( 4)= 0.16673471D 01 IN SLAB
     Y( 5)= 0.18582602D 01 IN SLAB
     Y( 6)= 0.21251088D 01 IN SLAB
     Y( 7)= 0.24686672D 01 IN SLAB
     Y( 8)= 0.28793640D 01 IN SLAB
     Y( 9)= 0.33284572D 01 IN SLAB
     Y(10)= 0.37520557D 01 IN SLAB
     Y(11)= 0.40375941D 01 IN SLAB
     Y( 1)= 0.40375941D 01 IN EXTENSION
     Y( 2)= 0.40730014D 01 IN EXTENSION
     Y( 3)= 0.41077986D 01 IN EXTENSION
     Y( 4)= 0.41423052D 01 IN EXTENSION
     Y( 5)= 0.41771269D 01 IN EXTENSION
     Y( 6)= 0.42114964D 01 IN EXTENSION
     VP=-0.230965970 04 VE=-0.285340640 03
```

Table 3. Output of "Soil React" Program with Temperature and Live Load Effect for Soil Modulus = 20 psi/in.

```
    BETA= 0.29170000D-02      U= 0.333188140 00
FP( 1)=-0.14665618D 02
FP( 2)=-0.14735530D 02
FP( 3)=-0.14992816D 02
FP( 4)=-0.15614116D 02
FP( 5)=-0.16853322D 02
FP( 6)=-0.19069110D 02
FP( 7)=-0.22470813D 02
FP( 8)=-0.27132531D 02
FP( 9)=-0.32841411D 02
FP(10)=-0.38743571D 02
FP(11)=-0.42842401D 02
FE( 1)=-0.42842401D 02
FE( 2)=-0.43341443D 02
FE( 3)=-0.43826373D 02
FE( 4)=-0.44304083D 02
FE( 5)=-0.44784898D 02
FE( 6)=-0.45258780D 02
    NET PRESSURE = 0.32543820D 01 AT STATION 1 IN SLAB
    NET PRESSURE = 0.31844702D 01 AT STATION 2 IN SLAB
    NET PRESSURE = 0.29271839D 01 AT STATION 3 IN SLAB
    NET PRESSURE = 0.23058838D 01 AT STATION 4 IN SLAB
    NET PRESSURE = 0.10666776D 01 AT STATION 5 IN SLAB
    NET PRESSURE =-0.11491102D 01 AT STATION 6 IN SLAB
    NET PRESSURE =-0.45508128D 01 AT STATION 7 IN SLAB
    NET PRESSURE =-0.92125312D 01 AT STATION 8 IN SLAB
    NET PRESSURE =-0.14921411D 02 AT STATION 9 IN SLAB
    NET PRESSURE =-0.20823571D 02 AT STATION10 IN SLAB
    NET PRESSURE =-0.24922401D 02 AT STATION11 IN SLAB
    NET PRESSURE =-0.78424015D 01 AT STATION 1 IN EXTENSION
    NET PRESSURE =-0.83414426D 01 AT STATION 2 IN EXTENSION
    NET PRESSURE =-0.88263733D 01 AT STATION 3 IN EXTENSION
    NET PRESSURE =-0.93040826D 01 AT STATION 4 IN EXTENSION
    NET PRESSURE =-0.97848984D 01 AT STATION 5 IN EXTENSION
    NET PRESSURE =-0.10258780D 02 AT STATION 6 IN EXTENSION
    Y( 1)= 0.7332809CD 00 IN SLAB
    Y( 2)= 0.73677588D 00 IN SLAB
    Y( 3)= 0.74964059D 00 IN SLAB
    Y( 4)= 0.78070509D 00 IN SLAB
    Y( 5)= 0.84266688D 00 IN SLAB
    Y( 6)= 0.95345547D 00 IN SLAB
    Y( 7)= 0.11235394D 01 IN SLAB
    Y( 8)= 0.13566265D 01 IN SLAB
    Y( 9)= 0.16420689D 01 IN SLAB
    Y(10)= 0.19371794D 01 IN SLAB
    Y(11)= 0.21421198D 01 IN SLAB
    Y( 1)= 0.21421198D 01 IN EXTENSION
    Y( 2)= 0.21670718D 01 IN EXTENSION
    Y( 3)= 0.21913183D 01 IN EXTENSION
    Y( 4)= 0.22152038D 01 IN EXTENSION
    Y( 5)= 0.22392445D 01 IN EXTENSION
    Y( 6)= 0.22629387D 01 IN EXTENSION
    VP=-0.21813105D 04 VE=-0.41368988D 03
```

Table 4. Output of "Soil React" Program with Temperature and Live Load Effect for Soil Modulus = 100 psi/in.

```
     BETA= 0.10640363D-02      U= 0.33922240D 00

 FP( 1)=-0.18082031D 02
 FP( 2)=-0.17891817D 02
 FP( 3)=-0.17420825D 02
 FP( 4)=-0.16725515D 02
 FP( 5)=-0.15998185D 02
 FP( 6)=-0.15853729D 02
 FP( 7)=-0.17251987D 02
 FP( 8)=-0.21174976D 02
 FP( 9)=-0.29063882D 02
 FP(10)=-0.40295156D 02
 FP(11)=-0.48642899D 02
 FE( 1)=-0.48642899D 02
 FE( 2)=-0.49503021D 02
 FE( 3)=-0.50265300D 02
 FE( 4)=-0.50973818D 02
 FE( 5)=-0.51669959D 02
 FE( 6)=-0.52346916D 02
      NET PRESSURE =-0.16203100D 00 AT STATION 1 IN SLAB
      NET PRESSURE = 0.28183208D-01 AT STATION 2 IN SLAB
      NET PRESSURE = 0.49917443D 00 AT STATION 3 IN SLAB
      NET PRESSURE = 0.11944850D 01 AT STATION 4 IN SLAB
      NET PRESSURE = 0.19218146D 01 AT STATION 5 IN SLAB
      NET PRESSURE = 0.20662658D 01 AT STATION 6 IN SLAB
      NET PRESSURE = 0.66801301D 00 AT STATION 7 IN SLAB
      NET PRESSURE =-0.32549764D 01 AT STATION 8 IN SLAB
      NET PRESSURE =-0.11143882D 02 AT STATION 9 IN SLAB
      NET PRESSURE =-0.22378156D 02 AT STATION10 IN SLAB
      NET PRESSURE =-0.30722899D 02 AT STATION11 IN SLAB
      NET PRESSURE =-0.13642899D 02 AT STATION 1 IN EXTENSION
      NET PRESSURE =-0.14503021D 02 AT STATION 2 IN EXTENSION
      NET PRESSURE =-0.15265390D 02 AT STATION 3 IN EXTENSION
      NET PRESSURE =-0.15973818D 02 AT STATION 4 IN EXTENSION
      NET PRESSURE =-0.16669959D 02 AT STATION 5 IN EXTENSION
      NET PRESSURE =-0.17346916D 02 AT STATION 6 IN EXTENSION
      Y( 1)= 0.18082031D 00 IN SLAB
      Y( 2)= 0.17891810D 00 IN SLAB
      Y( 3)= 0.17420825D 00 IN SLAB
      Y( 4)= 0.16725515D 00 IN SLAB
      Y( 5)= 0.15998180D 00 IN SLAB
      Y( 6)= 0.15853729D 00 IN SLAB
      Y( 7)= 0.17251984D 00 IN SLAB
      Y( 8)= 0.21174969D 00 IN SLAB
      Y( 9)= 0.29063878D 00 IN SLAB
      Y(10)= 0.40298192D 00 IN SLAB
      Y(11)= 0.48642893D 00 IN SLAB
      Y( 1)= 0.48642893D 00 IN EXTENSION
      Y( 2)= 0.49502997D 00 IN EXTENSION
      Y( 3)= 0.50265365D 00 IN EXTENSION
      Y( 4)= 0.50973795D 00 IN EXTENSION
      Y( 5)= 0.51669936D 00 IN EXTENSION
      Y( 6)= 0.52346895D 00 IN EXTENSION
      VP=-0.18838131D 04 VE=-0.71118728D 03
```

Table 5. Output of "Soil React" Program with Temperature and Live Load Effect for Soil Modulus = 200 psi/ in.

```
 BETA= 0.580330000-03      U= 0.340894080 00
 FP( 1)=-0.182395070 02
 FP( 2)=-0.181989980 02
 FP( 3)=-0.180287640 02
 FP( 4)=-0.175928340 02
 FP( 5)=-0.168186370 02
 FP( 6)=-0.159653260 02
 FP( 7)=-0.159693020 02
 FP( 8)=-0.187084550 02
 FP( 9)=-0.266858150 02
 FP(10)=-0.400067060 02
 FP(11)=-0.513496110 02
 FE( 1)=-0.513496110 02
 FE( 2)=-0.522124020 02
 FE( 3)=-0.528637400 02
 FE( 4)=-0.533948760 02
 FE( 5)=-0.538702100 02
 FE( 6)=-0.543275220 02
 NET PRESSURE =-0.319507240 00 AT STATION 1 IN SLAB
 NET PRESSURE =-0.278997910 00 AT STATION 2 IN SLAB
 NET PRESSURE =-0.108763810 00 AT STATION 3 IN SLAB
 NET PRESSURE = 0.327166080 00 AT STATION 4 IN SLAB
 NET PRESSURE = 0.110136310 01 AT STATION 5 IN SLAB
 NET PRESSURE = 0.195467440 01 AT STATION 6 IN SLAB
 NET PRESSURE = 0.195069840 01 AT STATION 7 IN SLAB
 NET PRESSURE =-0.788455170 00 AT STATION 8 IN SLAB
 NET PRESSURE =-0.876581460 01 AT STATION 9 IN SLAB
 NET PRESSURE =-0.220867060 02 AT STATION10 IN SLAB
 NET PRESSURE =-0.334296110 02 AT STATION11 IN SLAB
 NET PRESSURE =-0.163496110 02 AT STATION 1 IN EXTENSION
 NET PRESSURE =-0.172124020 02 AT STATION 2 IN EXTENSION
 NET PRESSURE =-0.178637400 02 AT STATION 3 IN EXTENSION
 NET PRESSURE =-0.183948760 02 AT STATION 4 IN EXTENSION
 NET PRESSURE =-0.188702100 02 AT STATION 5 IN EXTENSION
 NET PRESSURE =-0.193275220 02 AT STATION 6 IN EXTENSION
 Y( 1)= 0.911975360-01 IN SLAB
 Y( 2)=-0.909949820-01 IN SLAB
 Y( 3)= 0.901438200-01 IN SLAB
 Y( 4)=-0.879641610-01 IN SLAB
 Y( 5)= 0.840931940-01 IN SLAB
 Y( 6)=-0.798266250-01 IN SLAB
 Y( 7)= 0.798464950-01 IN SLAB
 Y( 8)=-0.935422650-01 IN SLAB
 Y( 9)= 0.133429060 00 IN SLAB
 Y(10)=-0.200033530 00 IN SLAB
 Y(11)= 0.256748140 00 IN SLAB
 Y( 1)=-0.256748140 00 IN EXTENSION
 Y( 2)= 0.261061970 00 IN EXTENSION
 Y( 3)= 0.264318630 00 IN EXTENSION
 Y( 4)= 0.266974410 00 IN EXTENSION
 Y( 5)=-0.269351120 00 IN EXTENSION
 Y( 6)= 0.271637530 00 IN EXTENSION
 VP=-0.177261200-04 VE=-0.822769420 03
```

Table 6. Output of "Soil React" Program with Temperature and Live Load Effect for Soil Modulus = 1,000 psi/in.

```
     BETA= 0.23091449D-04      U= 0.342588746 00

 FP( 1)=-0.17897582D C2
 FP( 2)=-0.17920037D C2
 FP( 3)=-0.17943447D C2
 FP( 4)=-0.17881567D 02
 FP( 5)=-0.18225982D C2
 FP( 6)=-0.18038154D C2
 FP( 7)=-0.16795691D C2
 FP( 8)=-0.14725317D C2
 FP( 9)=-0.19411994D C2
 FP(10)=-0.39541356D C2
 FP(11)=-0.59603347D C2
 FE( 1)=-0.59603347D C2
 FE( 2)=-0.59071275D C2
 FE( 3)=-0.57489071D 02
 FE( 4)=-0.55342423D C2
 FE( 5)=-0.52960745D C2
 FE( 6)=-0.50490589D 02
      NET PRESSURE = 0.22418494D-01 AT STATION 1 IN SLAB
      NET PRESSURE =-0.372777520-04 AT STATION 2 IN SLAB
      NET PRESSURE =-0.234474800-01 AT STATION 3 IN SLAB
      NET PRESSURE = 0.384326830-01 AT STATION 4 IN SLAB
      NET PRESSURE =-0.305882280 00 AT STATION 5 IN SLAB
      NET PRESSURE =-0.118153880 00 AT STATION 6 IN SLAB
      NET PRESSURE = 0.112430940 01 AT STATION 7 IN SLAB
      NET PRESSURE = 0.319468350 01 AT STATION 8 IN SLAB
      NET PRESSURE =-0.149199360 01 AT STATION 9 IN SLAB
      NET PRESSURE =-0.216213560 02 AT STATION10 IN SLAB
      NET PRESSURE =-0.416833470 02 AT STATION11 IN SLAB
      NET PRESSURE =-0.246033470 02 AT STATION 1 IN EXTENSION
      NET PRESSURE =-0.240712750 02 AT STATION 2 IN EXTENSION
      NET PRESSURE =-0.224890710 02 AT STATION 3 IN EXTENSION
      NET PRESSURE =-0.203424230 02 AT STATION 4 IN EXTENSION
      NET PRESSURE =-0.179607450 02 AT STATION 5 IN EXTENSION
      NET PPESSURE =-0.154905890 02 AT STATION 6 IN EXTENSION
      Y( 1)= 0.17897582D-01 IN SLAB
      Y( 2)= 0.17920040D-01 IN SLAB
      Y( 3)= 0.17943446D-01 IN SLAB
      Y( 4)= 0.17881598D-01 IN SLAB
      Y( 5)= 0.18225878D-01 IN SLAB
      Y( 6)= 0.18038150D-01 IN SLAB
      Y( 7)= 0.16795647D-01 IN SLAB
      Y( 8)= 0.14725314D-01 IN SLAB
      Y( 9)= 0.19411993D-01 IN SLAB
      Y(10)= 0.39541363D-01 IN SLAB
      Y(11)= 0.59603865D-01 IN SLAB
      Y( 1)= 0.59603865D-01 IN EXTENSION
      Y( 2)= 0.59071788D-01 IN EXTENSION
      Y( 3)= 0.57489578D-01 IN EXTENSION
      Y( 4)= 0.55342933D-01 IN EXTENSION
      Y( 5)= 0.52961261D-01 IN EXTENSION
      Y( 6)= 0.50491160D-01 IN EXTENSION
      VP=-0.16421330D C4 VE=-0.952867350 03
```

Table 7. Output of "Soil React" Program with Temperature and Live Load Effect for Soil Modulus = 2,000 psi/in.

```
    BETA=-0.505000000-04      U= 0.342937210 00
FP( 1)=-0.179319770 02
FP( 2)=-0.179267190 02
FP( 3)=-0.178961200 02
FP( 4)=-0.178520310 02
FP( 5)=-0.179650150 02
FP( 6)=-0.184185750 02
FP( 7)=-0.180869360 02
FP( 8)=-0.148856200 02
FP( 9)=-0.157969530 02
FP(10)=-0.379100940 02
FP(11)=-0.659239290 02
FE( 1)=-0.659239290 02
FE( 2)=-0.636991390 02
FE( 3)=-0.596620920 02
FE( 4)=-0.547099860 02
FE( 5)=-0.493864730 02
FE( 6)=-0.439579400 02
    NET PRESSURE =-0.119765990-01 AT STATION 1 IN SLAB
    NET PRESSURE =-0.671939050-02 AT STATION 2 IN SLAB
    NET PRESSURE = 0.238796840-01 AT STATION 3 IN SLAB
    NET PRESSURE = 0.679688420-01 AT STATION 4 IN SLAB
    NET PRESSURE =-0.450149000-01 AT STATION 5 IN SLAB
    NET PRESSURE =-0.498575060 00 AT STATION 6 IN SLAB
    NET PRESSURE =-0.163936420 00 AT STATION 7 IN SLAB
    NET PRESSURE = 0.303438000 01 AT STATION 8 IN SLAB
    NET PRESSURE = 0.212304710 01 AT STATION 9 IN SLAB
    NET PRESSURE =-0.199900940 02 AT STATION10 IN SLAB
    NET PRESSURE =-0.480039290 02 AT STATION11 IN SLAB
    NET PRESSURE =-0.309239290 02 AT STATION 1 IN EXTENSION
    NET PRESSURE =-0.286991390 02 AT STATION 2 IN EXTENSION
    NET PRESSURE =-0.246620920 02 AT STATION 3 IN EXTENSION
    NET PRESSURE =-0.197099860 02 AT STATION 4 IN EXTENSION
    NET PRESSURE =-0.143864730 02 AT STATION 5 IN EXTENSION
    NET PRESSURE =-0.895793960 01 AT STATION 6 IN EXTENSION
    Y( 1)= 0.896598830-02 IN SLAB
    Y( 2)= 0.896336040-02 IN SLAB
    Y( 3)= 0.894807280-02 IN SLAB
    Y( 4)= 0.892601490-02 IN SLAB
    Y( 5)= 0.898252430-02 IN SLAB
    Y( 6)= 0.920928750-02 IN SLAB
    Y( 7)= 0.904195820-02 IN SLAB
    Y( 8)= 0.744280430-02 IN SLAB
    Y( 9)= 0.789847350-02 IN SLAB
    Y(10)= 0.189550460-01 IN SLAB
    Y(11)= 0.329620570-01 IN SLAB
    Y( 1)= 0.329620570-01 IN EXTENSION
    Y( 2)= 0.318496460-01 IN EXTENSION
    Y( 3)= 0.298311280-01 IN EXTENSION
    Y( 4)= 0.273550790-01 IN EXTENSION
    Y( 5)= 0.246933220-01 IN EXTENSION
    Y( 6)= 0.219790550-01 IN EXTENSION
    VP=-0.162422890 04 VE=-0.971152960 03
```

Table 8. Output of "Soil React" Program with Temperature and Live Load Effect for Soil Modulus = 10,000 psi/in.

```
    BETA=-0.81937253D-04        U= 0.34293553D 00

FP( 1)=-0.17626799D 02
FP( 2)=-0.17942423D 02
FP( 3)=-0.19108814D 02
FP( 4)=-0.14916266D 02
FP( 5)=-0.21486011D 02
FP( 6)=-0.15048702D 02
FP( 7)=-0.21664615D 02
FP( 8)=-0.13417212D 02
FP( 9)=-0.19613939D 02
FP(10)=-0.17983764D 02
FP(11)=-0.92820802D 02
FE( 1)=-0.92820802D 02
FE( 2)=-0.81822330D 02
FE( 3)=-0.66978340D 02
FE( 4)=-0.51482356D 02
FE( 5)=-0.36144850D 02
FE( 6)=-0.20965760D 02
     NET PRESSURE = 0.29320130D 00 AT STATION 1 IN SLAB
     NET PRESSURE =-0.22423143D-01 AT STATION 2 IN SLAB
     NET PRESSURE =-0.11888240D 01 AT STATION 3 IN SLAB
     NET PRESSURE = 0.30037365D 01 AT STATION 4 IN SLAB
     NET PRESSURE =-0.35660105D 01 AT STATION 5 IN SLAB
     NET PRESSURE = 0.28712982D 01 AT STATION 6 IN SLAB
     NET PRESSURE =-0.37446153D 01 AT STATION 7 IN SLAB
     NET PRESSURE = 0.45027877D 01 AT STATION 8 IN SLAB
     NET PRESSURE =-0.16939394D 01 AT STATION 9 IN SLAB
     NET PRESSURE =-0.63764261D-01 AT STATION10 IN SLAB
     NET PRESSURE =-0.74900802D 02 AT STATION11 IN SLAB
     NET PRESSURE =-0.57920802D 02 AT STATION 1 IN EXTENSION
     NET PRESSURE =-0.46822330D 02 AT STATION 2 IN EXTENSION
     NET PRESSURE =-0.31978340D 02 AT STATION 3 IN EXTENSION
     NET PRESSURE =-0.16488356D 02 AT STATION 4 IN EXTENSION
     NET PRESSURE =-0.11448503D 01 AT STATION 5 IN EXTENSION
     NET PRESSURE = 0.14034240D 02 AT STATION 6 IN EXTENSION
     Y( 1)= 0.17626799D-02 IN SLAB
     Y( 2)= 0.17942424D-02 IN SLAB
     Y( 3)= 0.19108814D-02 IN SLAB
     Y( 4)= 0.14916266D-02 IN SLAB
     Y( 5)= 0.21486011D-02 IN SLAB
     Y( 6)= 0.15048156D-02 IN SLAB
     Y( 7)= 0.21664630D-02 IN SLAB
     Y( 8)= 0.13417185D-02 IN SLAB
     Y( 9)= 0.19613982D-02 IN SLAB
     Y(10)= 0.17983908D-02 IN SLAB
     Y(11)= 0.92825123D-02 IN SLAB
     Y( 1)= 0.92825123D-02 IN EXTENSION
     Y( 2)= 0.81826649D-02 IN EXTENSION
     Y( 3)= 0.66982654D-02 IN EXTENSION
     Y( 4)= 0.51492677D-02 IN EXTENSION
     Y( 5)= 0.36149129D-02 IN EXTENSION
     Y( 6)= 0.20970C8CD-02 IN EXTENSION
     VP=-0.15411444D 04 VE=-0.10538557D 04
```

Table 9. Output of "Soil React" Program with Temperature and Live Load Effect for Soil Modulus = 20,000 psi/in.

```
     BETA=-0.725000000-04      U= 0.343008630 00
 FP( 1)=-0.179207760 02
 FP( 2)=-0.179224750 02
 FP( 3)=-0.179078020 02
 FP( 4)=-0.179505390 02
 FP( 5)=-0.179156700 02
 FP( 6)=-0.175990680 02
 FP( 7)=-0.185582790 02
 FP( 8)=-0.196112130 02
 FP( 9)=-0.148003600 02
 FP(10)=-0.126365050 02
 FP(11)=-0.105239440 03
 FE( 1)=-0.105239440 03
 FE( 2)=-0.876115180 02
 FE( 3)=-0.868759110 02
 FE( 4)=-0.478231380 02
 FE( 5)=-0.308345310 02
 FE( 6)=-0.145297840 02
      NET PRESSURE =-0.776139830-03 AT STATION 1 IN SLAB
      NET PRESSURE =-0.247505060-02 AT STATION 2 IN SLAB
      NET PRESSURE = 0.129980220-01 AT STATION 3 IN SLAB
      NET PRESSURE =-0.305392990-01 AT STATION 4 IN SLAB
      NET PRESSURE = 0.433000400-02 AT STATION 5 IN SLAB
      NET PRESSURE = 0.320931820 00 AT STATION 6 IN SLAB
      NET PRESSURE =-0.638278910 00 AT STATION 7 IN SLAB
      NET PRESSURE =-0.169121250 01 AT STATION 8 IN SLAB
      NET PRESSURE = 0.311964020 01 AT STATION 9 IN SLAB
      NET PRESSURE = 0.528349470 01 AT STATION10 IN SLAB
      NET PRESSURE =-0.873194450 02 AT STATION11 IN SLAB
      NET PRESSURE =-0.702394450 02 AT STATION 1 IN EXTENSION
      NET PRESSURE =-0.526115180 02 AT STATION 2 IN EXTENSION
      NET PRESSURE =-0.318759110 02 AT STATION 3 IN EXTENSION
      NET PRESSURE =-0.128231380 02 AT STATION 4 IN EXTENSION
      NET PRESSURE = 0.416546860 01 AT STATION 5 IN EXTENSION
      NET PRESSURE = 0.204702160 02 AT STATION 6 IN EXTENSION
      Y( 1)= 0.896038810-03 IN SLAB
      Y( 2)= 0.896124320-03 IN SLAB
      Y( 3)= 0.895350200-03 IN SLAB
      Y( 4)= 0.897526540-03 IN SLAB
      Y( 5)= 0.895785380-03 IN SLAB
      Y( 6)= 0.879952590-03 IN SLAB
      Y( 7)= 0.927913630-03 IN SLAB
      Y( 8)= 0.980555660-03 IN SLAB
      Y( 9)= 0.740017650-03 IN SLAB
      Y(10)= 0.631824860-03 IN SLAB
      Y(11)= 0.526206400-02 IN SLAB
      Y( 1)= 0.526206400-02 IN EXTENSION
      Y( 2)= 0.438066720-02 IN EXTENSION
      Y( 3)= 0.334388630-02 IN EXTENSION
      Y( 4)= 0.239124800-02 IN EXTENSION
      Y( 5)= 0.154181830-02 IN EXTENSION
      Y( 6)= 0.726580500-03 IN EXTENSION
      VP=-0.155039860 04 VE=-0.104498320 04
```

Table 10. Output of "Soil React" Program without Temperature Effect for Soil Modulus = 10 psi/in.

```
     BETA= 0.78994099D-02      U= 0.50851438D-02

FP( 1)=-0.13817664D 02
FP( 2)=-0.14048968D 02
FP( 3)=-0.14677983D 02
FP( 4)=-0.15786163D 02
FP( 5)=-0.17508644D 02
FP( 6)=-0.20031106D 02
FP( 7)=-0.23437218D 02
FP( 8)=-0.27700041D 02
FP( 9)=-0.32667344D 02
FP(10)=-0.37845948D 02
FP(11)=-0.42072239D 02
FE( 1)=-0.42072239D 02
FE( 2)=-0.42754223D 02
FE( 3)=-0.43426078D 02
FE( 4)=-0.44093314D 02
FE( 5)=-0.44767120D 02
FE( 6)=-0.45432598D 02
     NET PRESSURE = 0.41023363D 01 AT STATION 1 IN SLAB
     NET PRESSURE = 0.38710318D 01 AT STATION 2 IN SLAB
     NET PRESSURE = 0.32420173D 01 AT STATION 3 IN SLAB
     NET PRESSURE = 0.21338368D 01 AT STATION 4 IN SLAB
     NET PRESSURE = 0.41135637D 00 AT STATION 5 IN SLAB
     NET PRESSURE =-0.21111062D 01 AT STATION 6 IN SLAB
     NET PRESSURE =-0.55172181D 01 AT STATION 7 IN SLAB
     NET PRESSURE =-0.97800410D 01 AT STATION 8 IN SLAB
     NET PRESSURE =-0.14747344D 02 AT STATION 9 IN SLAB
     NET PRESSURE =-0.19925948D 02 AT STATION10 IN SLAB
     NET PRESSURE =-0.24152239D 02 AT STATION11 IN SLAB
     NET PRESSURE =-0.70722387D 01 AT STATION 1 IN EXTENSION
     NET PRESSURE =-0.77542234D 01 AT STATION 2 IN EXTENSION
     NET PRESSURE =-0.84260783D 01 AT STATION 3 IN EXTENSION
     NET PRESSURE =-0.90933138D 01 AT STATION 4 IN EXTENSION
     NET PRESSURE =-0.97671201D 01 AT STATION 5 IN EXTENSION
     NET PRESSURE =-0.10432598D 02 AT STATION 6 IN EXTENSION
     Y( 1)= 0.13817664D 01 IN SLAB
     Y( 2)= 0.14048967D 01 IN SLAB
     Y( 3)= 0.14677977D 01 IN SLAB
     Y( 4)= 0.15786162D 01 IN SLAB
     Y( 5)= 0.17508647D 01 IN SLAB
     Y( 6)= 0.20031096D 01 IN SLAB
     Y( 7)= 0.23437204D 01 IN SLAB
     Y( 8)= 0.27700033D 01 IN SLAB
     Y( 9)= 0.32667327D 01 IN SLAB
     Y(10)= 0.37845952D 01 IN SLAB
     Y(11)= 0.42072231D 01 IN SLAB
     Y( 1)= 0.42072231D 01 IN EXTENSION
     Y( 2)= 0.42754195D 01 IN EXTENSION
     Y( 3)= 0.43426061D 01 IN EXTENSION
     Y( 4)= 0.44093297D 01 IN EXTENSION
     Y( 5)= 0.44767105D 01 IN EXTENSION
     Y( 6)= 0.45432573D 01 IN EXTENSION
     VP=-0.21947971D 04 VE=-0.40020326D 03
```

Table 11. Output of "Soil React" Program without Temperature Effect for Soil Modulus = 20 psi/in.

```
 BETA= 0.64443611D-02      U= 0.97997227D-02

FP( 1)=-0.14668080D 02
FP( 2)=-0.14646852D 02
FP( 3)=-0.14677629D 02
FP( 4)=-0.14965170D 02
FP( 5)=-0.15781222D 02
FP( 6)=-0.17554148D 02
FP( 7)=-0.20626898D 02
FP( 8)=-0.25209259D 02
FP( 9)=-0.31402955D 02
FP(10)=-0.38730266D 02
FP(11)=-0.45242792D 02
FE( 1)=-0.45242792D 02
FE( 2)=-0.46350498D 02
FE( 3)=-0.47434496D 02
FE( 4)=-0.48506808D 02
FE( 5)=-0.49588042D 02
FE( 6)=-0.50655065D 02
     NET PRESSURE = 0.32519204D 01 AT STATION 1 IN SLAB
     NET PRESSURE = 0.32731483D 01 AT STATION 2 IN SLAB
     NET PRESSURE = 0.32423713D 01 AT STATION 3 IN SLAB
     NET PRESSURE = 0.29548301D 01 AT STATION 4 IN SLAB
     NET PRESSURE = 0.21387785D 01 AT STATION 5 IN SLAB
     NET PRESSURE = 0.36585202D 00 AT STATION 6 IN SLAB
     NET PRESSURE =-0.27068977D 01 AT STATION 7 IN SLAB
     NET PRESSURE =-0.72892591D 01 AT STATION 8 IN SLAB
     NET PRESSURE =-0.13482955D 02 AT STATION 9 IN SLAB
     NET PRESSURE =-0.20810266D 02 AT STATION10 IN SLAB
     NET PRESSURE =-0.27322792D 02 AT STATION11 IN SLAB
     NET PRESSURE =-0.10242792D 02 AT STATION 1 IN EXTENSION
     NET PRESSURE =-0.11350498D 02 AT STATION 2 IN EXTENSION
     NET PRESSURE =-0.12434496D 02 AT STATION 3 IN EXTENSION
     NET PRESSURE =-0.13506808D 02 AT STATION 4 IN EXTENSION
     NET PRESSURE =-0.14588042D 02 AT STATION 5 IN EXTENSION
     NET PRESSURE =-0.15655065D 02 AT STATION 6 IN EXTENSION
     Y( 1)= 0.73340398D 00 IN SLAB
     Y( 2)= 0.73234198D 00 IN SLAB
     Y( 3)= 0.73388123D 00 IN SLAB
     Y( 4)= 0.74825781D 00 IN SLAB
     Y( 5)= 0.78906184D 00 IN SLAB
     Y( 6)= 0.87770736D 00 IN SLAB
     Y( 7)= 0.10313437D 01 IN SLAB
     Y( 8)= 0.12604629D 01 IN SLAB
     Y( 9)= 0.15701461D 01 IN SLAB
     Y(10)= 0.19365141D 01 IN SLAB
     Y(11)= 0.22621393D 01 IN SLAB
     Y( 1)= 0.22621393D 01 IN EXTENSION
     Y( 2)= 0.23175246D 01 IN EXTENSION
     Y( 3)= 0.23717245D 01 IN EXTENSION
     Y( 4)= 0.24253400D 01 IN EXTENSION
     Y( 5)= 0.24794017D 01 IN EXTENSION
     Y( 6)= 0.25327529D 01 IN EXTENSION
     VP=-0.20024201D 04 VE=-0.59258027D 03
```

Table 12. Output of "Soil React" Program without Temperature Effect for Soil Modulus = 100 psi/in.

```
    BETA= 0.38066886D-02      U= 0.163461810-01

FP( 1)=-0.18449646D 02
FP( 2)=-0.18299991D 02
FP( 3)=-0.17875444D 02
FP( 4)=-0.17134303D 02
FP( 5)=-0.16053834D 02
FP( 6)=-0.14970626D 02
FP( 7)=-0.14855015D 02
FP( 8)=-0.16797250D 02
FP( 9)=-0.23481547D 02
FP(10)=-0.36719924D 02
FP(11)=-0.52890361D 02
FE( 1)=-0.52890361D 02
FE( 2)=-0.56083241D 02
FE( 3)=-0.59091102D 02
FE( 4)=-0.61998170D 02
FE( 5)=-0.64902456D 02
FE( 6)=-0.67755061D 02
     NET PRESSURE =-0.52964601D 00 AT STATION 1 IN SLAB
     NET PRESSURE =-0.37999106D 00 AT STATION 2 IN SLAB
     NET PRESSURE = 0.44555657D-01 AT STATION 3 IN SLAB
     NET PRESSURE = 0.78569739D 00 AT STATION 4 IN SLAB
     NET PRESSURE = 0.18661660D 01 AT STATION 5 IN SLAB
     NET PRESSURE = 0.29493745D 01 AT STATION 6 IN SLAB
     NET PRESSURE = 0.30649853D 01 AT STATION 7 IN SLAB
     NET PRESSURE = 0.11227497D 01 AT STATION 8 IN SLAB
     NET PRESSURE =-0.55615471D 01 AT STATION 9 IN SLAB
     NET PRESSURE =-0.18799924D 02 AT STATION10 IN SLAB
     NET PRESSURE =-0.34970361D 02 AT STATION11 IN SLAB
     NET PRESSURE =-0.17890361D 02 AT STATION 1 IN EXTENSION
     NET PRESSURE =-0.21083241D 02 AT STATION 2 IN EXTENSION
     NET PRESSURE =-0.24091102D 02 AT STATION 3 IN EXTENSION
     NET PRESSURE =-0.26998170D 02 AT STATION 4 IN EXTENSION
     NET PRESSURE =-0.29902456D 02 AT STATION 5 IN EXTENSION
     NET PRESSURE =-0.32755061D 02 AT STATION 6 IN EXTENSION
     Y( 1)= 0.18449646D 00 IN SLAB
     Y( 2)= 0.18299990D 00 IN SLAB
     Y( 3)= 0.17875444D 00 IN SLAB
     Y( 4)= 0.17134303D 00 IN SLAB
     Y( 5)= 0.16053829D 00 IN SLAB
     Y( 6)= 0.14970620D 00 IN SLAB
     Y( 7)= 0.14855013D 00 IN SLAB
     Y( 8)= 0.16797245D 00 IN SLAB
     Y( 9)= 0.23481544D 00 IN SLAB
     Y(10)= 0.36719961D 00 IN SLAB
     Y(11)= 0.52890354D 00 IN SLAB
     Y( 1)= 0.52890354D 00 IN EXTENSION
     Y( 2)= 0.56083214D 00 IN EXTENSION
     Y( 3)= 0.59091073D 00 IN EXTENSION
     Y( 4)= 0.61998143D 00 IN EXTENSION
     Y( 5)= 0.64902429D 00 IN EXTENSION
     Y( 6)= 0.67755036D 00 IN EXTENSION
     VP=-0.14291225D 04 VE=-0.11658778D 04
```

Table 13. Output of "Soil React" Program without Temperature Effect for Soil Modulus = 200 psi/in.

```
     BETA= 0.29418383D-02      U= 0.21148427D-01

FP( 1)=-0.18212380D 02
FP( 2)=-0.18252880D 02
FP( 3)=-0.18265399D 02
FP( 4)=-0.18091770D 02
FP( 5)=-0.17457232D 02
FP( 6)=-0.16074831D 02
FP( 7)=-0.14564867D 02
FP( 8)=-0.13891548D 02
FP( 9)=-0.18423284D 02
FP(10)=-0.32957846D 02
FP(11)=-0.55811269D 02
FE( 1)=-0.55811269D 02
FE( 2)=-0.60635439D 02
FE( 3)=-0.65011645D 02
FE( 4)=-0.69138065D 02
FE( 5)=-0.73218782D 02
FE( 6)=-0.77205700D 02
     NET PRESSURE =-0.29238004D 00 AT STATION 1 IN SLAB
     NET PRESSURE =-0.33288026D 00 AT STATION 2 IN SLAB
     NET PRESSURE =-0.34539908D 00 AT STATION 3 IN SLAB
     NET PRESSURE =-0.17177044D 00 AT STATION 4 IN SLAB
     NET PRESSURE = 0.46276791D 00 AT STATION 5 IN SLAB
     NET PRESSURE = 0.18451690D 01 AT STATION 6 IN SLAB
     NET PRESSURE = 0.33551329D 01 AT STATION 7 IN SLAB
     NET PRESSURE = 0.40284524D 01 AT STATION 8 IN SLAB
     NET PRESSURE =-0.50328430D 00 AT STATION 9 IN SLAB
     NET PRESSURE =-0.15037846D 02 AT STATION10 IN SLAB
     NET PRESSURE =-0.37891269D 02 AT STATION11 IN SLAB
     NET PRESSURE =-0.20811269D 02 AT STATION 1 IN EXTENSION
     NET PRESSURE =-0.25635439D 02 AT STATION 2 IN EXTENSION
     NET PRESSURE =-0.30011645D 02 AT STATION 3 IN EXTENSION
     NET PRESSURE =-0.34138065D 02 AT STATION 4 IN EXTENSION
     NET PRESSURE =-0.38218782D 02 AT STATION 5 IN EXTENSION
     NET PRESSURE =-0.42205700D 02 AT STATION 6 IN EXTENSION
     Y( 1)= 0.91061900D-01 IN SLAB
     Y( 2)= 0.91264459D-01 IN SLAB
     Y( 3)= 0.91326984D-01 IN SLAB
     Y( 4)= 0.90458883D-01 IN SLAB
     Y( 5)= 0.87286136D-01 IN SLAB
     Y( 6)= 0.80374154D-01 IN SLAB
     Y( 7)= 0.72824308D-01 IN SLAB
     Y( 8)= 0.69457729D-01 IN SLAB
     Y( 9)= 0.92116405D-01 IN SLAB
     Y(10)= 0.16478937D 00 IN SLAB
     Y(11)= 0.27905687D 00 IN SLAB
     Y( 1)= 0.27905687D 00 IN EXTENSION
     Y( 2)= 0.30317771D 00 IN EXTENSION
     Y( 3)= 0.32505858D 00 IN EXTENSION
     Y( 4)= 0.34569081D 00 IN EXTENSION
     Y( 5)= 0.36609421D 00 IN EXTENSION
     Y( 6)= 0.38602894D 00 IN EXTENSION
     VP=-0.11343429D 04 VE=-0.14606573D 04
```

Table 14. Output of "Soil React" Program without Temperature Effect for Soil Modulus = 1,000 psi/in.

```
     BETA= 0.15353764D-02      U= 0.25705577D-01

 FP( 1)=-0.17957837D 02
 FP( 2)=-0.17930730D 02
 FP( 3)=-0.17804314D 02
 FP( 4)=-0.17828021D 02
 FP( 5)=-0.18166678D 02
 FP( 6)=-0.18701900D 02
 FP( 7)=-0.18174882D 02
 FP( 8)=-0.15193712D 02
 FP( 9)=-0.89554212D 01
 FP(10)=-0.15785096D 02
 FP(11)=-0.61103941D 02
 FE( 1)=-0.61103941D 02
 FE( 2)=-0.72318296D 02
 FE( 3)=-0.80355205D 02
 FE( 4)=-0.86583666D 02
 FE( 5)=-0.92185952D 02
 FE( 6)=-0.97375151D 02
      NET PRESSURE =-0.37837331D-01 AT STATION 1 IN SLAB
      NET PRESSURE =-0.10730182D-01 AT STATION 2 IN SLAB
      NET PRESSURE = 0.11568577D 00 AT STATION 3 IN SLAB
      NET PRESSURE = 0.91978888D-01 AT STATION 4 IN SLAB
      NET PRESSURE =-0.24667784D 00 AT STATION 5 IN SLAB
      NET PRESSURE =-0.78189994D 00 AT STATION 6 IN SLAB
      NET PRESSURE =-0.25488235D 00 AT STATION 7 IN SLAB
      NET PRESSURE = 0.27262883D 01 AT STATION 8 IN SLAB
      NET PRESSURE = 0.89645788D 01 AT STATION 9 IN SLAB
      NET PRESSURE = 0.21349042D 01 AT STATION10 IN SLAB
      NET PRESSURE =-0.43183941D 02 AT STATION11 IN SLAB
      NET PRESSURE =-0.26103941D 02 AT STATION 1 IN EXTENSION
      NET PRESSURE =-0.37318296D 02 AT STATION 2 IN EXTENSION
      NET PRESSURE =-0.45355205D 02 AT STATION 3 IN EXTENSION
      NET PRESSURE =-0.51583666D 02 AT STATION 4 IN EXTENSION
      NET PRESSURE =-0.57185952D 02 AT STATION 5 IN EXTENSION
      NET PRESSURE =-0.62375151D 02 AT STATION 6 IN EXTENSION
      Y( 1)= 0.17957837D-01 IN SLAB
      Y( 2)= 0.17930733D-01 IN SLAB
      Y( 3)= 0.17804313D-01 IN SLAB
      Y( 4)= 0.17828052D-01 IN SLAB
      Y( 5)= 0.18166674D-01 IN SLAB
      Y( 6)= 0.18701896D-01 IN SLAB
      Y( 7)= 0.18174836D-01 IN SLAB
      Y( 8)= 0.15193709D-01 IN SLAB
      Y( 9)= 0.89554208D-02 IN SLAB
      Y(10)= 0.15785103D-01 IN SLAB
      Y(11)= 0.61104458D-01 IN SLAB
      Y( 1)= 0.61104458D-01 IN EXTENSION
      Y( 2)= 0.72318806D-01 IN EXTENSION
      Y( 3)= 0.80355706D-01 IN EXTENSION
      Y( 4)= 0.86584170D-01 IN EXTENSION
      Y( 5)= 0.92186465D-01 IN EXTENSION
      Y( 6)= 0.97375666D-01 IN EXTENSION
      VP=-0.43575352D 03 VE=-0.21592466D 04
```

Table 15. Output of "Soil React" Program without Temperature Effect for Soil Modulus = 2,000 psi/in.

```
     BETA=0.11767414D-02      U=0.26867609D-01
FP( 1)=-0.17967662D 02
FP( 2)=-0.17948365D 02
FP( 3)=-0.17829323D 02
FP( 4)=-0.17984459D 02
FP( 5)=-0.17625892D 02
FP( 6)=-0.18318804D 02
FP( 7)=-0.18833326D 02
FP( 8)=-0.18998459D 02
FP( 9)=-0.80165660D 01
FP(10)=-0.54900978D 01
FP(11)=-0.63693944D 02
FE( 1)=-0.63693944D 02
FE( 2)=-0.79473832D 02
FE( 3)=-0.88358811D 02
FE( 4)=-0.93346952D 02
FE( 5)=-0.96900241D 02
FE( 6)=-0.99666144D 02
     NET PRESSURE =-0.47661803D-01 AT STATION 1 IN SLAB
     NET PRESSURE =-0.28365102D-01 AT STATION 2 IN SLAB
     NET PRESSURE = 0.90677036D-01 AT STATION 3 IN SLAB
     NET PRESSURE =-0.64459031D-01 AT STATION 4 IN SLAB
     NET PRESSURE = 0.29410766D 00 AT STATION 5 IN SLAB
     NET PRESSURE =-0.39880423D 00 AT STATION 6 IN SLAB
     NET PRESSURE =-0.91332567D 00 AT STATION 7 IN SLAB
     NET PRESSURE =-0.10784594D 01 AT STATION 8 IN SLAB
     NET PRESSURE = 0.99034340D 01 AT STATION 9 IN SLAB
     NET PRESSURE = 0.12429902D 02 AT STATION10 IN SLAB
     NET PRESSURE =-0.45773944D 02 AT STATION11 IN SLAB
     NET PRESSURE =-0.28693944D 02 AT STATION 1 IN EXTENSION
     NET PRESSURE =-0.44473832D 02 AT STATION 2 IN EXTENSION
     NET PRESSURE =-0.53358811D 02 AT STATION 3 IN EXTENSION
     NET PRESSURE =-0.58346952D 02 AT STATION 4 IN EXTENSION
     NET PRESSURE =-0.61900241D 02 AT STATION 5 IN EXTENSION
     NET PRESSURE =-0.64666144D 02 AT STATION 6 IN EXTENSION
     Y( 1)= 0.89838309D-02 IN SLAB
     Y( 2)= 0.89741834D-02 IN SLAB
     Y( 3)= 0.89146606D-02 IN SLAB
     Y( 4)= 0.89922303D-02 IN SLAB
     Y( 5)= 0.88129458D-02 IN SLAB
     Y( 6)= 0.91594016D-02 IN SLAB
     Y( 7)= 0.94165953D-02 IN SLAB
     Y( 8)= 0.94992260D-02 IN SLAB
     Y( 9)= 0.40082815D-02 IN SLAB
     Y(10)= 0.27450496D-02 IN SLAB
     Y(11)= 0.31847493D-01 IN SLAB
     Y( 1)= 0.31847493D-01 IN EXTENSION
     Y( 2)= 0.39737426D-01 IN EXTENSION
     Y( 3)= 0.44179923D-01 IN EXTENSION
     Y( 4)= 0.46673990D-01 IN EXTENSION
     Y( 5)= 0.48450636D-01 IN EXTENSION
     Y( 6)= 0.49833583D-01 IN EXTENSION
     VP=-0.17152532D 03 VE=-0.24234747D 04
```

Table 16. Output of "Soil React" Program without Temperature Effect for Soil Modulus = 10,000 psi/in.

```
     BETA= 0.92575800D-03      U= 0.27660833D-01

 FP( 1)=-0.16524238D 02
 FP( 2)=-0.17613043D 02
 FP( 3)=-0.25150135D 02
 FP( 4)= 0.0
 FP( 5)=-0.40563862D 02
 FP( 6)= 0.0
 FP( 7)=-0.33896010D 02
 FP( 8)= 0.0
 FP( 9)=-0.27648302D 02
 FP(10)= 0.0
 FP(11)=-0.43173068D 02
 FE( 1)=-0.43173068D 02
 FE( 2)=-0.97476516D 02
 FE( 3)=-0.11413587D 03
 FE( 4)=-0.11054599D 03
 FE( 5)=-0.99705117D 02
 FE( 6)=-0.85358775D 02
     NET PRESSURE = 0.13957622D 01 AT STATION 1 IN SLAB
     NET PRESSURE = 0.30695690D 00 AT STATION 2 IN SLAB
     NET PRESSURE =-0.72301348D 01 AT STATION 3 IN SLAB
     NET PRESSURE = 0.17920000D 02 AT STATION 4 IN SLAB
     NET PRESSURE =-0.22643862D 02 AT STATION 5 IN SLAB
     NET PRESSURE = 0.17920000D 02 AT STATION 6 IN SLAB
     NET PRESSURE =-0.15976010D 02 AT STATION 7 IN SLAB
     NET PRESSURE = 0.17920000D 02 AT STATION 8 IN SLAB
     NET PRESSURE =-0.97283018D 01 AT STATION 9 IN SLAB
     NET PRESSURE = 0.17920000D 02 AT STATION10 IN SLAB
     NET PRESSURE =-0.25253068D 02 AT STATION11 IN SLAB
     NET PRESSURE =-0.81730682D 01 AT STATION 1 IN EXTENSION
     NET PRESSURE =-0.62476516D 02 AT STATION 2 IN EXTENSION
     NET PRESSURE =-0.79135870D 02 AT STATION 3 IN EXTENSION
     NET PRESSURE =-0.75545994D 02 AT STATION 4 IN EXTENSION
     NET PRESSURE =-0.64705117D 02 AT STATION 5 IN EXTENSION
     NET PRESSURE =-0.50358775D 02 AT STATION 6 IN EXTENSION
     Y( 1)= 0.16524238D-02 IN SLAB
     Y( 2)= 0.17613044D-02 IN SLAB
     Y( 3)= 0.25150167D-02 IN SLAB
     Y( 4)= 0.77374644D-03 IN SLAB
     Y( 5)= 0.40564737D-02 IN SLAB
     Y( 6)= 0.62995429D-03 IN SLAB
     Y( 7)= 0.33895949D-02 IN SLAB
     Y( 8)=-0.16767382D-02 IN SLAB
     Y( 9)= 0.27648325D-02 IN SLAB
     Y(10)=-0.20497181D-01 IN SLAB
     Y(11)= 0.43188529D-02 IN SLAB
     Y( 1)= 0.43188529D-02 IN EXTENSION
     Y( 2)= 0.97491975D-02 IN EXTENSION
     Y( 3)= 0.11415132D-01 IN EXTENSION
     Y( 4)= 0.11056145D-01 IN EXTENSION
     Y( 5)= 0.99720492D-02 IN EXTENSION
     Y( 6)= 0.85374230D-02 IN EXTENSION
     VP= 0.13992083D 03 VE=-0.28425981D 04
```

Table 17. Output of "Soil React" Program without Temperature Effect for Soil Modulus = 20,000 psi/in.

```
 BETA= 0.771802090-03      U= 0.281796730-01

FP( 1)=-0.179611310 02
FP( 2)=-0.175521730 02
FP( 3)=-0.198159950 02
FP( 4)=-0.131793910 02
FP( 5)=-0.246552180 02
FP( 6)=-0.116928860 02
FP( 7)=-0.221523450 02
FP( 8)=-0.194088560 02
FP( 9)=-0.119291650 02
FP(10)= 0.0
FP(11)=-0.372655240 02
FE( 1)=-0.372655240 02
FE( 2)=-0.121536330 03
FE( 3)=-0.136801670 03
FE( 4)=-0.118136010 03
FE( 5)=-0.887901450 02
FE( 6)=-0.543875680 02
   NET PRESSURE =-0.411307650-01 AT STATION 1 IN SLAB
   NET PRESSURE = 0.367827170 00 AT STATION 2 IN SLAB
   NET PRESSURE =-0.189599490 01 AT STATION 3 IN SLAB
   NET PRESSURE = 0.474060860 01 AT STATION 4 IN SLAB
   NET PRESSURE =-0.673521790 01 AT STATION 5 IN SLAB
   NET PRESSURE = 0.622711400 01 AT STATION 6 IN SLAB
   NET PRESSURE =-0.423234520 01 AT STATION 7 IN SLAB
   NET PRESSURE =-0.148885650 01 AT STATION 8 IN SLAB
   NET PRESSURE = 0.599083540 01 AT STATION 9 IN SLAB
   NET PRESSURE = 0.179200000 02 AT STATION10 IN SLAB
   NET PRESSURE =-0.193455240 02 AT STATION11 IN SLAB
   NET PRESSURE =-0.226552450 01 AT STATION 1 IN EXTENSION
   NET PRESSURE =-0.865363290 02 AT STATION 2 IN EXTENSION
   NET PRESSURE =-0.101801670 03 AT STATION 3 IN EXTENSION
   NET PRESSURE =-0.831360110 02 AT STATION 4 IN EXTENSION
   NET PRESSURE =-0.537901450 02 AT STATION 5 IN EXTENSION
   NET PRESSURE =-0.193875680 02 AT STATION 6 IN EXTENSION
   Y( 1)= 0.898056540-03 IN SLAB
   Y( 2)= 0.877608800-03 IN SLAB
   Y( 3)= 0.990799250-03 IN SLAB
   Y( 4)= 0.658971000-03 IN SLAB
   Y( 5)= 0.123276080-02 IN SLAB
   Y( 6)= 0.584599220-03 IN SLAB
   Y( 7)= 0.110761950-02 IN SLAB
   Y( 8)= 0.970438510-03 IN SLAB
   Y( 9)= 0.596460090-03 IN SLAB
   Y(10)=-0.116552370-01 IN SLAB
   Y(11)= 0.186345010-02 IN SLAB
   Y( 1)= 0.186345010-02 IN EXTENSION
   Y( 2)= 0.607699000-02 IN EXTENSION
   Y( 3)= 0.684025550-02 IN EXTENSION
   Y( 4)= 0.590697390-02 IN EXTENSION
   Y( 5)= 0.443968110-02 IN EXTENSION
   Y( 6)= 0.271955200-02 IN EXTENSION
   VP= 0.421728940 03 VE=-0.305601640 04
```

Table 18. Output of "Soil React" Program without Temperature and Live Load Effect for Soil Modulus = 10 psi/in.

```
 BETA= 0.96855457D-02      U=-0.70220680D-03

FP( 1)= 0.11132592D 02
FP( 2)= 0.0
FP( 3)= 0.0
FP( 4)= 0.0
FP( 5)= 0.0
FP( 6)=-0.57444103D 00
FP( 7)=-0.57120789D 01
FP( 8)=-0.11702390D 02
FP( 9)=-0.18334265D 02
FP(10)=-0.25035044D 02
FP(11)=-0.30317330D 02
FE( 1)=-0.30317330D 02
FE( 2)=-0.31158770D 02
FE( 3)=-0.31995312D 02
FE( 4)=-0.32830338D 02
FE( 5)=-0.33675217D 02
FE( 6)=-0.34510468D 02
     NET PRESSURE = 0.11132592D 02 AT STATION 1 IN SLAB
     NET PRESSURE = 0.0            AT STATION 2 IN SLAB
     NET PRESSURE = 0.0            AT STATION 3 IN SLAB
     NET PRESSURE = 0.0            AT STATION 4 IN SLAB
     NET PRESSURE = 0.0            AT STATION 5 IN SLAB
     NET PRESSURE =-0.57444103D 00 AT STATION 6 IN SLAB
     NET PRESSURE =-0.57120789D 01 AT STATION 7 IN SLAB
     NET PRESSURE =-0.11702390D 02 AT STATION 8 IN SLAB
     NET PRESSURE =-0.18334265D 02 AT STATION 9 IN SLAB
     NET PRESSURE =-0.25035044D 02 AT STATION10 IN SLAB
     NET PRESSURE =-0.30317330D 02 AT STATION11 IN SLAB
     NET PRESSURE = 0.46826698D 01 AT STATION 1 IN EXTENSION
     NET PRESSURE = 0.38412298D 01 AT STATION 2 IN EXTENSION
     NET PRESSURE = 0.30046879D 01 AT STATION 3 IN EXTENSION
     NET PRESSURE = 0.21696624D 01 AT STATION 4 IN EXTENSION
     NET PRESSURE = 0.13247832D 01 AT STATION 5 IN EXTENSION
     NET PRESSURE = 0.48953171D 00 AT STATION 6 IN EXTENSION
     Y( 1)=-0.11132592D 01 IN SLAB
     Y( 2)=-0.10586518D 01 IN SLAB
     Y( 3)=-0.91585532D 00 IN SLAB
     Y( 4)=-0.68452318D 00 IN SLAB
     Y( 5)=-0.36124046D 00 IN SLAB
     Y( 6)= 0.57443707D-01 IN SLAB
     Y( 7)= 0.57120769D 00 IN SLAB
     Y( 8)= 0.11702390D 01 IN SLAB
     Y( 9)= 0.18334258D 01 IN SLAB
     Y(10)= 0.25035044D 01 IN SLAB
     Y(11)= 0.30317316D 01 IN SLAB
     Y( 1)= 0.30317316D 01 IN EXTENSION
     Y( 2)= 0.31158738D 01 IN EXTENSION
     Y( 3)= 0.31995280D 01 IN EXTENSION
     Y( 4)= 0.32830318D 01 IN EXTENSION
     Y( 5)= 0.33675196D 01 IN EXTENSION
     Y( 6)= 0.34510434D 01 IN EXTENSION
     VP=-0.27616380D 04 VE= 0.11641510D 03
```

Table 19. Output of "Soil React" Program without Temperature and Live Load Effect for Soil Modulus = 20 psi/in.

```
    BETA= 0.79719591D-02      U= 0.48500737D-02

FP( 1)= 0.18823685D 02
FP( 2)= 0.0
FP( 3)= 0.0
FP( 4)= 0.0
FP( 5)= 0.0
FP( 6)= 0.0
FP( 7)= 0.0
FP( 8)=-0.76108899D 01
FP( 9)=-0.16653865D 02
FP(10)=-0.26512243D 02
FP(11)=-0.34850793D 02
FE( 1)=-0.34850793D 02
FE( 2)=-0.36231139D 02
FE( 3)=-0.37596506D 02
FE( 4)=-0.38955402D 02
FE( 5)=-0.40328737D 02
FE( 6)=-0.41685617D 02
    NET PRESSURE = 0.18823685D 02 AT STATION 1 IN SLAB
    NET PRESSURE = 0.0            AT STATION 2 IN SLAB
    NET PRESSURE = 0.0            AT STATION 3 IN SLAB
    NET PRESSURE = 0.0            AT STATION 4 IN SLAB
    NET PRESSURE = 0.0            AT STATION 5 IN SLAB
    NET PRESSURE = 0.0            AT STATION 6 IN SLAB
    NET PRESSURE = 0.0            AT STATION 7 IN SLAB
    NET PRESSURE =-0.76108899D 01 AT STATION 8 IN SLAB
    NET PRESSURE =-0.16653865D 02 AT STATION 9 IN SLAB
    NET PRESSURE =-0.26512243D 02 AT STATION10 IN SLAB
    NET PRESSURE =-0.34850793D 02 AT STATION11 IN SLAB
    NET PRESSURE = 0.14920685D 00 AT STATION 1 IN EXTENSION
    NET PRESSURE =-0.12311386D 01 AT STATION 2 IN EXTENSION
    NET PRESSURE =-0.25965058D 01 AT STATION 3 IN EXTENSION
    NET PRESSURE =-0.39554019D 01 AT STATION 4 IN EXTENSION
    NET PRESSURE =-0.53287375D 01 AT STATION 5 IN EXTENSION
    NET PRESSURE =-0.66856167D 01 AT STATION 6 IN EXTENSION
    Y( 1)=-0.94118426D 00 IN SLAB
    Y( 2)=-0.91986212D 00 IN SLAB
    Y( 3)=-0.85628746D 00 IN SLAB
    Y( 4)=-0.73962846D 00 IN SLAB
    Y( 5)=-0.56193531D 00 IN SLAB
    Y( 6)=-0.31776717D 00 IN SLAB
    Y( 7)=-0.37101238D-02 IN SLAB
    Y( 8)= 0.38054358D 00 IN SLAB
    Y( 9)= 0.83269308D 00 IN SLAB
    Y(10)= 0.13256126D 01 IN SLAB
    Y(11)= 0.17425390D 01 IN SLAB
    Y( 1)= 0.17425390D 01 IN EXTENSION
    Y( 2)= 0.18115562D 01 IN EXTENSION
    Y( 3)= 0.18798246D 01 IN EXTENSION
    Y( 4)= 0.19477694D 01 IN EXTENSION
    Y( 5)= 0.20164361D 01 IN EXTENSION
    Y( 6)= 0.20842801D 01 IN EXTENSION
    VP=-0.25434788D 04 VE=-0.15153097D 03
```

Table 20. Output of "Soil React" Program without Temperature and Live Load Effect for Soil Modulus = 100 psi/in.

```
     BETA= 0.475087870-02      U= 0.152868620-01

 FP( 1)= 0.27529120D 02
 FP( 2)= 0.0
 FP( 3)= 0.0
 FP( 4)= 0.0
 FP( 5)= 0.0
 FP( 6)= 0.0
 FP( 7)= 0.0
 FP( 8)= 0.0
 FP( 9)=-0.17660858D 01
 FP(10)=-0.22876262D 02
 FP(11)=-0.448454620 02
 FE( 1)=-0.44845462D 02
 FE( 2)=-0.48869140D 02
 FE( 3)=-0.527301200 02
 FE( 4)=-0.56503099D 02
 FE( 5)=-0.60288578D 02
 FE( 6)=-0.640149180 02
      NET PRESSURE = 0.27529120D 02 AT STATION 1 IN SLAB
      NET PRESSURE = 0.0            AT STATION 2 IN SLAB
      NET PRESSURE = 0.0            AT STATION 3 IN SLAB
      NET PRESSURE = 0.0            AT STATION 4 IN SLAB
      NET PRESSURE = 0.0            AT STATION 5 IN SLAB
      NET PRESSURE = 0.0            AT STATION 6 IN SLAB
      NET PRESSURE = 0.0            AT STATION 7 IN SLAB
      NET PRESSURE = 0.0            AT STATION 8 IN SLAB
      NET PRESSURE =-0.17660858D 01 AT STATION 9 IN SLAB
      NET PRESSURE =-0.22876262D 02 AT STATION10 IN SLAB
      NET PRESSURE =-0.44845462D 02 AT STATION11 IN SLAB
      NET PRESSURE =-0.98454620D 01 AT STATION 1 IN EXTENSION
      NET PRESSURE =-0.13869140D 02 AT STATION 2 IN EXTENSION
      NET PRESSURE =-0.17730120D 02 AT STATION 3 IN EXTENSION
      NET PRESSURE =-0.21503099D 02 AT STATION 4 IN EXTENSION
      NET PRESSURE =-0.25288578D 02 AT STATION 5 IN EXTENSION
      NET PRESSURE =-0.29014918D 02 AT STATION 6 IN EXTENSION
      Y( 1)=-0.27529120D 00 IN SLAB
      Y( 2)=-0.29398567D 00 IN SLAB
      Y( 3)=-0.32593934D 00 IN SLAB
      Y( 4)=-0.34818033D 00 IN SLAB
      Y( 5)=-0.34704525D 00 IN SLAB
      Y( 6)=-0.31573785D 00 IN SLAB
      Y( 7)=-0.24838174D 00 IN SLAB
      Y( 8)=-0.13655095D 00 IN SLAB
      Y( 9)= 0.18235077D-01 IN SLAB
      Y(10)= 0.22948518D 00 IN SLAB
      Y(11)= 0.44933728D 00 IN SLAB
      Y( 1)= 0.44933728D 00 IN EXTENSION
      Y( 2)= 0.48960782D 00 IN EXTENSION
      Y( 3)= 0.52825125D 00 IN EXTENSION
      Y( 4)= 0.56601466D 00 IN EXTENSION
      Y( 5)= 0.60390337D 00 IN EXTENSION
      Y( 6)= 0.64120043D 00 IN EXTENSION
     VP=-0.18283024D 04 VE=-0.89776964D 03
```

Table 21. Output of "Soil React" Program without Temperature and Live Load Effect for Soil Modulus = 200 psi/in.

```
     BETA= 0.38036753D-02      U= 0.183559450-01

 FP( 1)= 0.268877970 02
 FP( 2)= 0.0
 FP( 3)= 0.0
 FP( 4)= 0.0
 FP( 5)= 0.0
 FP( 6)= 0.0
 FP( 7)= 0.0
 FP( 8)= 0.0
 FP( 9)= 0.0
 FP(10)=-0.141321950 02
 FP(11)=-0.478482990 02
 FE( 1)=-0.478482990 02
 FE( 2)=-0.541900900 02
 FE( 3)=-0.601006800 02
 FE( 4)=-0.657700770 02
 FE( 5)=-0.714148770 02
 FE( 6)=-0.769498310 02
     NET PRESSURE = 0.268877970 02 AT STATION 1 IN SLAB
     NET PRESSURE = 0.0            AT STATION 2 IN SLAB
     NET PRESSURE = 0.0            AT STATION 3 IN SLAB
     NET PRESSURE = 0.0            AT STATION 4 IN SLAB
     NET PRESSURE = 0.0            AT STATION 5 IN SLAB
     NET PRESSURE = 0.0            AT STATION 6 IN SLAB
     NET PRESSURE = 0.0            AT STATION 7 IN SLAB
     NET PRESSURE = 0.0            AT STATION 8 IN SLAB
     NET PRESSURE = 0.0            AT STATION 9 IN SLAB
     NET PRESSURE =-0.141321950 02 AT STATION10 IN SLAB
     NET PRESSURE =-0.478482990 02 AT STATION11 IN SLAB
     NET PRESSURE =-0.128482990 02 AT STATION 1 IN EXTENSION
     NET PRESSURE =-0.191900900 02 AT STATION 2 IN EXTENSION
     NET PRESSURE =-0.251006800 02 AT STATION 3 IN EXTENSION
     NET PRESSURE =-0.307700770 02 AT STATION 4 IN EXTENSION
     NET PRESSURE =-0.364148770 02 AT STATION 5 IN EXTENSION
     NET PRESSURE =-0.419498310 02 AT STATION 6 IN EXTENSION
     Y( 1)=-0.134438990 00 IN SLAB
     Y( 2)=-0.157681380 00 IN SLAB
     Y( 3)=-0.201366960 00 IN SLAB
     Y( 4)=-0.242333930 00 IN SLAB
     Y( 5)=-0.267147650 00 IN SLAB
     Y( 6)=-0.269135140 00 IN SLAB
     Y( 7)=-0.242440470 00 IN SLAB
     Y( 8)=-0.178262500 00 IN SLAB
     Y( 9)=-0.790294590-01 IN SLAB
     Y(10)= 0.706611300-01 IN SLAB
     Y(11)= 0.239241420 00 IN SLAB
     Y( 1)= 0.239241420 00 IN EXTENSION
     Y( 2)= 0.270950310 00 IN EXTENSION
     Y( 3)= 0.300503170 00 IN EXTENSION
     Y( 4)= 0.328850110 00 IN EXTENSION
     Y( 5)= 0.357074250 00 IN EXTENSION
     Y( 6)= 0.384749000 00 IN EXTENSION
     VP=-0.148611150 04 VE=-0.127513520 04
```

Table 22. Output of "Soil React" Program without Temperature and Live Load Effect for Soil Modulus = 1,000 psi/in.

```
 BETA= 0.229183030-02      U= 0.232545510-01

FP( 1)= 0.193702040 02
FP( 2)= 0.0
FP( 3)= 0.0
FP( 4)= 0.0
FP( 5)= 0.0
FP( 6)= 0.0
FP( 7)= 0.0
FP( 8)= 0.0
FP( 9)= 0.0
FP(10)= 0.0
FP(11)=-0.413611000 02
FE( 1)=-0.413611000 02
FE( 2)=-0.590745930 02
FE( 3)=-0.734022570 02
FE( 4)=-0.857543080 02
FE( 5)=-0.974684370 02
FE( 6)=-0.108661020 03
     NET PRESSURE = 0.193702040 02 AT STATION 1 IN SLAB
     NET PRESSURE = 0.0            AT STATION 2 IN SLAB
     NET PRESSURE = 0.0            AT STATION 3 IN SLAB
     NET PRESSURE = 0.0            AT STATION 4 IN SLAB
     NET PRESSURE = 0.0            AT STATION 5 IN SLAB
     NET PRESSURE = 0.0            AT STATION 6 IN SLAB
     NET PRESSURE = 0.0            AT STATION 7 IN SLAB
     NET PRESSURE = 0.0            AT STATION 8 IN SLAB
     NET PRESSURE = 0.0            AT STATION 9 IN SLAB
     NET PRESSURE = 0.0            AT STATION10 IN SLAB
     NET PRESSURE =-0.413611000 02 AT STATION11 IN SLAB
     NET PRESSURE =-0.636110030 01 AT STATION 1 IN EXTENSION
     NET PRESSURE =-0.240745930 02 AT STATION 2 IN EXTENSION
     NET PRESSURE =-0.384022570 02 AT STATION 3 IN EXTENSION
     NET PRESSURE =-0.507543080 02 AT STATION 4 IN EXTENSION
     NET PRESSURE =-0.624684370 02 AT STATION 5 IN EXTENSION
     NET PRESSURE =-0.736610200 02 AT STATION 6 IN EXTENSION
     Y( 1)=-0.193702040-01 IN SLAB
     Y( 2)=-0.392156500-01 IN SLAB
     Y( 3)=-0.784588810-01 IN SLAB
     Y( 4)=-0.119936770 00 IN SLAB
     Y( 5)=-0.153935210 00 IN SLAB
     Y( 6)=-0.175709050 00 IN SLAB
     Y( 7)=-0.180722410 00 IN SLAB
     Y( 8)=-0.162685070 00 IN SLAB
     Y( 9)=-0.123573820 00 IN SLAB
     Y(10)=-0.520199320-01 IN SLAB
     Y(11)= 0.413610830-01 IN SLAB
     Y( 1)= 0.413610830-01 IN EXTENSION
     Y( 2)= 0.590745630-01 IN EXTENSION
     Y( 3)= 0.734022290-01 IN EXTENSION
     Y( 4)= 0.857542890-01 IN EXTENSION
     Y( 5)= 0.974684120-01 IN EXTENSION
     Y( 6)= 0.108661000 00 IN EXTENSION
     VP=-0.813069140 03 VE=-0.198746500 04
```

Table 23. Output of "Soil React" Program without Temperature and Live Load Effect for Soil Modulus = 2,000 psi/in.

```
     BETA= 0.18698297D-02      U= 0.24557094D-01

 FP( 1)= 0.16732893D 02
 FP( 2)= 0.0
 FP( 3)= 0.0
 FP( 4)= 0.0
 FP( 5)= 0.0
 FP( 6)= 0.0
 FP( 7)= 0.0
 FP( 8)= 0.0
 FP( 9)= 0.0
 FP(10)= 0.0
 FP(11)=-0.30576608D 02
 FE( 1)=-0.30576608D 02
 FE( 2)=-0.58345590D 02
 FE( 3)=-0.78378680D 02
 FE( 4)=-0.93857236D 02
 FE( 5)=-0.10769885D 03
 FE( 6)=-0.12048396D 03
     NET PRESSURE = 0.16732893D 02 AT STATION 1 IN SLAB
     NET PRESSURE = 0.0            AT STATION 2 IN SLAB
     NET PRESSURE = 0.0            AT STATION 3 IN SLAB
     NET PRESSURE = 0.0            AT STATION 4 IN SLAB
     NET PRESSURE = 0.0            AT STATION 5 IN SLAB
     NET PRESSURE = 0.0            AT STATION 6 IN SLAB
     NET PRESSURE = 0.0            AT STATION 7 IN SLAB
     NET PRESSURE = 0.0            AT STATION 8 IN SLAB
     NET PRESSURE = 0.0            AT STATION 9 IN SLAB
     NET PRESSURE = 0.0            AT STATION10 IN SLAB
     NET PRESSURE =-0.30576608D 02 AT STATION11 IN SLAB
     NET PRESSURE = 0.44233924D 01 AT STATION 1 IN EXTENSION
     NET PRESSURE =-0.23345590D 02 AT STATION 2 IN EXTENSION
     NET PRESSURE =-0.43378680D 02 AT STATION 3 IN EXTENSION
     NET PRESSURE =-0.58857236D 02 AT STATION 4 IN EXTENSION
     NET PRESSURE =-0.72698847D 02 AT STATION 5 IN EXTENSION
     NET PRESSURE =-0.85483964D 02 AT STATION 6 IN EXTENSION
     Y( 1)=-0.83664466D-02 IN SLAB
     Y( 2)=-0.25926829D-01 IN SLAB
     Y( 3)=-0.60869311D-01 IN SLAB
     Y( 4)=-0.98313903D-01 IN SLAB
     Y( 5)=-0.12985271D 00 IN SLAB
     Y( 6)=-0.15137896D 00 IN SLAB
     Y( 7)=-0.15898293D 00 IN SLAB
     Y( 8)=-0.14716460D 00 IN SLAB
     Y( 9)=-0.11769488D 00 IN SLAB
     Y(10)=-0.60866485D-01 IN SLAB
     Y(11)= 0.14846888D-01 IN SLAB
     Y( 1)= 0.14846888D-01 IN EXTENSION
     Y( 2)= 0.28714424D-01 IN EXTENSION
     Y( 3)= 0.38714134D-01 IN EXTENSION
     Y( 4)= 0.46436606D-01 IN EXTENSION
     Y( 5)= 0.53340420D-01 IN EXTENSION
     Y( 6)= 0.59716173D-01 IN EXTENSION
     VP=-0.59584413D 03 VE=-0.22046900D 04
```

Table 24. Output of "Soil React" Program without Temperature and Live Load Effect for Soil Modulus = 10,000 psi/in.

```
     BETA= 0.12008470D-02      U= 0.26789503D-01

 FP( 1)= 0.10205333D 02
 FP( 2)= 0.0
 FP( 3)= 0.0
 FP( 4)= 0.0
 FP( 5)= 0.0
 FP( 6)= 0.0
 FP( 7)= 0.0
 FP( 8)= 0.0
 FP( 9)= 0.0
 FP(10)= 0.0
 FP(11)=-0.34827551D 01
 FE( 1)=-0.34827551D 01
 FE( 2)=-0.78387388D 02
 FE( 3)=-0.10965953D 03
 FE( 4)=-0.11641943D 03
 FE( 5)=-0.11409074D 03
 FE( 6)=-0.10723781D 03
      NET PRESSURE = 0.10205333D 02 AT STATION 1 IN SLAB
      NET PRESSURE = 0.0            AT STATION 2 IN SLAB
      NET PRESSURE = 0.0            AT STATION 3 IN SLAB
      NET PRESSURE = 0.0            AT STATION 4 IN SLAB
      NET PRESSURE = 0.0            AT STATION 5 IN SLAB
      NET PRESSURE = 0.0            AT STATION 6 IN SLAB
      NET PRESSURE = 0.0            AT STATION 7 IN SLAB
      NET PRESSURE = 0.0            AT STATION 8 IN SLAB
      NET PRESSURE = 0.0            AT STATION 9 IN SLAB
      NET PRESSURE = 0.0            AT STATION10 IN SLAB
      NET PRESSURE =-0.34827551D 01 AT STATION11 IN SLAB
      NET PRESSURE = 0.31517245D 02 AT STATION 1 IN EXTENSION
      NET PRESSURE =-0.43387388D 02 AT STATION 2 IN EXTENSION
      NET PRESSURE =-0.74659533D 02 AT STATION 3 IN EXTENSION
      NET PRESSURE =-0.81419425D 02 AT STATION 4 IN EXTENSION
      NET PRESSURE =-0.79090741D 02 AT STATION 5 IN EXTENSION
      NET PRESSURE =-0.72237807D 02 AT STATION 6 IN EXTENSION
      Y( 1)=-0.10205333D-02 IN SLAB
      Y( 2)=-0.11929615D-01 IN SLAB
      Y( 3)=-0.33736812D-01 IN SLAB
      Y( 4)=-0.57330299D-01 IN SLAB
      Y( 5)=-0.77604301D-01 IN SLAB
      Y( 6)=-0.92016191D-01 IN SLAB
      Y( 7)=-0.98211777D-01 IN SLAB
      Y( 8)=-0.92836358D-01 IN SLAB
      Y( 9)=-0.76864232D-01 IN SLAB
      Y(10)=-0.44547071D-01 IN SLAB
      Y(11)= 0.34824980D-03 IN SLAB
      Y( 1)= 0.34824980D-03 IN EXTENSION
      Y( 2)= 0.78387120D-02 IN EXTENSION
      Y( 3)= 0.10965926D-01 IN EXTENSION
      Y( 4)= 0.11641916D-01 IN EXTENSION
      Y( 5)= 0.11409033D-01 IN EXTENSION
      Y( 6)= 0.10723754D-01 IN EXTENSION
      VP=-0.49897792D 02 VE=-0.27506363D 04
```

Table 25. Output of "Soil React" Program without Temperature and Live Load Effect for Soil Modulus = 20,000 psi/in.

```
    BETA= 0.10102457D-02      U= 0.27407080D-01

FP( 1)= 0.77595947D 01
FP( 2)= 0.0
FP( 3)= 0.0
FP( 4)= 0.0
FP( 5)= 0.0
FP( 6)= 0.0
FP( 7)= 0.0
FP( 8)= 0.0
FP( 9)= 0.0
FP(10)= 0.0
FP(11)= 0.11567158D 02
FE( 1)= 0.11567158D 02
FE( 2)=-0.10530192D 03
FE( 3)=-0.13886345D 03
FE( 4)=-0.12909304D 03
FE( 5)=-0.10479963D 03
FE( 6)=-0.73432529D 02
      NET PRESSURE = 0.77595947D 01 AT STATION 1 IN SLAB
      NET PRESSURE = 0.0            AT STATION 2 IN SLAB
      NET PRESSURE = 0.0            AT STATION 3 IN SLAB
      NET PRESSURE = 0.0            AT STATION 4 IN SLAB
      NET PRESSURE = 0.0            AT STATION 5 IN SLAB
      NET PRESSURE = 0.0            AT STATION 6 IN SLAB
      NET PRESSURE = 0.0            AT STATION 7 IN SLAB
      NET PRESSURE = 0.0            AT STATION 8 IN SLAB
      NET PRESSURE = 0.0            AT STATION 9 IN SLAB
      NET PRESSURE = 0.0            AT STATION10 IN SLAB
      NET PRESSURE = 0.11567158D 02 AT STATION11 IN SLAB
      NET PRESSURE = 0.46567158D 02 AT STATION 1 IN EXTENSION
      NET PRESSURE =-0.70301920D 02 AT STATION 2 IN EXTENSION
      NET PRESSURE =-0.10386345D 03 AT STATION 3 IN EXTENSION
      NET PRESSURE =-0.94093044D 02 AT STATION 4 IN EXTENSION
      NET PRESSURE =-0.69759625D 02 AT STATION 5 IN EXTENSION
      NET PRESSURE =-0.38432529D 02 AT STATION 6 IN EXTENSION
      Y( 1)=-0.38797974D-03 IN SLAB
      Y( 2)=-0.87176114D-02 IN SLAB
      Y( 3)=-0.25384111D-01 IN SLAB
      Y( 4)=-0.43443709D-01 IN SLAB
      Y( 5)=-0.59043155D-01 IN SLAB
      Y( 6)=-0.70213630D-01 IN SLAB
      Y( 7)=-0.75193564D-01 IN SLAB
      Y( 8)=-0.71460672D-01 IN SLAB
      Y( 9)=-0.59613571D-01 IN SLAB
      Y(10)=-0.35418933D-01 IN SLAB
      Y(11)=-0.52319272D-03 IN SLAB
      Y( 1)=-0.52319272D-03 IN EXTENSION
      Y( 2)= 0.53223801D-02 IN EXTENSION
      Y( 3)= 0.70025613D-02 IN EXTENSION
      Y( 4)= 0.65161394D-02 IN EXTENSION
      Y( 5)= 0.53015947D-02 IN EXTENSION
      Y( 6)= 0.37373373D-02 IN EXTENSION
      VP= 0.25591617D 03 VE=-0.30564502D 04
```

APPENDIX B: FIGURES

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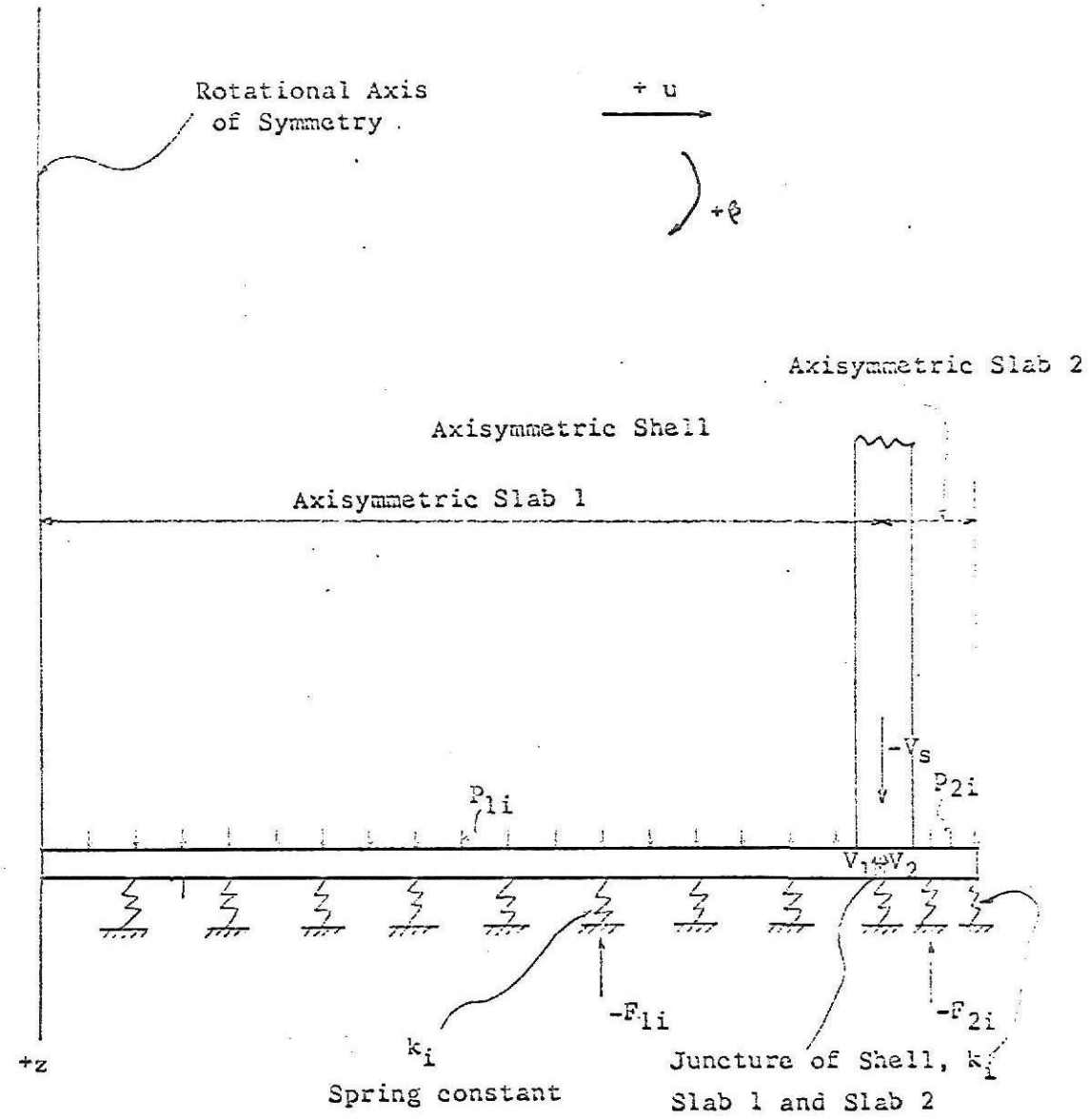

Fig. 1. An Axisymmetric Mat Footing Connected to an Axisymmetric Shell

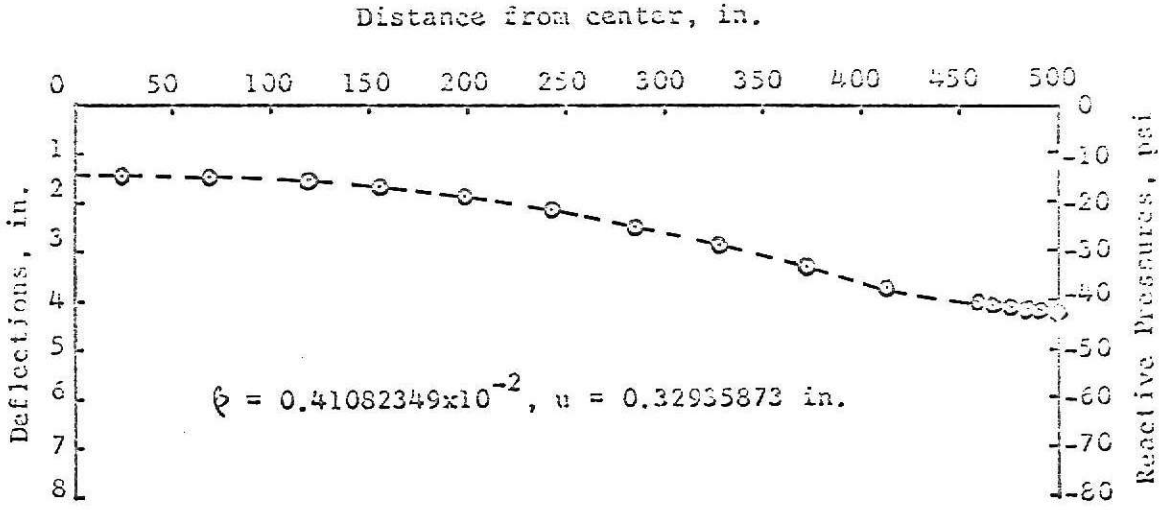

Fig. 2. Reactive Soil Pressures and Slab Deflections with Temperature and Live Load Effect for Soil Modulus = 10 psi/in.

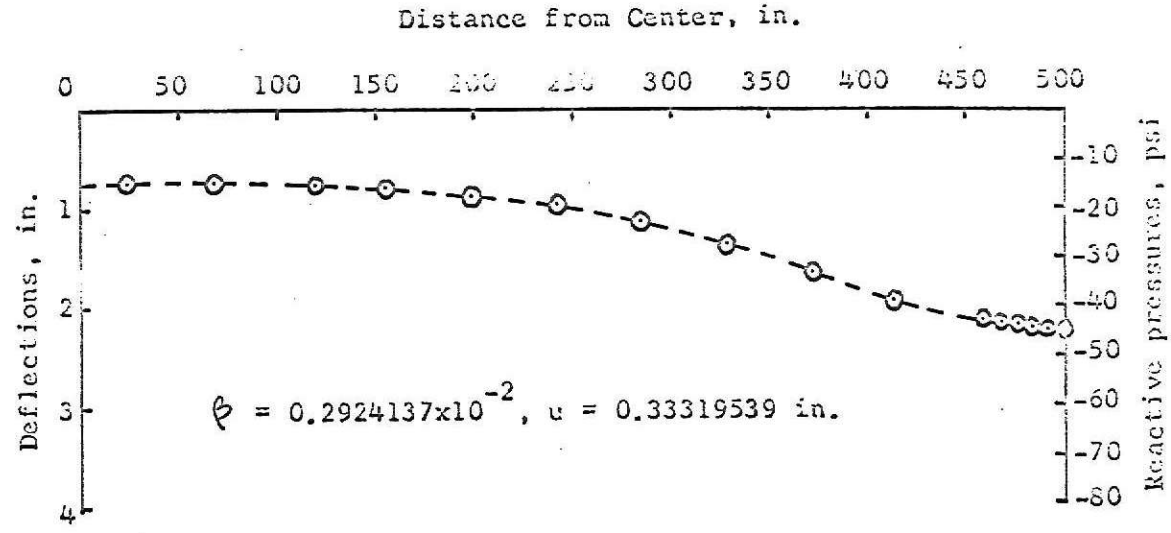

Fig. 3. Reactive Soil Pressures and Slab Deflections with Temperature and Live Load Effect for Soil Modulus = 20 psi/in.

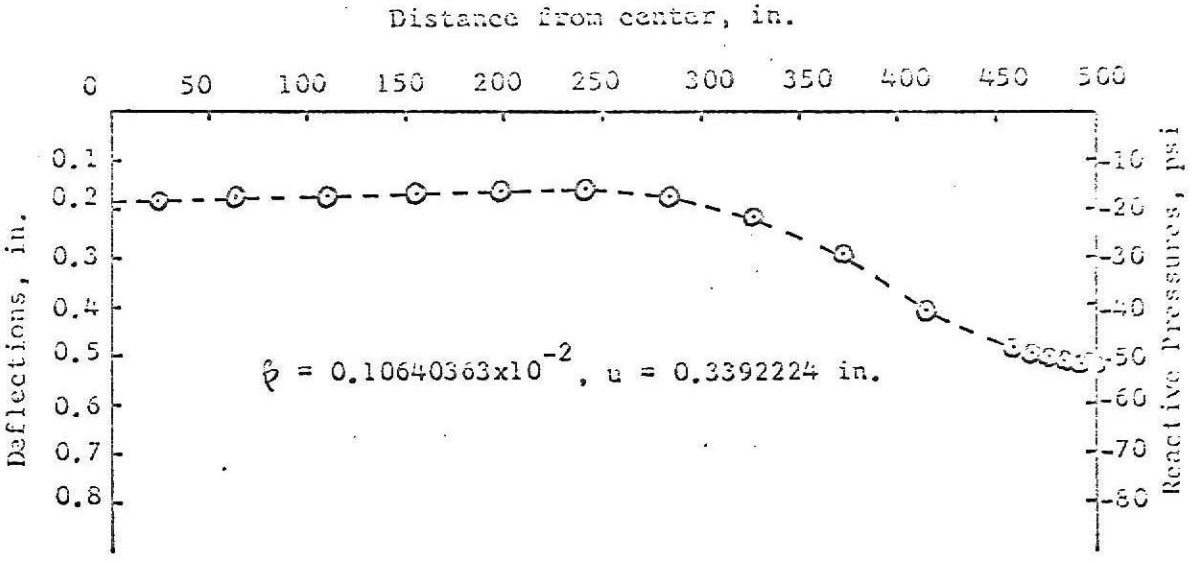

Fig. 4. Reactive Soil Pressures and Slab Deflections with Temperature and Live Load Effect for Soil Modulus = 100 psi/in.

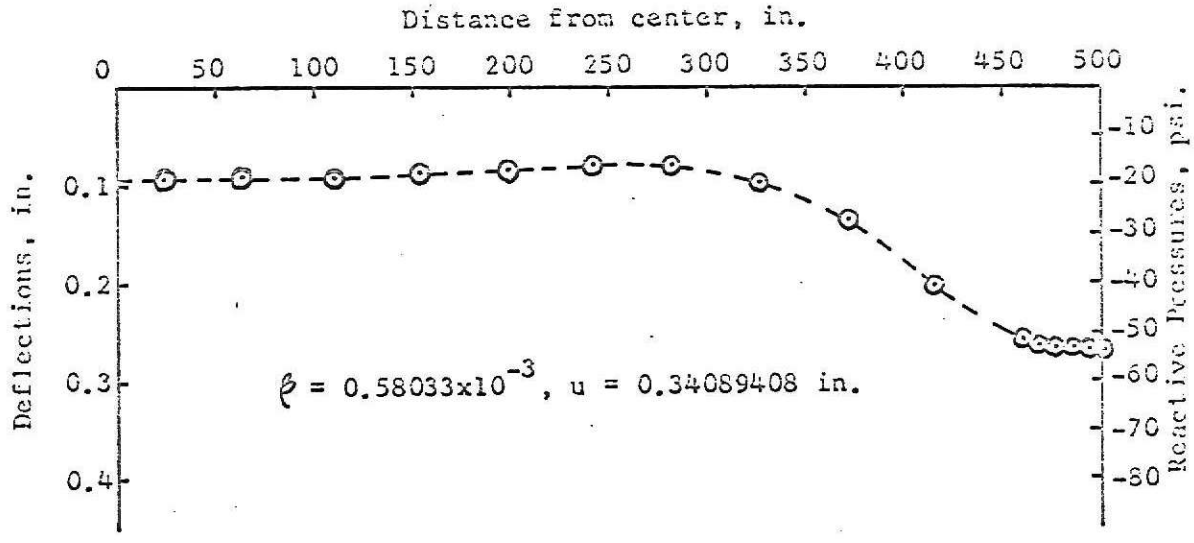

Fig. 5. Reactive Soil Pressures and Slab Deflections with Temperature and Live Load Effect for Soil Modulus = 200 psi/in.

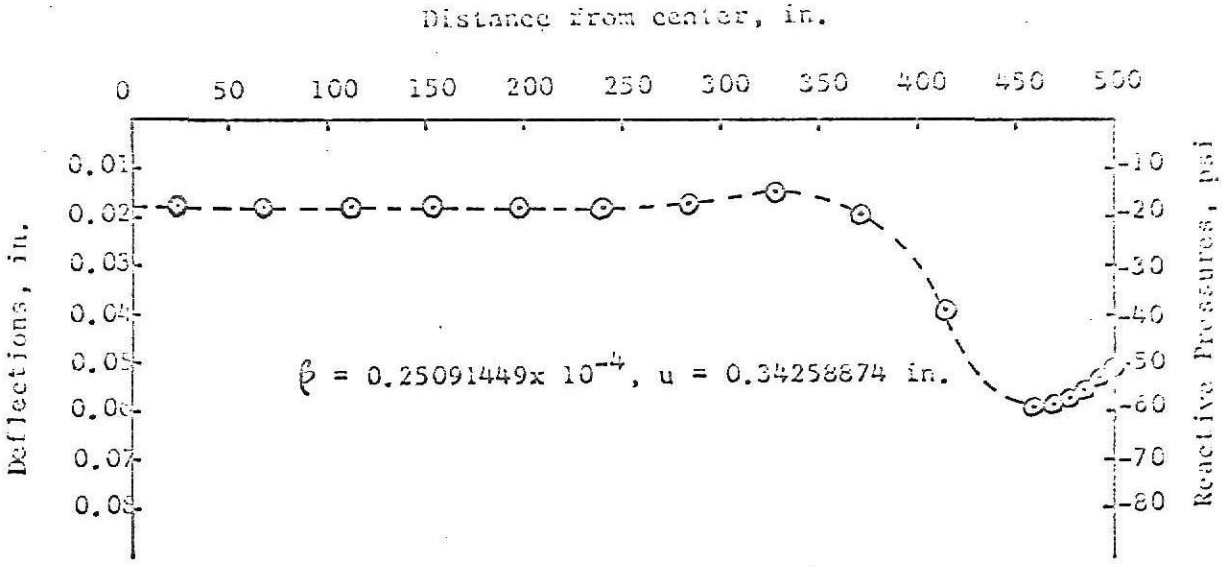

Fig. 6. Reactive Soil Pressures and Slab Deflections with Temperature and Live Load Effect for Soil Modulus = 1,000 psi/in.

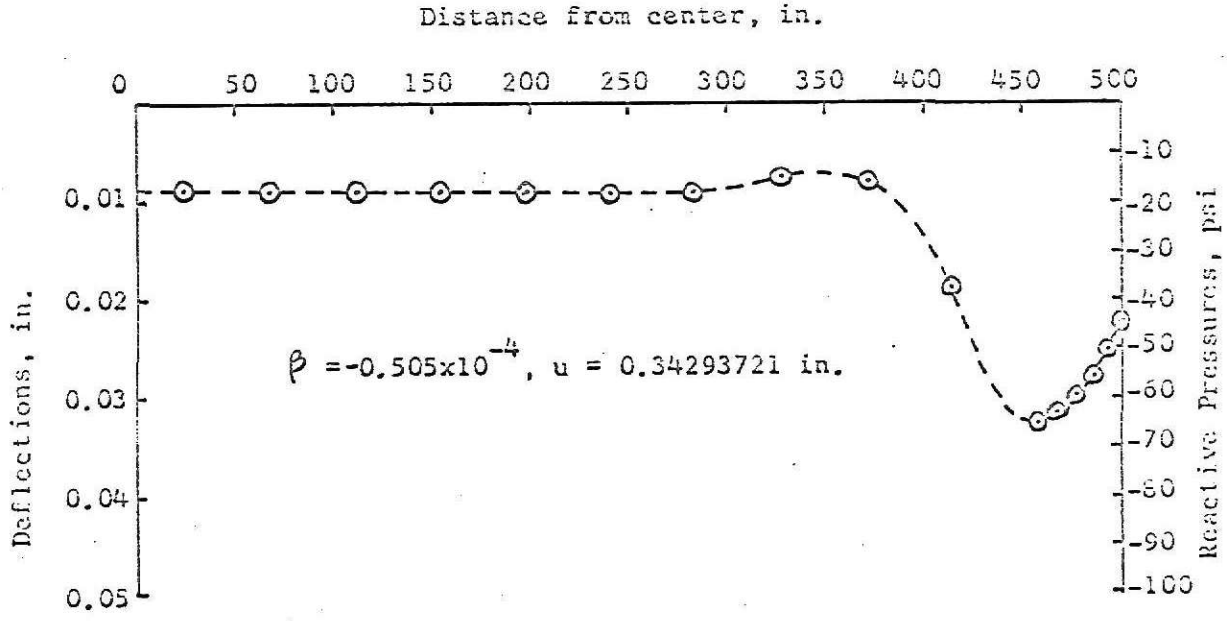

Fig. 7. Reactive Soil Pressures and Slab Deflections with Temperature and Live Load Effect for Soil Modulus = 2,000 psi/in.

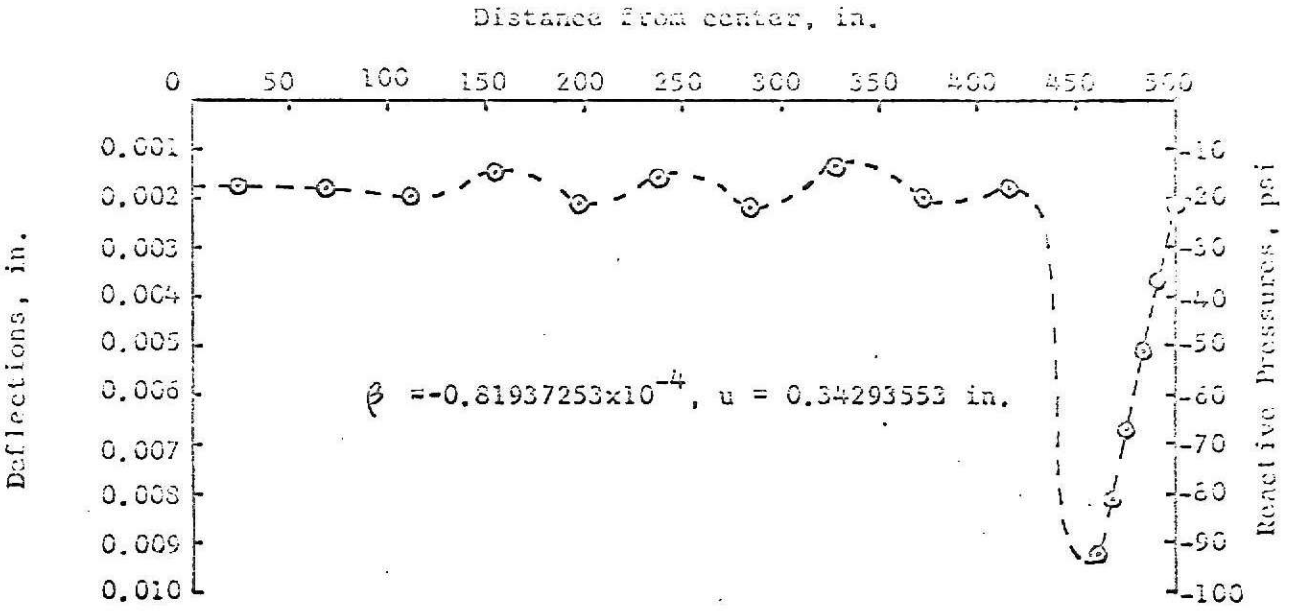

Fig. 8. Reactive Soil Pressures and Slab Deflections with Temperature and Live Load Effect for Soil Modulus = 10,000 psi/in.

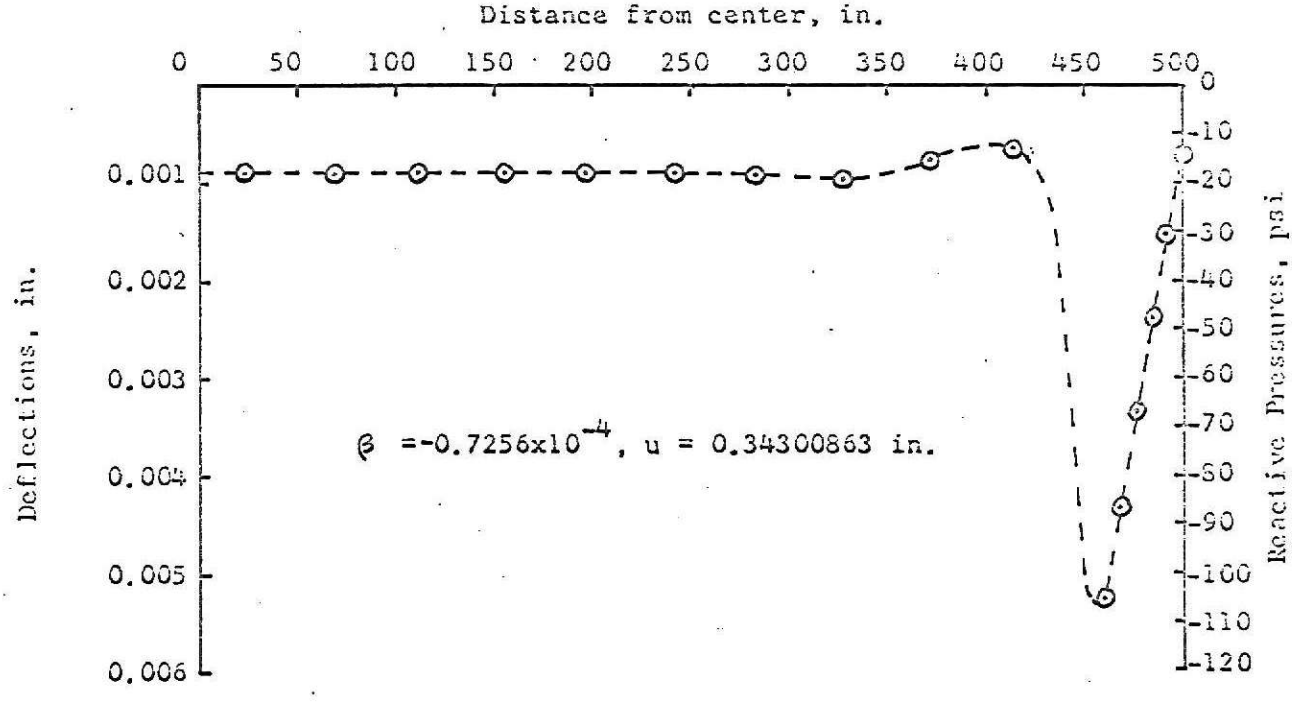

Fig. 9. Reactive Soil Pressures and Slab Deflections with Temperature and Live Load Effect for Soil Modulus = 20,000 psi/in.

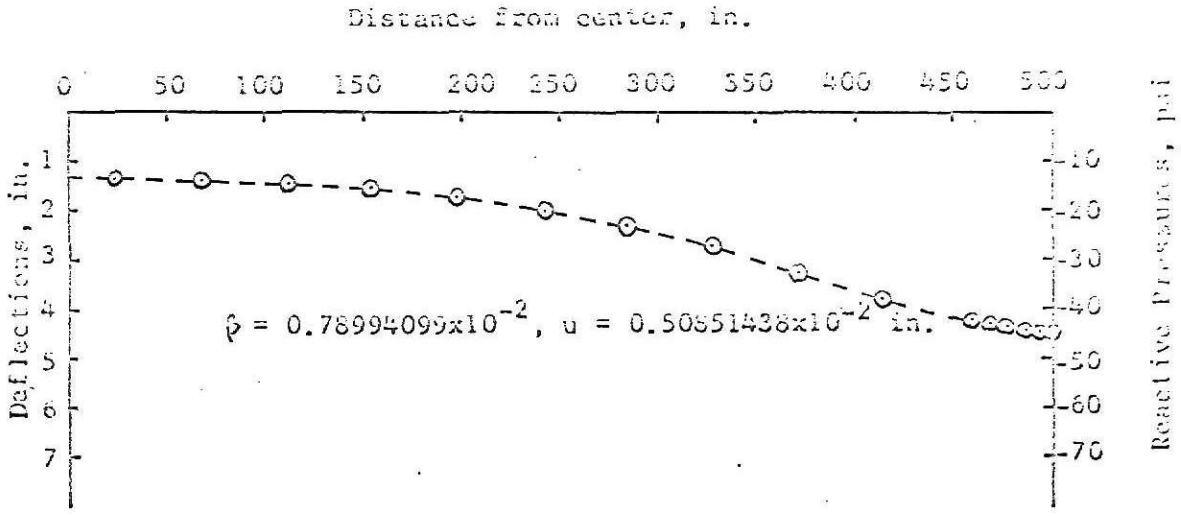

Fig. 10. Reactive Soil Pressures and Slab Deflections without Temperature Effect for Soil Modulus = 10 psi/in.

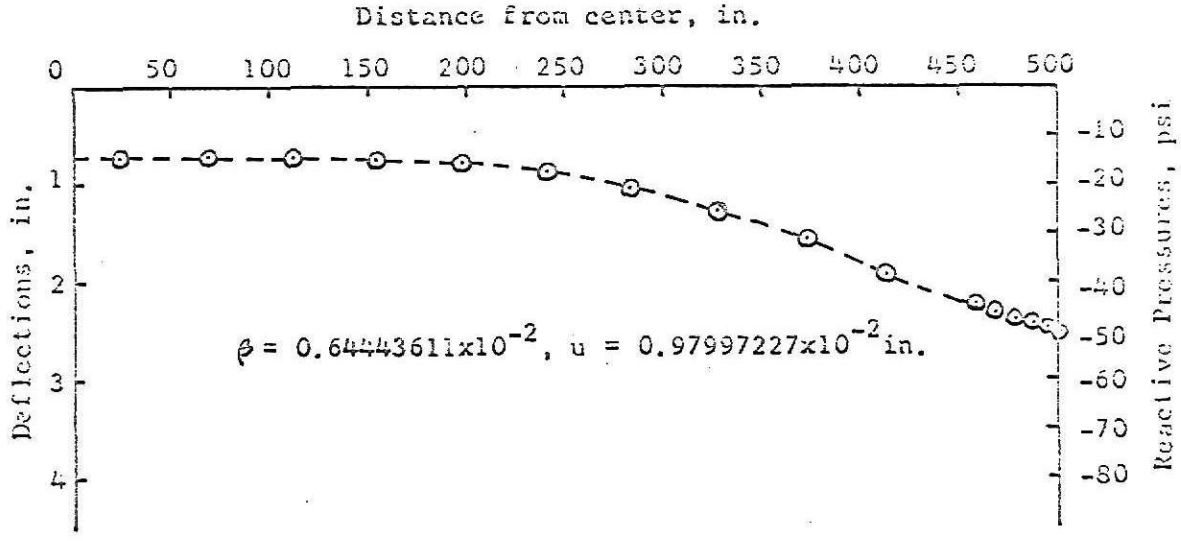

Fig. 11. Reactive Soil Pressures and Slab Deflections without Temperature Effect for Soil Modulus = 20 psi/in.

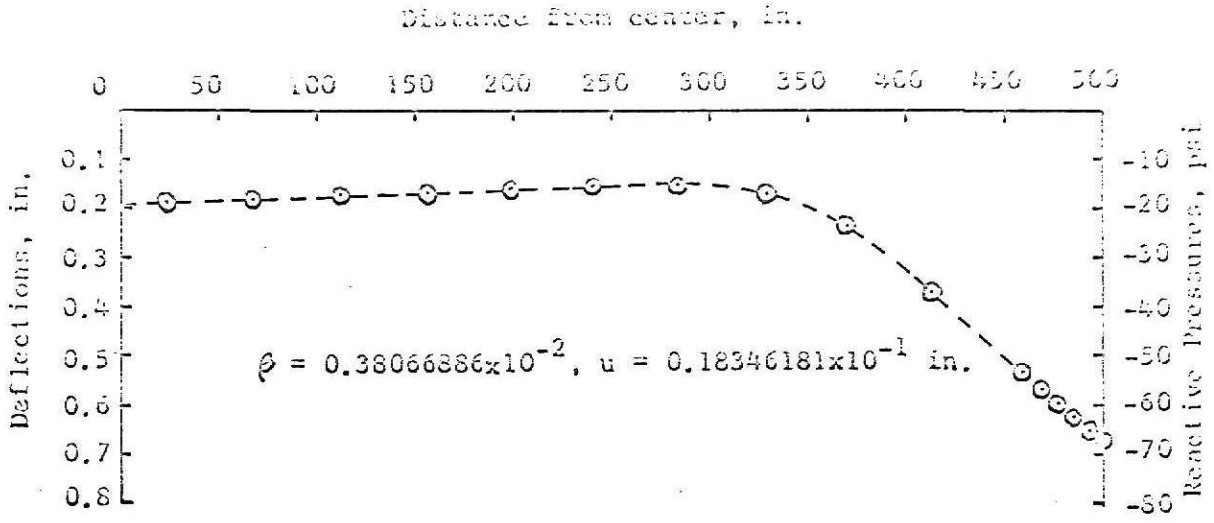

Fig. 12. Reactive Soil Pressures and Slab Deflections without Temperature Effect for Soil Modulus = 100 psi/in.

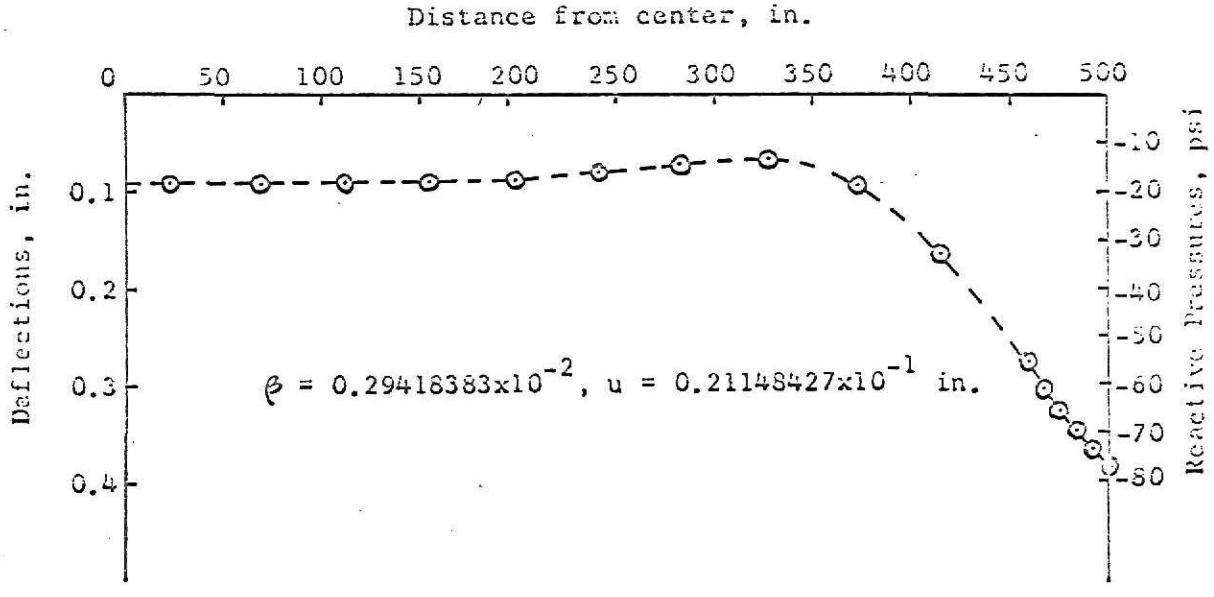

Fig. 13. Reactive Soil Pressures and Slab Deflections without Temperature Effect for Soil Modulus = 200 psi/in.

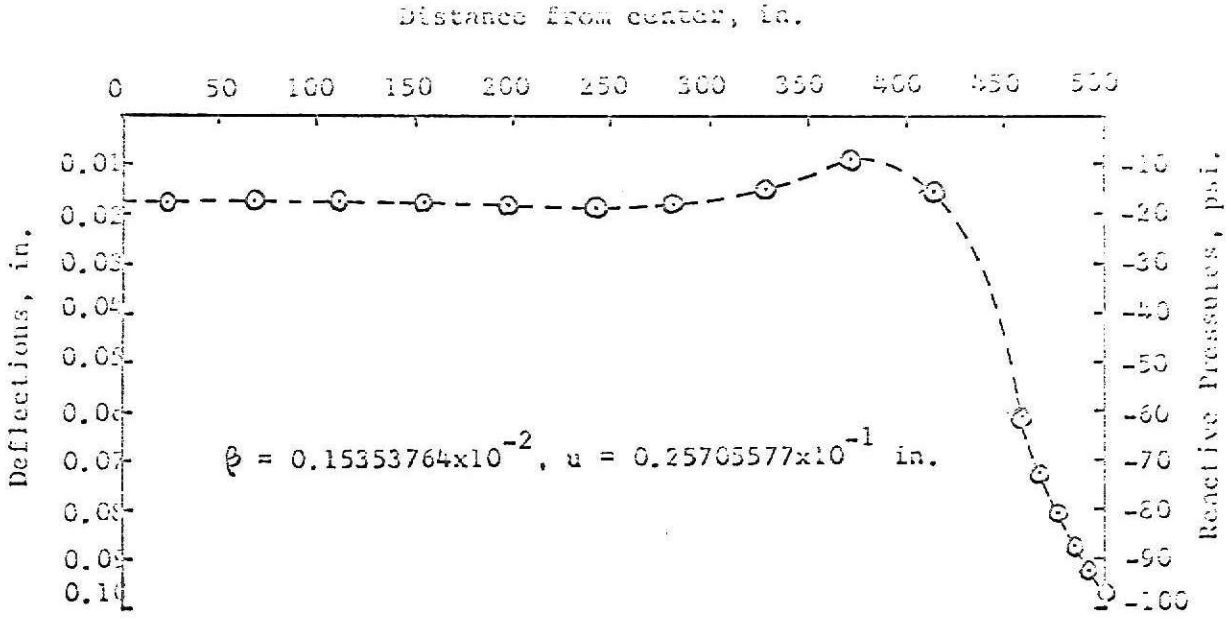

Fig. 14. Reactive Soil Pressures and Slab Deflections without Temperature Effect for Soil Modulus = 1,000 psi/in.

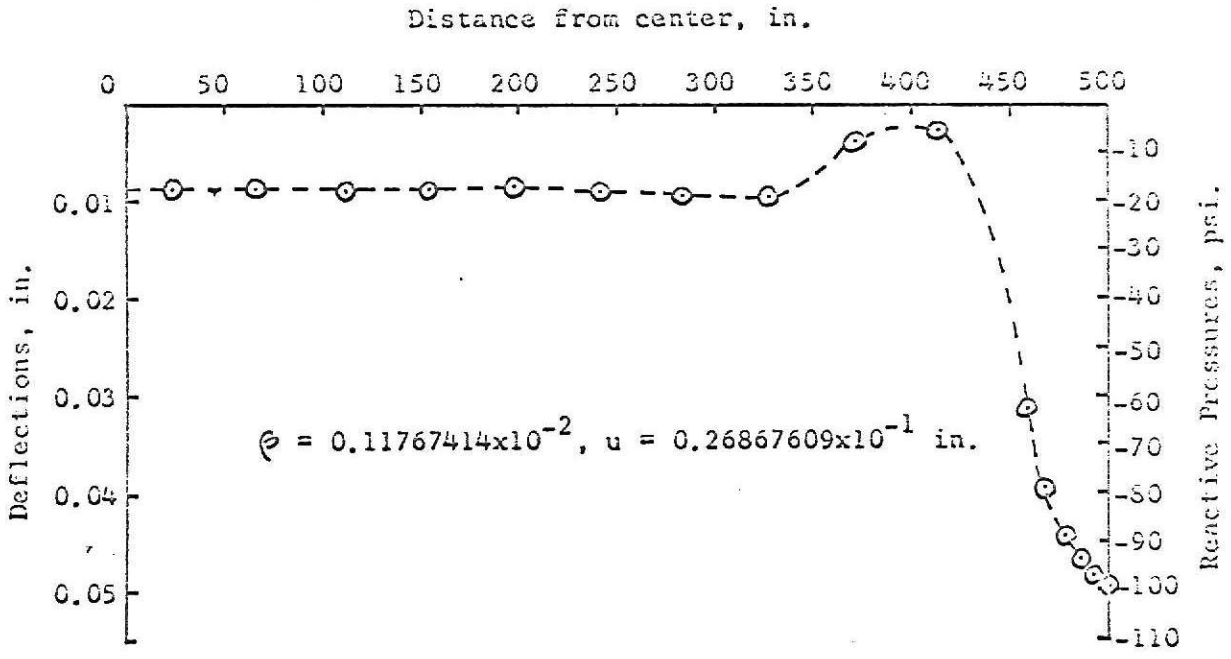

Fig. 15. Reactive Soil Pressures and slab Deflections without Temperature Effect for Soil Modulus = 2,000 psi/in.

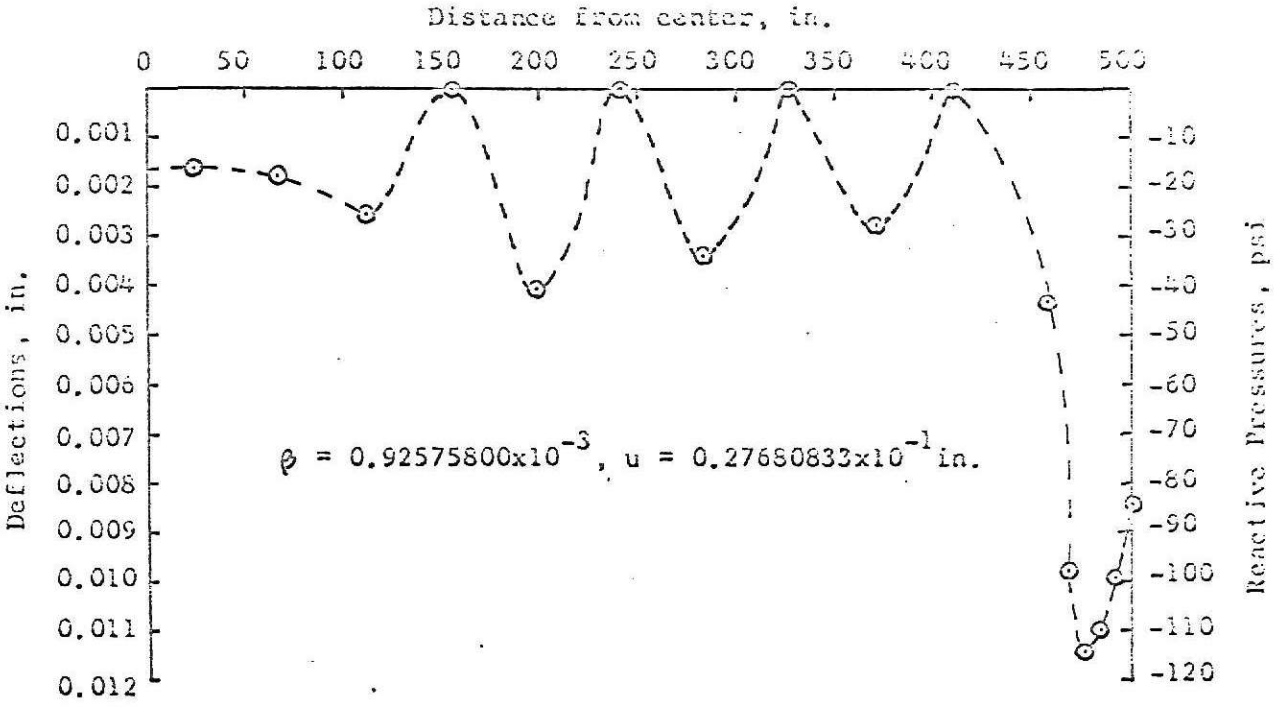

Fig. 16. Reactive Soil Pressures and Slab Deflections without Temperature Effect for Soil Modulus = 10,000 psi/in.

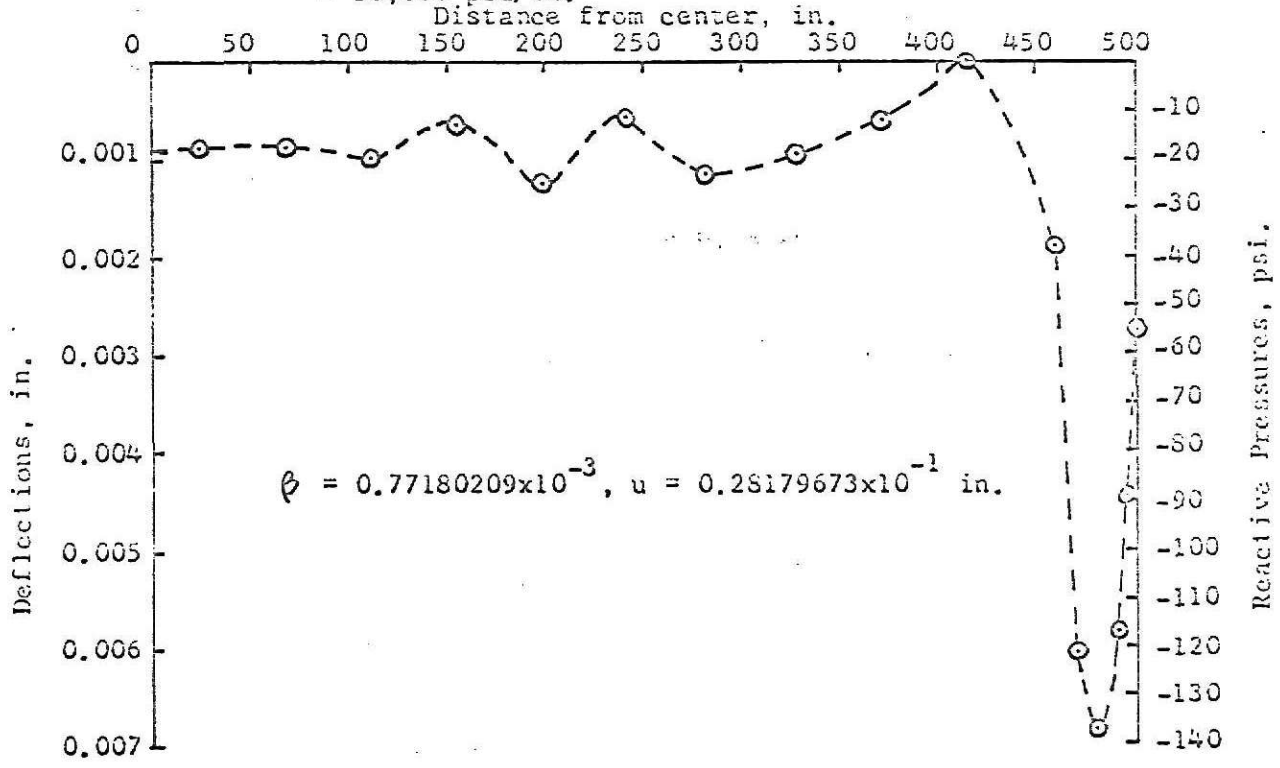

Fig. 17. Reactive Soil Pressures and Slab Deflections without Temperature Effect for Soil Modulus = 20,000 psi/in.

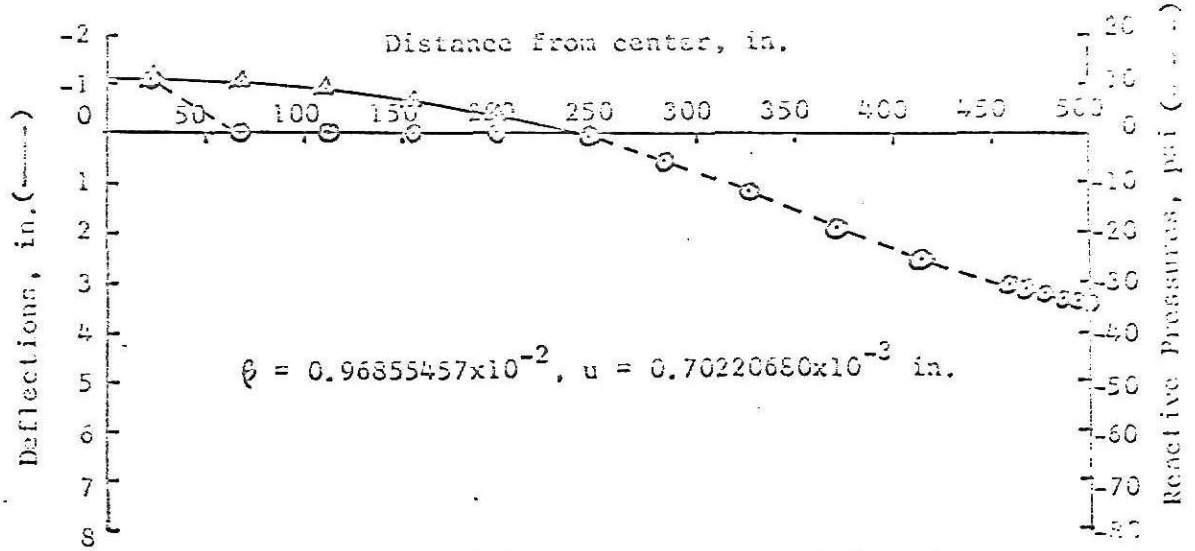

Fig. 18. Reactive Soil Pressures and Slab Deflections without Temperature and Live Loads Effect for Soil Modulus = 10 psi/in.

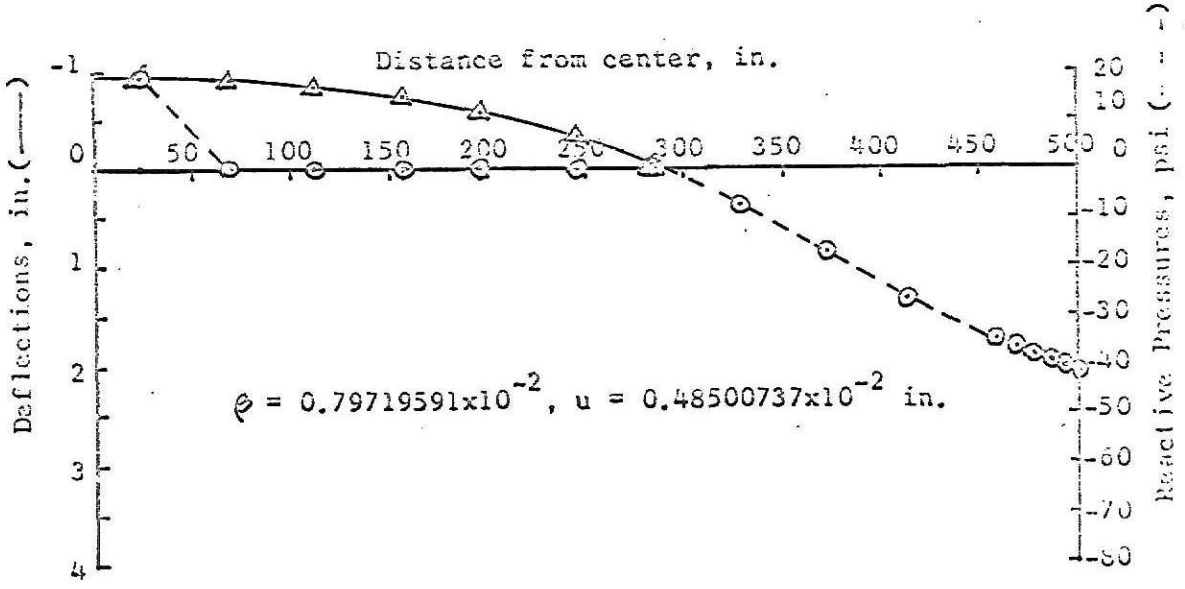

Fig. 19. Reactive Soil Pressures and Slab Deflections without Temperature and Live Loads Effect for Soil Modulus = 20 psi/in.

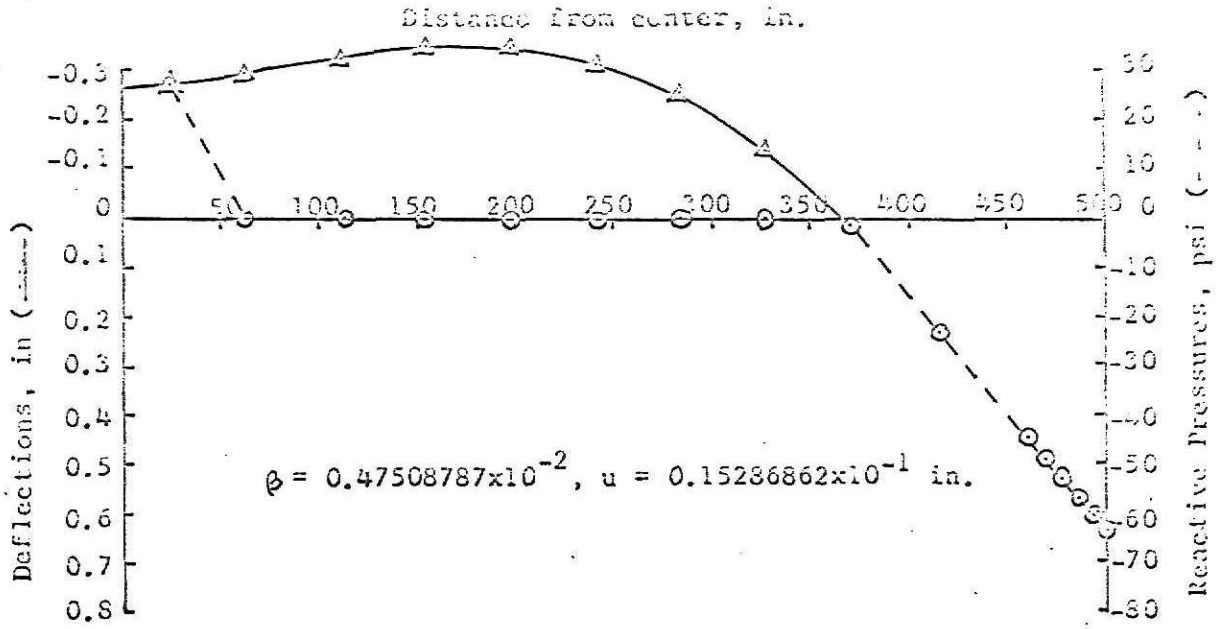

Fig. 20. Reactive Soil Pressures and Slab Deflections without Temperature and Live Load Effect for Soil Modulus = 100 psi/in.

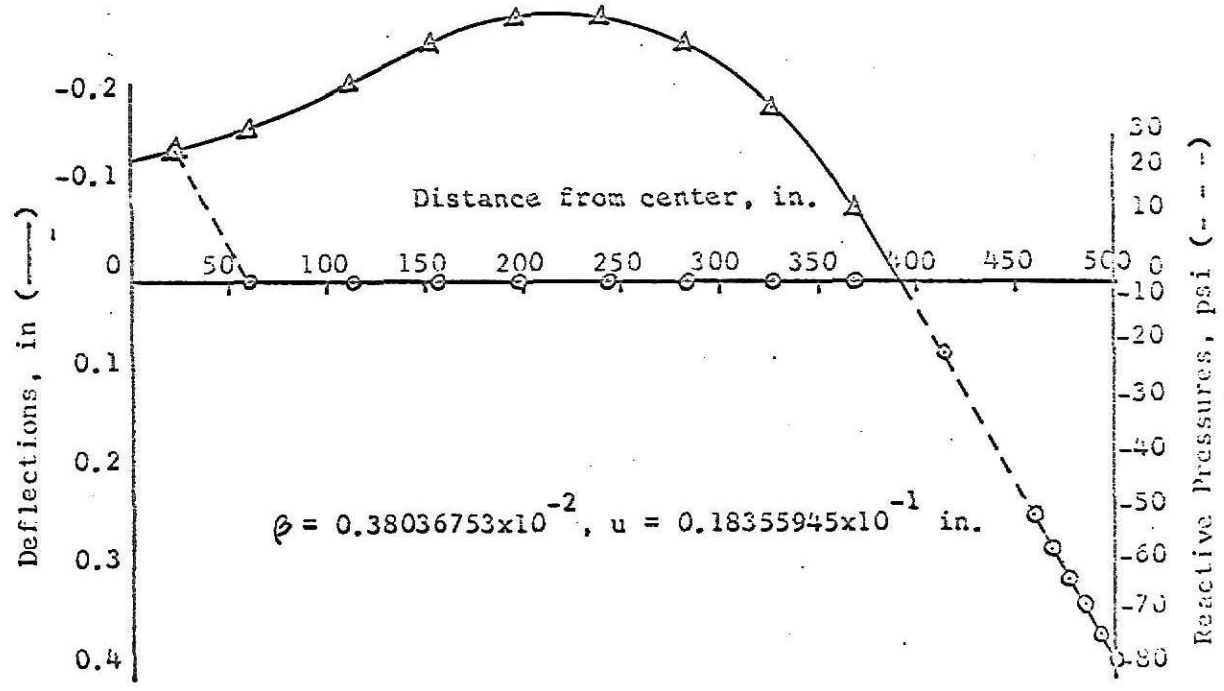

Fig. 21. Reactive Soil Pressures and Slab Deflections without Temperature and Live Load Effect for Soil Modulus = 200 psi/in.

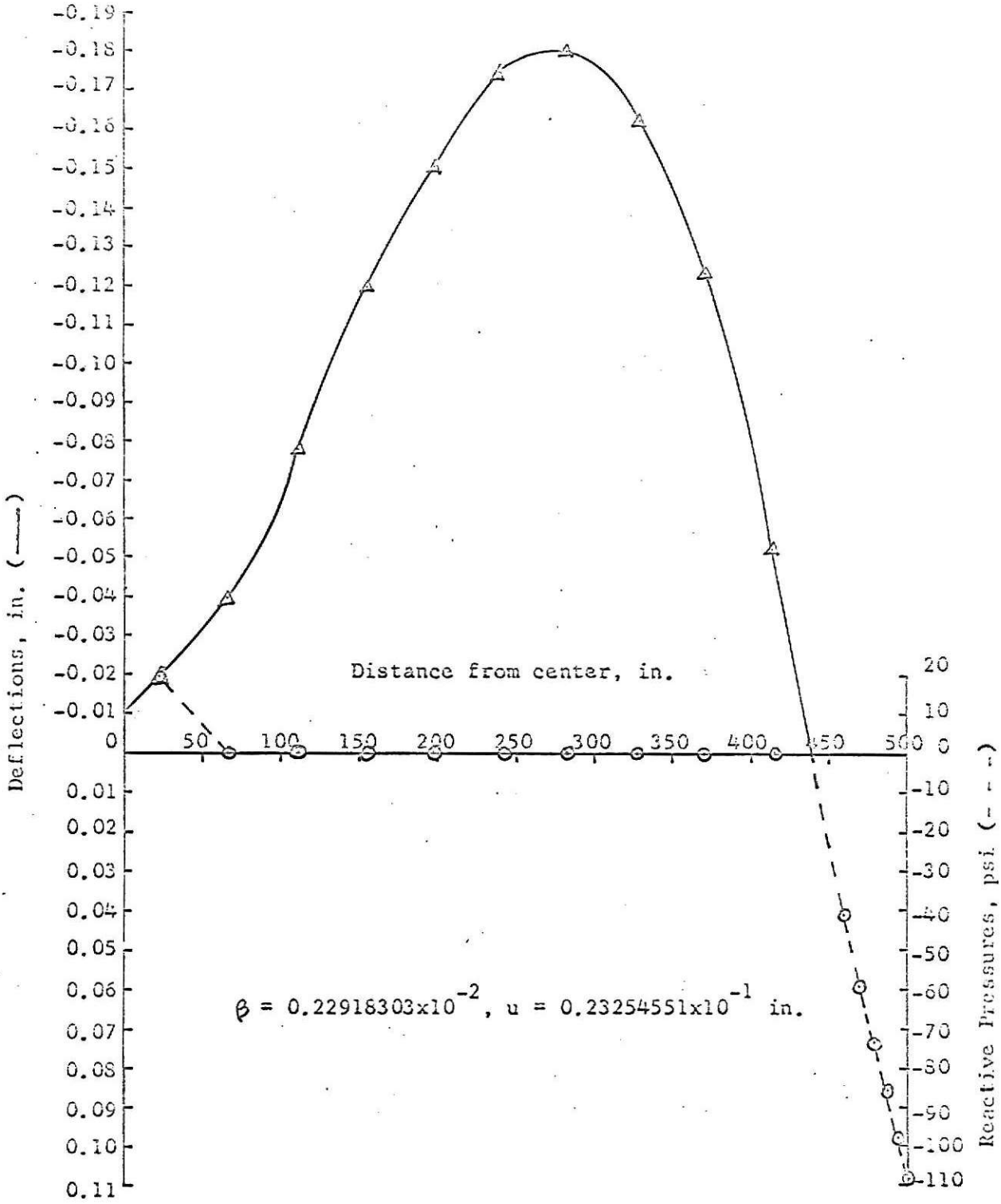

Fig. 22. Reactive Soil Pressures and Slab Deflections without Temperature and Live Load Effect for Soil Modulus = 1,000 psi/in.

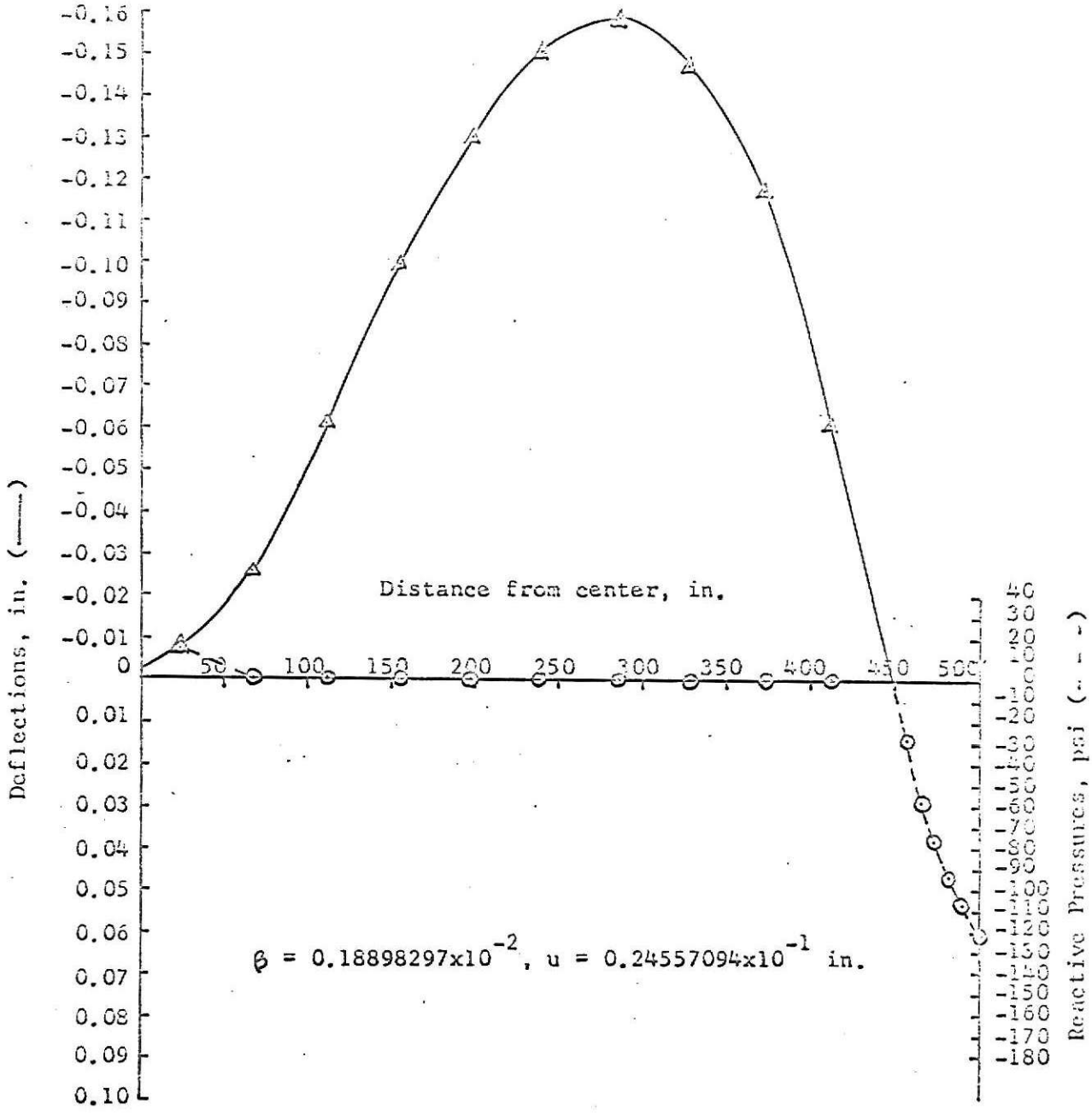

Fig. 23. Reactive Soil Pressures and Slab Deflections without Temperature and Live Load Effect for Soil Modulus = 2,000 psi/in.

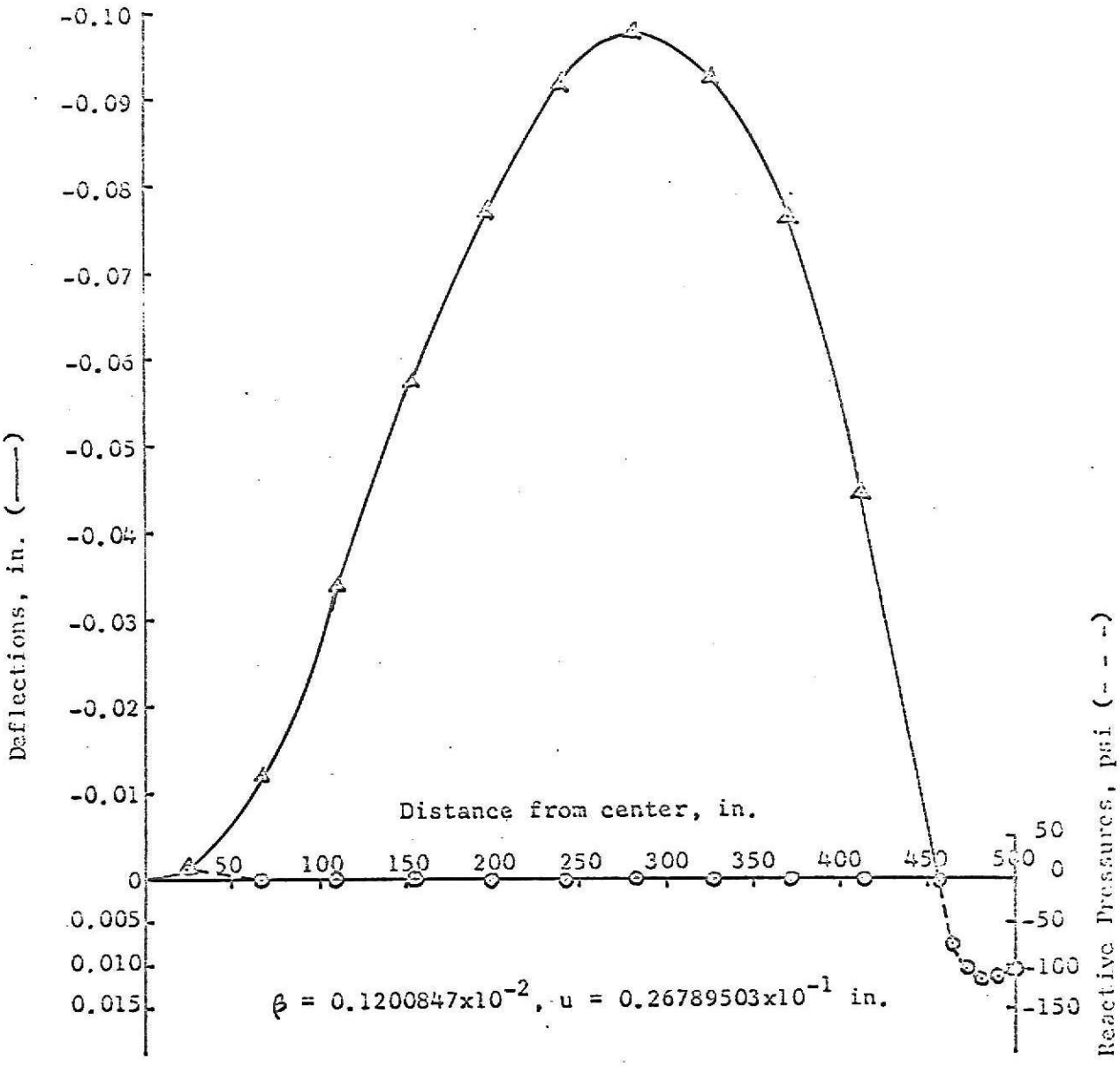

Fig. 24. Reactive Soil Pressures and Slab Deflections without Temperature and Live Load Effect for Soil Modulus = 10,000 psi/in.

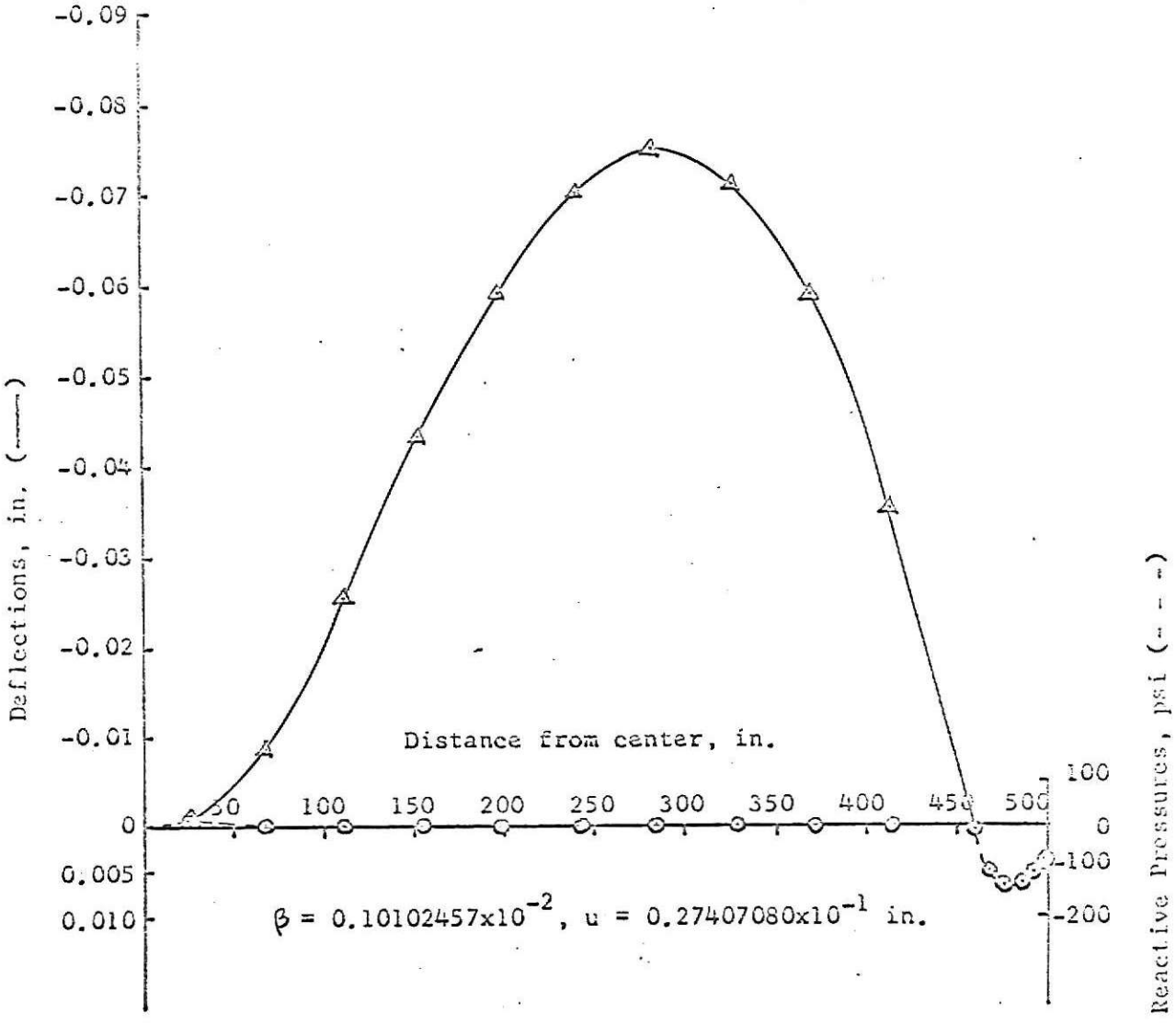

Fig. 25. Reactive Soil Pressures and Slab Deflections without Temperature and Live Load Effect for Soil Modulus = 20,000 psi/in.

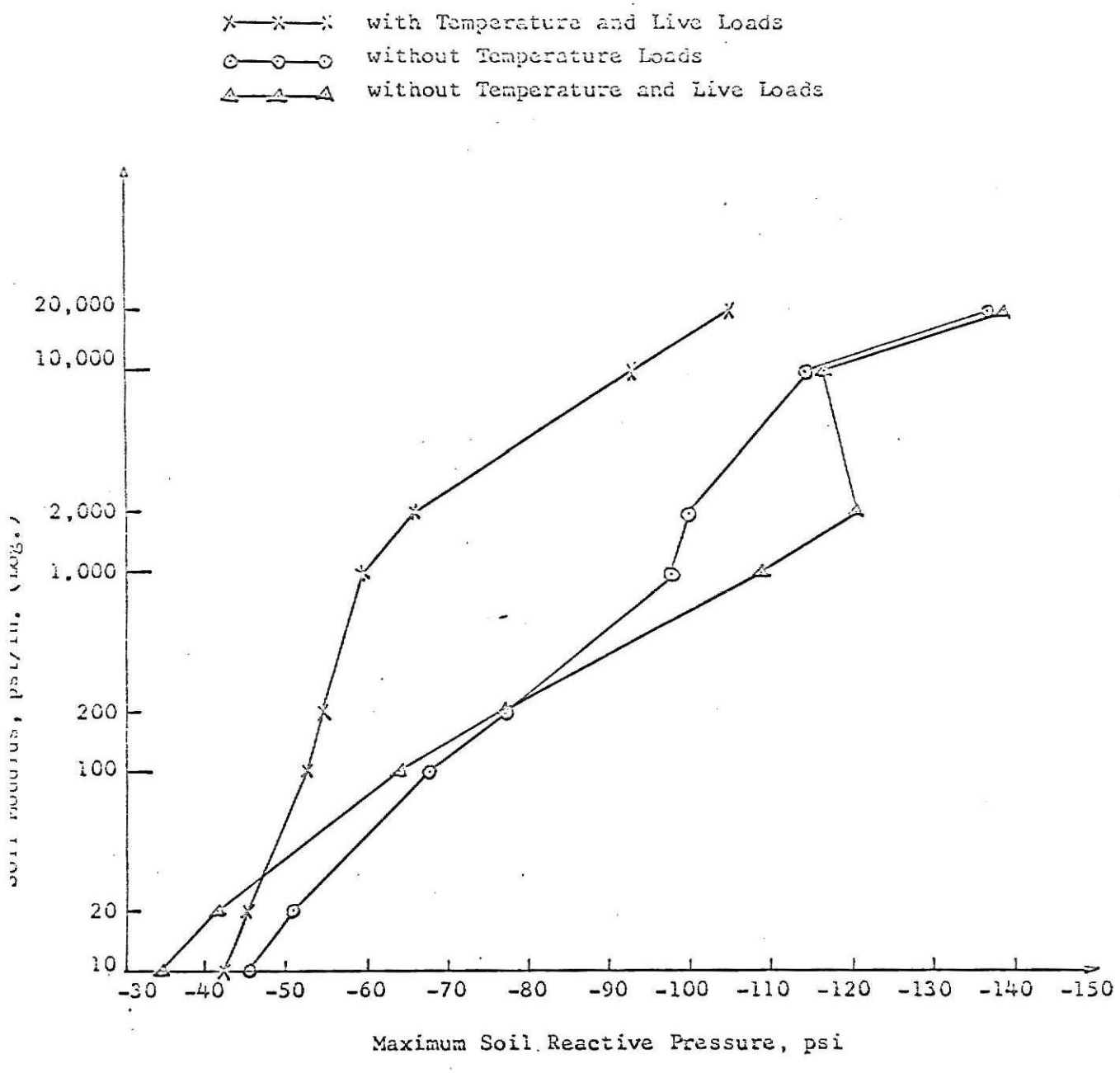

Fig. 26. Maximum Soil Reactions Versus Soil Moduli.

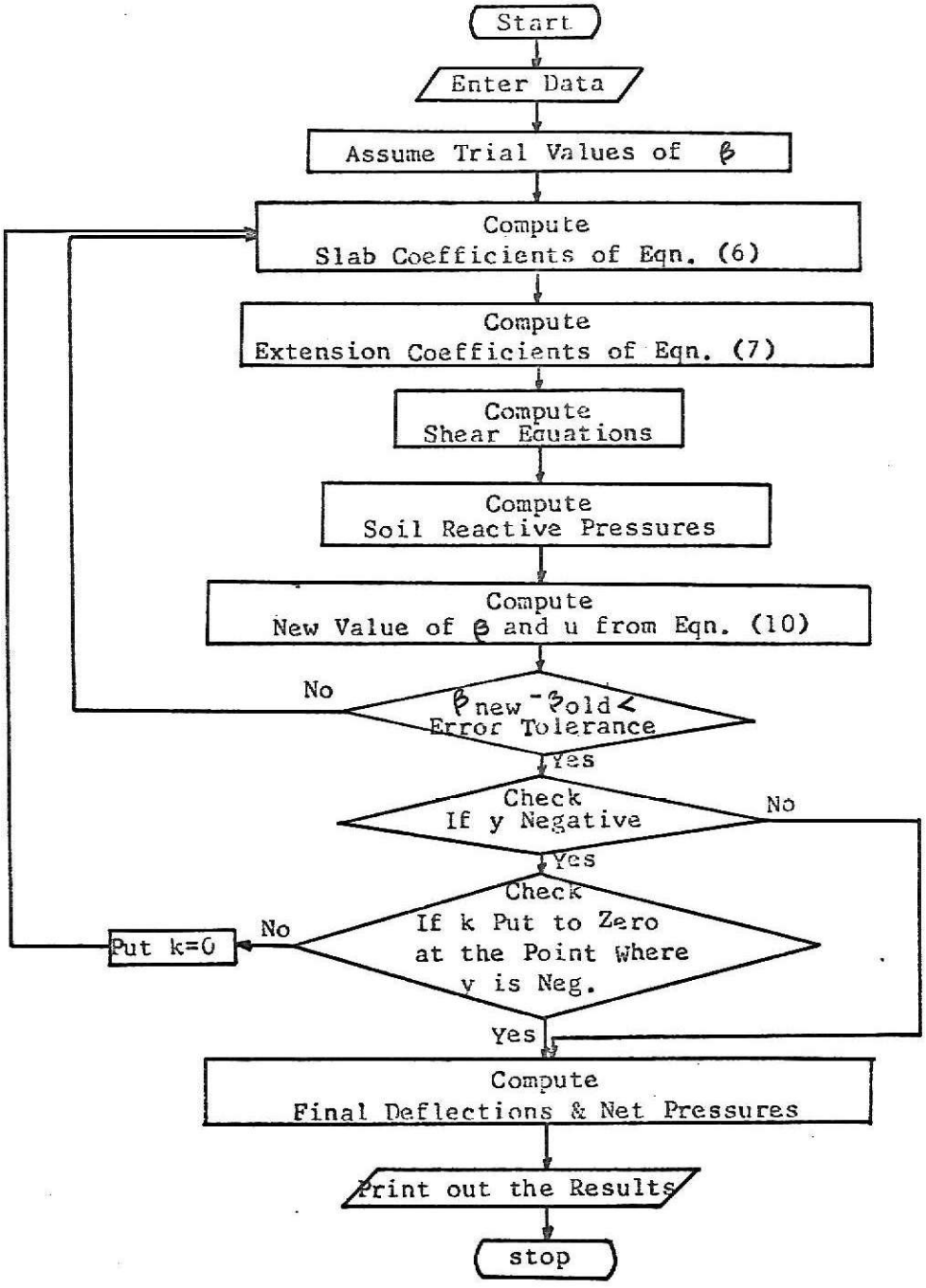

Fig. 27. Flow Shart of the Computer Program.

A STUDY OF MAT FOOTINGS ON ONE-WAY ELASTIC SUBGRADES FOR STORAGE TANKS

by

TING-YEE WANG

Diploma, Taipei Institute of Technology, 1964

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

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Manhattan, Kansas
1970

The object of this report is to present a method for calculating the elastic reactive soil forces for a slab and footing connected to an axisymmetrical underground tank subjected to axisymmetric loading. A computer program is used in analyzing numerical examples of a tank mat footing for three cases:

(1) Tank, slab and footing subjected to temperature differentials and live loads;

(2) Tank subjected to the same loads as in (1) but the slab and footing subjected to live load only;

(3) Tank subjected to the same loads as in (1) but the slab subjected to no temperature or live load and the footing subjected to live load only.

In analyzing the mat footing of storage tank, the soil is assumed to be a one-way, elastic subgrade and the reactive soil forces and the wall-footing deformations are considered to be the unknowns with a known active load. These unknowns are determined by the method of influence coefficients. The simultaneous matrix equations are solved by a computer program.